FflasFfpack

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Chapter 1

FFLAS-FFPACK Documentation.

1.1 Introduction

FFLAS-FFPACK is a LGPL-2.1+ source code library for basic linear algebra operations over a finite field. It is inspired by BLAS interface (Basic Linear Algebra Subprograms) and the LAPACK library for numerical linear algebra, and shares part of their design. Yet it differs in many aspects due to the specifities of computing over a finite field:

- it is generic with respect to the finite field, so as to accomodate a large variety of field sizes and implementations;
- it is a pure source code library, to be included and compiled in the user's software. Its build system is only used for tests and benchmarks.

1.2 Goals

1.3 Design

1.4 Using FFLAS-FFPACK.

- Copying and Licence.
- Tutorial. This is a brief introduction to FFLAS-FFPACK capabilities.
- Configuring and Installing FFLAS-FFPACK. Explains how to configure/install from sources or from the latest svn version.
- Architecture of the library.. Describes how FFLAS-FFPACK is organized
- `Documentation for Users`. If everything around is blue, then you are reading the lighter, user-oriented, documentation.
- `Documentation for Developers`. If everything around is green, then you can get to everything (not necessarily yet) documented.

1.5 Contributing to fflas-ffpack, getting assistance.

Version

2.5.0

Chapter 2

Configuring and Installing FFLAS-FFPACK

FFLAS-FFPACK is a header-only package.

Hower configuration process can be tweaked a lot. Configure looks for BLAS routines and Givaro library which are both mandatory dependencies. See the output of `./configure -help` for information about the LAPACK/↩ BLAS discovering strategies.

Chapter 3

Copying and Licence

The FFLAS-FFPACK library is licensed under the terms of the GNU LGPL v2.1 or later.

See https://www.gnu.org/licenses/lgpl-2.1.html

Chapter 4

Tutorial

no doc.

Chapter 5

Architecture of the library.

no doc.

Chapter 6

Bug List

Global DOUBLE_TO_FLOAT_CROSSOVER
: to be benchmarked.

Global FFLAS::details::pack_lhs (int64_t *XX, const int64_t *X, size_t ldx, size_t rows, size_t cols)
: this is fassign
: this is fassign

Global FFLAS::details::pack_rhs (int64_t *XX, const int64_t *X, size_t ldx, size_t rows, size_t cols)
: this is fassign
: this is fassign

Global FFLAS::fconvert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT *X, const size_t incX, const FFLAS_ELT *Y, const size_t incY)
: use cblas_(d)scal when possible

Global FFLAS::fconvert (const Field &F, const size_t n, OtherElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)
: use cblas_(d)scal when possible

Global FFLAS::finit (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT *Y, const size_t incY, FFLAS_ELT *X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::finit (const Field &F, const size_t n, const OtherElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::fneg (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT *Y, const size_t incY, FFLAS_ELT *X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::fneg (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::fnegin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT *X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::fnegin (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT *X, const size_t incX)
: use cblas_(d)scal when possible

Global FFLAS::freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT *Y, const size_t incY, FFLAS_ELT *X, const size_t incX)

use cblas_(d)scal when possible

Global FFLAS::fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *X, const size_t incX, FFLAS_ELT *Y, const size_t incY)

use cblas_(d)scal when possible

Global FFLAS::fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, FFLAS_ELT *X, const size_t incX)

use cblas_(d)scal when possible

Global FFLAS::fsquare (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

why double ?

Global FFLAS::fswap (const Field &F, const size_t N, typename Field::Element_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

use cblas_dswap when double

Global FFLAS::fswap (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, FFLAS_ELT *X, const size↩_t incX, FFLAS_ELT *Y, const size_t incY)

use cblas_dswap when double

Global FFLAS::ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

α must be non zero.

Global FFLAS::ftrsm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_SIDE Side, const FFLAS_↩UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb)

α must be non zero.

Global FFPACK::buildMatrix (const Field &F, typename Field::ConstElement_ptr E, typename Field::ConstElement_ptr C, const size_t lda, const size_t *B, const size_t *T, const size_t me, const size_t mc, const size_t lambda, const size_t mu)

is this :

Global FFPACK::Invert2 (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

not tested.

Global launch_fger_dispatch (const Field &F, const size_t nn, const typename Field::Element alpha, const size_t iters, RandIter &G)

test for incx equal

test for transpo

Global launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, RandIter &G)

test for ldX equal

test for transpo

Global launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, const int nbw, const bool par, RandIter &G)

test for ldX equal

test for transpo

Global printvect (std::ostream &o, vector< T > &vect)

does not belong here

Chapter 7

Bibliography

Global FFLAS::Protected::TRSMBound (const Givaro::ModularBalanced< Element > &F)

Dumas Giorgi Pernet 06, arXiv:cs/0601133

Global FFPACK::LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size↩_t LSm, const size_t LSn, const size_t *P, const size_t *Q, size_t *RRP, size_t *CRP)

Dumas J-G., Pernet C., and Sultan Z. `Simultaneous` *computation of the row and column rank profiles* , ISSAC'13.

Global FFPACK::LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive, const size_t cutoff=__FFLASFFPACK_LUDIVINE_THRESHOLD)

Jeannerod C-P, Pernet, C. and Storjohann, A. `Rank-profile` *revealing Gaussian elimination and the CUP matrix decomposition* , J. of Symbolic Comp., 2013

- Pernet C, Brassel M `LUdivine`*, une divine factorisation* `LU`, 2002

Class ftrsmLeftUpperNoTransNonUnit< Element >

Dumas, Giorgi, Pernet 06, arXiv:cs/0601133.

Global FFPACK::PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)

Dumas J-G., Pernet C., and Sultan Z. `Simultaneous` *computation of the row and column rank profiles* , ISSAC'13, 2013

Global FFPACK::productBruhatxTS (const Field &Fi, size_t N, size_t s, size_t r, size_t t, const size_t *P, const size_t *Q, typename Field::ConstElement_ptr Xu, size_t ldu, size_t NbBlocksU, const size_t *Ku, const size_t *Tu, const size_t *MU, typename Field::ConstElement_ptr Xl, size_t ldl, size_t NbBlocksL, const size_t *Kl, const size_t *Tl, const size_t *ML, typename Field::Element_ptr B, size_t ldb, const typename Field::Element beta, typename Field::Element_ptr D, size_t ldd)

Pernet C. and Storjohann A. `Time` *and space efficient generators for quasiseparable matrices* , JSC (85), 2018, doi:10.1016/j.jsc.2017.07.010

Global FFPACK::Protected::GaussJordan (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t colbeg, const size_t rowbeg, const size_t colsize, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)

Algorithm 2.8 of A. Storjohann Thesis 2000,

- Algorithm 11 of Jeannerod C-P., Pernet, C. and Storjohann, A. `Rank-profile` *revealing Gaussian elimination and the CUP matrix decomposition* , J. of Symbolic Comp., 2013

Chapter 8

Todo List

File debug.h

we should put vector printing elsewhere.

Global FFLAS::fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)

optimise here

Global FFLAS::fassign (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *Y, const size_t incY, FFLAS_ELT *X, const size_t incX)

variant for triagular matrix

Global FFLAS::fconvert (const Field &F, const size_t m, const size_t n, OtherElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb)

check if n == lda

Global FFLAS::fneg (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

check if n == lda

Global FFLAS::fnegin (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

check if n == lda

Global FFLAS::fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *X, const size_t incX, FFLAS_ELT *Y, const size_t incY)

check if comparison with +/-1,0 is necessary.

Global FFLAS::fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, FFLAS_ELT *X, const size_t incX)

check if comparison with +/-1,0 is necessary.

Global FFLAS::Protected::igemm (const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, const int64_t beta, int64_t *C, size_t ldc)

use primitive (no Field()) and specialise for int64.

Global FFLAS::Protected::MatF2MatFl_Triangular (const Field &F, Givaro::FloatDomain::Element_ptr S, const size_t lds, typename Field::ConstElement_ptr const E, const size_t lde, const size_t m, const size_t n)

do finit(...,FFLAS_TRANS,FFLAS_DIAG)

do fconvert(...,FFLAS_TRANS,FFLAS_DIAG)

Global FFPACK::LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag, const size_t cutoff)

std::swap ?

Global FFPACK::Protected::RandomKrylovPrecond (const PolRing &PR, std::list< typename PolRing::↩ Element > &completedFactors, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, size_t &Nb, typename PolRing::Domain_t::Element_ptr &B, size_t &ldb, typename PolRing↩ ::Domain_t::RandIter &g, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

don't assing K2 c*noc x N but only mas (c,noc) x N and store each one after the other

swap to save space ??

Module field

biblio

Global launch_fger_dispatch (const Field &F, const size_t nn, const typename Field::Element alpha, const size_t iters, RandIter &G)

does nbw actually do nbw recursive calls and then call blas (check ?) ?

Global launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, const int nbw, const bool par, RandIter &G)

does nbw actually do nbw recursive calls and then call blas (check ?) ?

Global launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, RandIter &G)

does nbw actually do nbw recursive calls and then call blas (check ?) ?

Global test_redcolechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)

check lda

Global test_redrowechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)

check lda

Module MMalgos

biblio

Module simd

biblio

Global test_colechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)

check lda

Global test_det (Field &F, size_t n, int iter, RandIter &G)

test with stride

Global test_rowechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)

check lda

Chapter 9

Module Index

9.1 Modules

Here is a list of all modules:

Chapter 10

Namespace Index

10.1 Namespace List

Here is a list of all namespaces with brief descriptions:

Chapter 11

Hierarchical Index

11.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 12

Data Structure Index

12.1 Data Structures

Here are the data structures with brief descriptions:

Chapter 13

File Index

13.1 File List

Here is a list of all files with brief descriptions:

Chapter 14

Module Documentation

14.1 CHECKER

Class CHECKER provides functions to verify computations in FFLAS and FFPACK.

Class CHECKER provides functions to verify computations in FFLAS and FFPACK.

14.2 FFLAS

The C-style wrapper of BLAS for finite field linear algebra.

The C-style wrapper of BLAS for finite field linear algebra.

FFLAS, Finite Field Linear Algebra Subroutines, provide basic linear algebra subroutines based on the BLAS interface. Therefore, the specifications are in C style; only the field given as a template parameter requires `C++`.

As much as possible, these routines use `ATLAS/BLAS` computations and achieve therefore high efficiency.

14.3 Matrix Multiplication Algorithms

Matrix Multiplication (level 3) algorithms.

Files

- file schedule_bini.inl

  Bini implementation.

14.3.1 Detailed Description

Matrix Multiplication (level 3) algorithms.

Todo biblio

14.4 SIMD wrapper

wraps SIMD functions Supporst SSE4.1, AVX, AVX2.

wraps SIMD functions Supporst SSE4.1, AVX, AVX2.

Todo biblio

14.5 FFLAS-FFPACK

the FFLAS FFPACK library

Modules

- FFLAS
  The C-style wrapper of BLAS for finite field linear algebra.
- Interfaces
  Intefaces for FFLAS-FFPACK.

14.5.1 Detailed Description

the FFLAS FFPACK library

C++ header library for fast exact dense linear algebra

See also

FFLAS
FFPACK

14.6 FFPACK

Class FFPACK provides functions using fflas much as Lapack uses BLAS.

Class FFPACK provides functions using fflas much as Lapack uses BLAS.

14.7 FFLAS-FFPACK fields

fields in the FFLAS-FFPACK library

Files

- file rns-double-elt.h

  rns elt structure with double support
- file rns-double.h

  rns structure with double support
- file rns-integer-mod.h

  representation of $\mathbb{Z}/p\mathbb{Z}$ using RNS representation (note: fixed precision)
- file rns-integer.h

  representation of $\mathbb{Z}$ using RNS representation (note: fixed precision)
- file rns.h

14.7.1 Detailed Description

fields in the FFLAS-FFPACK library

Unparametric/Random elements

Todo biblio

14.8 RNS

just include them all

just include them all

14.9 Interfaces

Intefaces for FFLAS-FFPACK.

Intefaces for FFLAS-FFPACK.

C interface in folder

See also

libs

Chapter 15

Namespace Documentation

15.1 FFLAS Namespace Reference

Namespaces

- _ftranspose_impl
- BLAS3
- csr_hyb_details
- CuttingStrategy
- details
- details_spmv
- ElementCategories
- FieldCategories

  Traits and categories will need to be placed in a proper file later.
- MMHelperAlgo
- ModeCategories

  Specifies the mode of action for an algorithm w.r.t.
- ParSeqHelper

  ParSeqHelper for both fgemm and ftrsm.
- Protected
- sell_details
- sparse_details
- sparse_details_impl
- StrategyParameter
- StructureHelper

  StructureHelper for ftrsm.
- vectorised

Data Structures

- struct Checker_Empty
- class CheckerImplem_fgemm
- class CheckerImplem_ftrsm
- struct support_simd_add
- struct MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeqTrait >
- struct MMHelper< FFPACK::RNSInteger< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >

- struct MMHelper< FFPACK::RNSIntegerMod< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >
- struct support_simd_mod
- struct support_fast_mod
- struct support_fast_mod< float >
- struct support_fast_mod< double >
- struct support_fast_mod< int64_t >
- struct AlgoChooser
- struct AlgoChooser< ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq >
- struct MMHelper
- struct MMHelper< Field, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >

    FGEMM Helper for Default and ConvertTo modes of operation.
- struct MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< Dest >, ParSeqTrait >
- struct TRSMHelper

    TRSM Helper.
- struct support_simd
- struct Sparse< _Field, SparseMatrix_t::COO >
- struct Sparse< _Field, SparseMatrix_t::COO_ZO >
- struct Sparse< _Field, SparseMatrix_t::CSR >
- struct Sparse< _Field, SparseMatrix_t::CSR_ZO >
- struct Sparse< _Field, SparseMatrix_t::CSR_HYB >
- struct Sparse< _Field, SparseMatrix_t::ELL >
- struct Sparse< _Field, SparseMatrix_t::ELL_ZO >
- struct Sparse< _Field, SparseMatrix_t::ELL_simd >
- struct Sparse< _Field, SparseMatrix_t::ELL_simd_ZO >
- struct Sparse< _Field, SparseMatrix_t::HYB_ZO >
- struct readMyMachineType
- struct readMyMachineType< Field, mpz_t >
- struct Sparse< _Field, SparseMatrix_t::SELL >
- struct Sparse< _Field, SparseMatrix_t::SELL_ZO >
- struct isSparseMatrix
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_HYB > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::HYB_ZO > >
- struct isZOSparseMatrix
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >
- struct isSparseMatrixSimdFormat
- struct isSparseMatrixMKLFormat
- struct tfn_plus
- struct tfn_mul
- struct tfn_mul_eq
- struct tfn_minus

- struct tfn_plus_eq
- struct tfn_minus_eq
- struct has_plus_impl
- struct has_mul_impl
- struct has_mul_eq_impl
- struct has_plus_eq_impl
- struct has_minus_eq_impl
- struct has_minus_impl
- struct has_operation
- struct StatsMatrix
- struct Sparse
- struct HelperFlag
- struct CsrMat
- struct CooMat
- struct EllMat
- struct SpMat
- struct BlockTransposeSIMD
- struct ElementTraits

  ElementTraits.
- struct ElementTraits< float >
- struct ElementTraits< double >
- struct ElementTraits< int8_t >
- struct ElementTraits< int16_t >
- struct ElementTraits< int32_t >
- struct ElementTraits< int64_t >
- struct ElementTraits< uint8_t >
- struct ElementTraits< uint16_t >
- struct ElementTraits< uint32_t >
- struct ElementTraits< uint64_t >
- struct ElementTraits< Givaro::Integer >
- struct ElementTraits< RecInt::rint< K > >
- struct ElementTraits< RecInt::ruint< K > >
- struct ElementTraits< RecInt::rmint< K, MG > >
- struct ElementTraits< FFPACK::rns_double_elt >
- struct ModeTraits

  ModeTraits.
- struct ModeTraits< Givaro::Modular< Element, Compute > >
- struct ModeTraits< Givaro::Modular< int64_t, uint64_t > >
- struct ModeTraits< Givaro::Modular< int8_t, Compute > >
- struct ModeTraits< Givaro::Modular< int16_t, Compute > >
- struct ModeTraits< Givaro::Modular< int32_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint8_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint16_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint32_t, Compute > >
- struct ModeTraits< Givaro::Modular< Givaro::Integer, Compute > >
- struct ModeTraits< Givaro::Modular< RecInt::ruint< K >, Compute > >
- struct ModeTraits< Givaro::ModularBalanced< Element > >
- struct ModeTraits< Givaro::ModularBalanced< int8_t > >
- struct ModeTraits< Givaro::ModularBalanced< int16_t > >
- struct ModeTraits< Givaro::ModularBalanced< int32_t > >
- struct ModeTraits< Givaro::ModularBalanced< Givaro::Integer > >
- struct ModeTraits< Givaro::ZRing< Givaro::Integer > >
- struct ModeTraits< Givaro::ZRing< float > >
- struct ModeTraits< Givaro::ZRing< double > >

- struct ModeTraits< Givaro::Montgomery< T > >
- struct FieldTraits

  FieldTrait.
- struct FieldTraits< Givaro::ZRing< RecInt::ruint< K > > >
- struct FieldTraits< Givaro::Modular< Element > >
- struct FieldTraits< Givaro::ModularBalanced< Element > >
- struct FieldTraits< Givaro::ZRing< double > >
- struct FieldTraits< Givaro::ZRing< float > >
- struct FieldTraits< Givaro::ZRing< int16_t > >
- struct FieldTraits< Givaro::ZRing< uint16_t > >
- struct FieldTraits< Givaro::ZRing< int32_t > >
- struct FieldTraits< Givaro::ZRing< uint32_t > >
- struct FieldTraits< Givaro::ZRing< int64_t > >
- struct FieldTraits< Givaro::ZRing< uint64_t > >
- struct FieldTraits< Givaro::ZRing< Givaro::Integer > >
- struct FieldTraits< FFPACK::RNSInteger< T > >
- struct FieldTraits< FFPACK::RNSIntegerMod< T > >
- struct associatedDelayedField
- struct associatedDelayedField< const Givaro::Modular< T, X > >
- struct associatedDelayedField< const Givaro::ModularBalanced< T > >
- struct associatedDelayedField< const Givaro::ZRing< T > >
- struct associatedDelayedField< const FFPACK::RNSIntegerMod< RNS > >
- struct ForStrategy1D
- struct ForStrategy2D

Typedefs

- template<class Field >
  using Checker_fgemm = FFLAS::Checker_Empty< Field >
- template<class Field >
  using Checker_ftrsm = FFLAS::Checker_Empty< Field >
- template<class Field >
  using ForceCheck_fgemm = CheckerImplem_fgemm< Field >
- template<class Field >
  using ForceCheck_ftrsm = CheckerImplem_ftrsm< Field >
- using ZOSparseMatrix = std::true_type
- using NotZOSparseMatrix = std::false_type
- using SimdSparseMatrix = std::true_type
- using NoSimdSparseMatrix = std::false_type
- using MKLSparseMatrixFormat = std::true_type
- using NotMKLSparseMatrixFormat = std::false_type
- template<class T >
  using has_plus = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_plus_impl< T > >::type
- template<class T >
  using has_minus = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_minus_impl< T > >::type
- template<class T >
  using has_equal = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, std::is_copy↔_assignable< T > >::type
- template<class T >
  using has_plus_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_plus_eq_impl< T > >::type

- template< class T >
  using has_minus_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_minus_eq_impl< T > >::type
- template< class T >
  using has_mul = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_mul_impl< T > >::type
- template< class T >
  using has_mul_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_mul_eq_impl< T > >::type
- typedef Givaro::Timer Timer
- typedef Givaro::BaseTimer BaseTimer
- typedef Givaro::UserTimer UserTimer
- typedef Givaro::SysTimer SysTimer

Enumerations

- enum FFLAS_ORDER { FflasRowMajor =101 , FflasColMajor =102 }

  Storage by row or col ?
- enum FFLAS_TRANSPOSE { FflasNoTrans = 111 , FflasTrans = 112 }

  Is matrix transposed ?
- enum FFLAS_UPLO { FflasUpper = 121 , FflasLower = 122 , FflasLeftTri = 123 , FflasRightTri = 124 }

  Is triangular matrix's shape upper ?
- enum FFLAS_DIAG { FflasNonUnit = 131 , FflasUnit = 132 }

  Is the triangular matrix implicitly unit diagonal ?
- enum FFLAS_SIDE { FflasLeft = 141 , FflasRight = 142 }

  On what side ?
- enum FFLAS_BASE { FflasDouble = 151 , FflasFloat = 152 , FflasGeneric = 153 }

  `FFLAS_BASE` *determines the type of the element representation for Matrix Mult kernel.*
- enum number_kind { zero =0 , one =1 , mone =-1 , other =2 }
- enum class SparseMatrix_t {
  CSR , CSR_ZO , CSC , CSC_ZO ,
  COO , COO_ZO , ELL , ELL_ZO ,
  SELL , SELL_ZO , ELL_simd , ELL_simd_ZO ,
  CSR_HYB , HYB_ZO }
- enum FFLAS_FORMAT {
  FflasAuto = 0 , FflasDense = 1 , FflasSMS = 2 , FflasBinary = 3 ,
  FflasMath = 4 , FflasMaple = 5 , FflasSageMath = 6 }

Functions

- Givaro::Integer InfNorm (const size_t M, const size_t N, const Givaro::Integer ∗A, const size_t lda)
- template< class T >
  const T & min3 (const T &m, const T &n, const T &k)
- template< class T >
  const T & max3 (const T &m, const T &n, const T &k)
- template< class T >
  const T & min4 (const T &m, const T &n, const T &k, const T &l)
- template< class T >
  const T & max4 (const T &m, const T &n, const T &k, const T &l)
- template< class Field >
  void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)

- template<class Field >
void faddin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
void fsub (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
void fsubin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
void pfadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
void pfsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
void pfaddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
void pfsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadd : matrix addition.
- template<class Field >
void fsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsub : matrix subtraction.
- template<class Field >
void faddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size←_t ldb, typename Field::Element_ptr C, const size_t ldc)

  faddin
- template<class Field >
void faddin (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadding for symmetric matrices
- template<class Field >
void fsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsubin C = C - B
- template<class Field >
void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadd : matrix addition with scaling.
- template<class Field >
void fassign (const Field &F, const size_t N, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  fassign : $x \leftarrow y$.

- template<> void fassign (const Givaro::Modular< float > &F, const size_t N, const float *Y, const size_t incY, float *X, const size_t incX)
- template<> void fassign (const Givaro::ModularBalanced< float > &F, const size_t N, const float *Y, const size_t incY, float *X, const size_t incX)
- template<> void fassign (const Givaro::ZRing< float > &F, const size_t N, const float *Y, const size_t incY, float *X, const size_t incX)
- template<> void fassign (const Givaro::Modular< double > &F, const size_t N, const double *Y, const size_t incY, double *X, const size_t incX)
- template<> void fassign (const Givaro::ModularBalanced< double > &F, const size_t N, const double *Y, const size_t incY, double *X, const size_t incX)
- template<> void fassign (const Givaro::ZRing< double > &F, const size_t N, const double *Y, const size_t incY, double *X, const size_t incX)
- template<class Field >
  void fassign (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  fassign : $A \leftarrow B$.
- template<class Field >
  void faxpy (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template<> void faxpy (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::Element a, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void faxpy (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, Givaro::FloatDomain::Element_ptr y, const size_t incy)
- template<class Field >
  void faxpy (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t ldx, typename Field::Element_ptr Y, const size_t ldy)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DelayedTag &MT)
- template<> Givaro::DoubleDomain::Element fdot (const Givaro::DoubleDomain &, const size_t N, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<> Givaro::FloatDomain::Element fdot (const Givaro::FloatDomain &, const size_t N, Givaro::FloatDomain::ConstElem x, const size_t incx, Givaro::FloatDomain::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<class Field , class T >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::ConvertTo< T > &MT)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultBoundedTag &dbt)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, const ParSeqHelper::Sequential seq)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fdot: dot product $x^T y$.

- template<typename RNS , typename ParSeqTrait >
FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Compose< ParSeqHelper::Sequential, ParSeqTrait > > &H)
- template<typename RNS >
FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Sequential > &H)
- template<typename RNS , typename ParSeqTrait >
FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Compose< ParSeqHelper::Parallel< CuttingStrategy::RNSModulus, StrategyParameter::Threads >, ParSeqTrait > > &H)
- template<typename RNS , typename Cut , typename Param >
FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Parallel< Cut, Param > > &H)
- template<class ParSeq >
Givaro::Integer * fgemm (const Givaro::ZRing< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, const Givaro::Integer *B, const size_t ldb, Givaro::Integer beta, Givaro::Integer *C, const size_t ldc, MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template<typename RNS , class ModeT >
RNS::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename RNS::Element alpha, typename RNS::ConstElement_ptr Ad, const size_t lda, typename RNS::ConstElement_ptr Bd, const size_t ldb, const typename RNS::Element beta, typename RNS::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Winograd, ModeT, ParSeqHelper::Sequential > &H)
- template<typename RNS >
RNS::Element_ptr fgemm (const FFPACK::RNSIntegerMod< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename RNS::Element alpha, typename RNS::ConstElement_ptr Ad, const size_t lda, typename RNS::ConstElement_ptr Bd, const size_t ldb, const typename RNS::Element beta, typename RNS::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Winograd > &H)
- Givaro::Integer * fgemm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, const Givaro::Integer *B, const size_t ldb, const Givaro::Integer beta, Givaro::Integer *C, const size_t ldc, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)

- template< class ParSeq >
Givaro::Integer ∗ fgemm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer ∗A, const size_t lda, const Givaro::Integer ∗B, const size_t ldb, const Givaro::Integer beta, Givaro::Integer ∗C, const size_t ldc, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Auto, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template<size_t K1, size_t K2, class ParSeq >
RecInt::ruint< K1 > ∗ fgemm (const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const RecInt::ruint< K1 > alpha, const RecInt::ruint< K1 > ∗A, const size_t lda, const RecInt::ruint< K1 > ∗B, const size_t ldb, RecInt::ruint< K1 > beta, RecInt::ruint< K1 > ∗C, const size_t ldc, MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template<class Field , class ModeT >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeT > &H)
- template<class Field , class ModeT , class Cut , class Param >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::WinogradPar, ModeT, ParSeqHelper::Parallel< Cut, Param > > &H)
- template<class Field >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag >, ParSeqHelper::Sequential > &H)
- template<typename Field >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template<typename Field , class Cut , class Param >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par)
- template<typename Field >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.*
- template<typename Field , class ModeT , class ParSeq >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Auto, ModeT, ParSeq > &H)
- template<class Field >
Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE

tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential > &H)

- template<class Field >
  Field::Element_ptr fsquare (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsquare: Squares a matrix.
- template<> double * fsquare (const Givaro::ModularBalanced< double > &F, const FFLAS_TRANSPOSE ta, const size_t n, const double alpha, const double *A, const size_t lda, const double beta, double *C, const size_t ldc)
- template<> float * fsquare (const Givaro::ModularBalanced< float > &F, const FFLAS_TRANSPOSE ta, const size_t n, const float alpha, const float *A, const size_t lda, const float beta, float *C, const size_t ldc)
- template<> double * fsquare (const Givaro::Modular< double > &F, const FFLAS_TRANSPOSE ta, const size_t n, const double alpha, const double *A, const size_t lda, const double beta, double *C, const size_t ldc)
- template<> float * fsquare (const Givaro::Modular< float > &F, const FFLAS_TRANSPOSE ta, const size_t n, const float alpha, const float *A, const size_t lda, const float beta, float *C, const size_t ldc)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE TransA, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)

  finite prime Field GEneral Matrix Vector multiplication.
- Givaro::ZRing< int64_t >::Element_ptr fgemv (const Givaro::ZRing< int64_t > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const int64_t alpha, const int64_t *A, const size_t lda, const int64_t *X, const size_t incX, const int64_t beta, int64_t *Y, const size_t incY, MMHelper< Givaro::ZRing< int64_t >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- Givaro::DoubleDomain::Element_ptr fgemv (const Givaro::DoubleDomain &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const Givaro::DoubleDomain::Element alpha, const Givaro::DoubleDomain::ConstElement_ptr A, const size_t lda, const Givaro::DoubleDomain::ConstElement_ptr X, const size_t incX, const Givaro::DoubleDomain::Element beta, Givaro::DoubleDomain::Element_ptr Y, const size_t incY, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)

- template< class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- Givaro::FloatDomain::Element_ptr fgemv (const Givaro::FloatDomain &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const Givaro::FloatDomain::Element alpha, const Givaro::FloatDomain::ConstElement_ptr A, const size_t lda, const Givaro::FloatDomain::ConstElement_ptr X, const size_t incX, const Givaro::FloatDomain::Element beta, Givaro::FloatDomain::Element_ptr Y, const size_t incY, MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template< class Field , class Cut , class Param >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, ParSeqHelper::Parallel< Cut, Param > &parH)
- template< class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, ParSeqHelper::Sequential &seqH)
- FFPACK::rns_double::Element_ptr fgemv (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::ConstElement_ptr X, const size_t incX, const FFPACK::rns_double::Element beta, FFPACK::rns_double::Element_ptr Y, const size_t incY, MMHelper< FFPACK::RNSInteger< FFPACK::rns_double >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- FFPACK::rns_double::Element_ptr fgemv (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::ConstElement_ptr X, const size_t incX, const FFPACK::rns_double::Element beta, FFPACK::rns_double::Element_ptr Y, const size_t incY, MMHelper< FFPACK::RNSIntegerMod< FFPACK::rns_double >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- Givaro::Integer * fgemv (const Givaro::ZRing< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const Givaro::Integer alpha, Givaro::Integer *A, const size_t lda, Givaro::Integer *X, const size_t ldx, Givaro::Integer beta, Givaro::Integer *Y, const size_t ldy, MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- Givaro::Integer * fgemv (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const Givaro::Integer alpha, Givaro::Integer *A, const size_t lda, Givaro::Integer *X, const size_t ldx, Givaro::Integer beta, Givaro::Integer *Y, const size_t ldy, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- template<size_t K1, size_t K2, class ParSeq >
  RecInt::ruint< K1 > * fgemv (const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const RecInt::ruint< K1 > alpha, const RecInt::ruint< K1 > *A, const size_t lda, const RecInt::ruint< K1 > *X, const size_t incx, RecInt::ruint< K1 > beta, RecInt::ruint< K1 > *Y, const size_t incy, MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda)

  fger: rank one update of a general matrix
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, type-

name Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > > &H)

- template<class Field , class AnyTag >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, AnyTag > &H)
- void fger (const Givaro::DoubleDomain &F, const size_t M, const size_t N, const Givaro::DoubleDomain::Element alpha, const Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, const Givaro::DoubleDomain::ConstElement_ptr y, const size_t incy, Givaro::DoubleDomain::Element_ptr A, const size_t lda, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, const typename Field::ConstElement_ptr x, const size_t incx, const typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- void fger (const Givaro::FloatDomain &F, const size_t M, const size_t N, const Givaro::FloatDomain::Element alpha, const Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, const Givaro::FloatDomain::ConstElement_ptr y, const size_t incy, Givaro::FloatDomain::Element_ptr A, const size_t lda, MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template<class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)
- void fger (const Givaro::Modular< Givaro::Integer > &F, const size_t M, const size_t N, const typename Givaro::Integer alpha, typename Givaro::Integer *x, const size_t incx, typename Givaro::Integer *y, const size_t incy, typename Givaro::Integer *A, const size_t lda, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- template<typename RNS >
  void fger (const FFPACK::RNSInteger< RNS > &F, const size_t M, const size_t N, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::Element_ptr x, const size_t incx, typename FFPACK::RNSInteger< RNS >::Element_ptr y, const size_t incy, typename FFPACK::RNSInteger< RNS >::Element_ptr A, const size_t lda, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<typename RNS >
  void fger (const FFPACK::RNSIntegerMod< RNS > &F, const size_t M, const size_t N, const typename FFPACK::RNSIntegerMod< RNS >::Element alpha, typename FFPACK::RNSIntegerMod< RNS >::Element_ptr x, const size_t incx, typename FFPACK::RNSIntegerMod< RNS >::Element_ptr y, const size_t incy, typename FFPACK::RNSIntegerMod< RNS >::Element_ptr A, const size_t lda, MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Classic > &H)
- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow ymodF$.
- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow xmodF$.
- template<class Field >
  void freduce_constoverride (const Field &F, const size_t m, typename Field::ConstElement_ptr A, const size_t incX)

- template<class Field , class ConstOtherElement_ptr >
void finit (const Field &F, const size_t n, ConstOtherElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)
- template<class Field >
void finit (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  finit Initializes X in F\$.
- template<class Field >
void freduce (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow AmodF$.
- template<class Field >
void freduce (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::Element_ptr A, const size_t lda)

  freduce for square symmetric matrices
- template<class Field >
void pfreduce (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, const size_t numths)
- template<class Field >
void freduce (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow BmodF$.
- template<class Field >
void freduce_constoverride (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda)
- template<class Field , class OtherElement_ptr >
void finit (const Field &F, const size_t m, const size_t n, const OtherElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  finit $A \leftarrow BmodF$.
- template<class Field >
void finit (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  finit Initializes A in F\$.
- template<> void freduce (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t n, FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A, size_t inc)
- template<> void freduce (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, FFPACK::rns_double::Element_ptr A, size_t lda)
- template<class Field >
bool freivalds (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::ConstElement_ptr C, const size_t ldc)

  *freivalds: **F**reivalds **GE**neral **M**atrix **M**ultiply **R**andom **C**heck.*
- template<class Field >
void fscalin (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr X, const size_t incX)

  fscalin $x \leftarrow \alpha \cdot x$.
- template<class Field >
void fscal (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

  fscal $y \leftarrow \alpha \cdot x$.
- template<> void fscal (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::↩ Element a, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void fscal (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, Givaro::FloatDomain::Element_ptr y, const size_t incy)

- template<> void fscalin (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::Element a, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void fscalin (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::Element_ptr y, const size_t incy)
- template<class Field >
  void fscalin (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda)

  fscalin $A \leftarrow a \cdot A$.
- template<class Field >
  void fscal (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  fscal $B \leftarrow a \cdot A$.
- template<> void fscalin (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t inc)
- template<> void fscal (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t Ainc, FFPACK::rns_double::Element_ptr B, const size_t Binc)
- template<> void fscalin (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t lda)
- template<> void fscal (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::Element_ptr B, const size_t ldb)
- template<> void fscalin (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t n, const typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element alpha, typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A, const size_t inc)
- template<> void fscal (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t Ainc, FFPACK::rns_double::Element_ptr B, const size_t Binc)
- template<> void fscalin (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t lda)
- template<> void fscal (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::Element_ptr B, const size_t ldb)
- template<class Field >
  Field::Element_ptr fsyr2k (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyr2k: Symmetric Rank 2K update
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyrk: Symmetric Rank K update
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)

- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag >, ParSeqHelper::Sequential > &H)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template<class Field , typename Mode >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::DivideAndConquer, Mode > &H)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- Givaro::FloatDomain::Element_ptr fsyrk (const Givaro::FloatDomain &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const Givaro::FloatDomain::Element alpha, Givaro::FloatDomain::ConstElement_ptr A, const size_t lda, const Givaro::FloatDomain::Element beta, Givaro::FloatDomain::Element_ptr C, const size_t ldc, MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- Givaro::DoubleDomain::Element_ptr fsyrk (const Givaro::DoubleDomain &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const Givaro::DoubleDomain::Element alpha, Givaro::DoubleDomain::ConstElement_ptr A, const size_t lda, const Givaro::DoubleDomain::Element beta, Givaro::DoubleDomain::Element_ptr C, const size_t ldc, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

  fsyrk: Symmetric Rank K update with diagonal scaling
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq, const size_t threshold)
- template<class Field , class Cut , class Param >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const

size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const std::vector< bool > &twoBlock, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

fsyrk: Symmetric Rank K update with diagonal scaling

- template<class Field , class FieldTrait >
void computeS1S2 (const Field &F, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element x, const typename Field::Element y, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr S, const size_t lds, typename Field::Element_ptr T, const size_t ldt, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential > &H)
- template<class Field , class Mode >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, Mode > &H)
- template<class Field , class FieldTrait >
Field::Element_ptr fsyrk_strassen (const Field &F, const FFLAS_UPLO uplo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element y1, const typename Field::Element y2, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field >
void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply.*
- template<class Field >
void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply with 3 operands Computes* $C \leftarrow \alpha \mathrm{op}(A) B + betaC$ *or* $C \leftarrow \alpha B \mathrm{op}(A) + betaC$.
- template<class Field >
void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)
- template<class Field >
void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const ParSeqHelper::Sequential &PSH)
- template<class Field , class Cut , class Param >
void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const ParSeqHelper::Parallel< Cut, Param > &PSH)
- template<class Field , class ParSeqTrait = ParSeqHelper::Sequential>
void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Recursive, ParSeqTrait > &H)
- void ftrsm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, Givaro::Integer *B, const size_t ldb)

- void cblas_imptrsm (const enum FFLAS_ORDER Order, const enum FFLAS_SIDE Side, const enum FFLAS_UPLO Uplo, const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_DIAG Diag, const int M, const int N, const FFPACK::rns_double_elt alpha, FFPACK::rns_double_elt_cstptr A, const int lda, FFPACK::rns_double_elt_ptr B, const int ldb)
- template<class Field >
  void ftrsv (const Field &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, int incX)

  ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$
- void igemm_ (const enum FFLAS_ORDER Order, const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, const size_t M, const size_t N, const size_t K, const int64_t alpha, const int64_t ∗A, const size_t lda, const int64_t ∗B, const size_t ldb, const int64_t beta, int64_t ∗C, const size_t ldc)
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t n, const OtherElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  finit $x \leftarrow ymodF$.
- template<class Field , class OtherElement_ptr >
  void fconvert (const Field &F, const size_t n, OtherElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fconvert $x \leftarrow ymodF$.
- template<class Field >
  void fnegin (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  fnegin $x \leftarrow -x$.
- template<class Field >
  void fneg (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  fneg $x \leftarrow -y$.
- template<class Field >
  void fzero (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  fzero : $A \leftarrow 0$.
- template<class Field , class RandIter >
  void frand (const Field &F, RandIter &G, const size_t n, typename Field::Element_ptr X, const size_t incX)

  frand : $A \leftarrow random$.
- template<class Field >
  bool fiszero (const Field &F, const size_t n, typename Field::ConstElement_ptr X, const size_t incX)

  fiszero : test $X = 0$.
- template<class Field >
  bool fequal (const Field &F, const size_t n, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fequal : test $X = Y$.
- template<class Field >
  void faxpby (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.
- template<typename Field , class Cut , class Param >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY, const ParSeqHelper::Parallel< Cut, Param > par)
- template<class Field >
  void fswap (const Field &F, const size_t N, typename Field::Element_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

  fswap: $X \leftrightarrow Y$.
- template<class Field >
  void fzero (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fzero : $A \leftarrow 0$.

- template<class Field >
  void fzero (const Field &F, const FFLAS_UPLO shape, const FFLAS_DIAG diag, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fzero : $A \leftarrow 0$ *for a triangular matrix.*
- template<class Field , class RandIter >
  void frand (const Field &F, RandIter &G, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  frand : $A \leftarrow random.$
- template<class Field >
  bool fequal (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb)

  fequal : test $A = B.$
- template<class Field >
  bool fiszero (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda)

  fiszero : test $A = 0.$
- template<class Field >
  void fidentity (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, const typename Field::Element &d)

  creates a diagonal matrix
- template<class Field >
  void fidentity (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  creates a diagonal matrix
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  finit Initializes $\mathtt{A}$ *in* $F\$.$
- template<class Field , class OtherElement_ptr >
  void fconvert (const Field &F, const size_t m, const size_t n, OtherElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb)

  fconvert $A \leftarrow BmodF.$
- template<class Field >
  void fnegin (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fnegin $A \leftarrow -A.$
- template<class Field >
  void fneg (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  fneg $A \leftarrow -B.$
- template<class Field >
  void faxpby (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t ldx, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t ldy)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y.$
- template<class Field >
  void fmove (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  fmove : $A \leftarrow B$ *and* $B \leftarrow 0.$
- template<class Field >
  size_t bitsize (const Field &F, size_t M, size_t N, const typename Field::ConstElement_ptr A, size_t lda)

  bitsize: Computes the largest bitsize of the matrix' coefficients.
- template<> size_t bitsize< Givaro::ZRing< Givaro::Integer > > (const Givaro::ZRing< Givaro::Integer > &F, size_t M, size_t N, const Givaro::Integer *A, size_t lda)
- template<class Field >
  void ftrmv (const Field &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, int incX)

ftrsm: TRiangular Matrix Vector prodcut Computes $X \leftarrow \mathrm{op}(A)X$

- template<class Field >
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  *ftrsm: **TR**iangular **S**ystem solve with **M**atrix.*
- template<class Field , typename FieldTrait >
  Field::Element_ptr fsyrk_strassen (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element y1, const typename Field::Element y2, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &H)
- template<typename Field >
  Field::Element_ptr pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t numthreads=0)
- template<class Field >
  Field::Element * pfgemm_1D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, size_t seuil)
- template<class Field >
  Field::Element * pfgemm_2D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, size_t seuil)
- template<class Field >
  Field::Element * pfgemm_3D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t seuil, size_t *x)
- template<class Field >
  Field::Element_ptr pfgemm_3D_rec2 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t seuil, size_t *x)
- template<class Field , class ModeTrait , class Strat , class Param >
  std::enable_if<!std::is_same< ModeTrait, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > >::value, typename Field::Element_ptr >::type fgemm (const Field &F, const FFLAS::FFLAS_TRANSPOSE ta, const FFLAS::FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeTrait, ParSeqHelper::Parallel< Strat, Param > > &H)
- template<class Field , class Cut , class Param >
  Field::Element_ptr ftrsm (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_TRANSPOSE TA, const FFLAS::FFLAS_DIAG Diag, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Iterative, ParSeqHelper::Parallel< Cut, Param > > &H)
- template<class Field , class Cut , class Param >
  Field::Element_ptr ftrsm (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_TRANSPOSE TA, const FFLAS::FFLAS_DIAG Diag, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Hybrid, ParSeqHelper::Parallel< Cut, Param > > &H)

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::COO > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::COO_ZO > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_ZO > &A)
- template<class Field >
  std::ostream & sparse_print (std::ostream &os, const Sparse< Field, SparseMatrix_t::CSR > &A)
- template<class IndexT >
  void sparse_init (const Givaro::Modular< Givaro::Integer > &F, Sparse< Givaro::Modular< Givaro::Integer >, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, Givaro::Integer ∗dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT >
  void sparse_init (const Givaro::ZRing< Givaro::Integer > &F, Sparse< Givaro::ZRing< Givaro::Integer >, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, Givaro::Integer ∗dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT , size_t RECINT_SIZE>
  void sparse_init (const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> &F, Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT , size_t RECINT_SIZE>
  void sparse_init (const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> &F, Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_HYB > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_HYB > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_ZO > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd > &A)

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A)
- template<class Field >
  void sparse_print (const Sparse< Field, SparseMatrix_t::ELL_simd > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::HYB_ZO > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::HYB_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<typename _Field >
  std::ostream & operator<< (std::ostream &os, const Sparse< _Field, SparseMatrix_t::HYB_ZO > &A)
- template<class Field , bool sorted = true, bool read_integer = false>
  void readSmsFormat (const std::string &path, const Field &f, index_t ∗&row, index_t ∗&col, typename Field::Element_ptr &val, index_t &rowdim, index_t &coldim, uint64_t &nnz)
- template<class Field >
  void readSprFormat (const std::string &path, const Field &f, index_t ∗&row, index_t ∗&col, typename Field::Element_ptr &val, index_t &rowdim, index_t &coldim, uint64_t &nnz)
- template<class T >
  std::enable_if< std::is_integral< T >::value, int > getDataType ()
- template<class T >
  std::enable_if< std::is_floating_point< T >::value, int > getDataType ()
- template<class T >
  std::enable_if< std::is_same< T, mpz_t >::value, int > getDataType ()
- template<class T >
  int getDataType ()
- template<class Field >
  void readMachineType (const Field &F, typename Field::Element &modulo, typename Field::Element_ptr val, std::ifstream &file, const uint64_t dims, const mask_t data_type, const mask_t field_desc)
- template<class Field >
  void readDnsFormat (const std::string &path, const Field &F, index_t &rowdim, index_t &coldim, typename Field::Element_ptr &val)
- template<class Field >
  void writeDnsFormat (const std::string &path, const Field &F, const index_t &rowdim, const index_t &coldim, typename Field::Element_ptr A, index_t ldA)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::SELL > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::SELL_ZO > &A)
- template<class Field >
  void sparse_print (const Sparse< Field, SparseMatrix_t::SELL > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::SELL > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz, uint64_t sigma=0)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::SELL_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

- template<class It >
  double computeDeviation (It begin, It end)
- template<class Field >
  StatsMatrix getStat (const Field &F, const index_t ∗row, const index_t ∗col, typename Field::ConstElement_ptr val, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, const typename Field::Element &beta, typename Field::Element_ptr y)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, const typename Field::Element &beta, typename Field::Element_ptr y, int ldy)
- template<class Field , class enable = void>
  Field::Residu_t maxCardinality ()
- template<> uint64_t maxCardinality< Givaro::Modular< int64_t > > ()
- template<> uint32_t maxCardinality< Givaro::Modular< int32_t > > ()
- template<class Field >
  Field::Residu_t minCardinality ()
- template<> void fflas_delete (FFPACK::rns_double_elt_ptr A)
- template<> void fflas_delete (FFPACK::rns_double_elt_cstptr A)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const Alignment align)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const Alignment align)
- template<typename RNS >
  void finit_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer ∗B, const size_t ldb, typename RNS::Element_ptr A)
- template<typename RNS >
  void finit_trans_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer ∗B, const size_t ldb, typename RNS::Element_ptr A)
- template<typename RNS >
  void fconvert_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, Givaro::↩
  Integer alpha, Givaro::Integer ∗B, const size_t ldb, typename RNS::ConstElement_ptr A)
- template<typename RNS >
  void fconvert_trans_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, Givaro::Integer alpha, Givaro::Integer ∗B, const size_t ldb, typename RNS::ConstElement_ptr A)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const Alignment align)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const Alignment align)
- template<typename RNS >
  void finit_rns (const FFPACK::RNSInteger< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer ∗B, const size_t ldb, typename FFPACK::RNSInteger< RNS >::Element_ptr A)
- template<typename RNS >
  void fconvert_rns (const FFPACK::RNSInteger< RNS > &F, const size_t m, const size_t n, Givaro::Integer alpha, Givaro::Integer ∗B, const size_t ldb, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr A)
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  freduce $x \leftarrow xmodF$.
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  freduce $x \leftarrow ymodF$.
- template INST_OR_DECL void finit (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  finit $x \leftarrow ymodF$.
- template INST_OR_DECL void fconvert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX, const FFLAS_ELT ∗Y, const size_t incY)

fconvert $x \leftarrow ymodF$.

- template INST_OR_DECL void fnegin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  fnegin $x \leftarrow -x$.

- template INST_OR_DECL void fneg (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  fneg $x \leftarrow -y$.

- template INST_OR_DECL void fzero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  fzero : $A \leftarrow 0$.

- template INST_OR_DECL bool fiszero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗X, const size_t incX)

  fiszero : test $X = 0$.

- template INST_OR_DECL bool fequal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗X, const size_t incX, const FFLAS_ELT ∗Y, const size_t incY)

  fequal : test $X = Y$.

- template INST_OR_DECL void fassign (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  fassign : $x \leftarrow y$.

- template INST_OR_DECL void fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, FFLAS_ELT ∗X, const size_t incX)

  fscalin $x \leftarrow \alpha \cdot x$.

- template INST_OR_DECL void fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT ∗X, const size_t incX, FFLAS_ELT ∗Y, const size_t incY)

  fscal $y \leftarrow \alpha \cdot x$.

- template INST_OR_DECL void faxpy (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT ∗X, const size_t incX, FFLAS_ELT ∗Y, const size_t incY)

  faxpy : $y \leftarrow \alpha \cdot x + y$.

- template INST_OR_DECL FFLAS_ELT fdot (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗X, const size_t incX, const FFLAS_ELT ∗Y, const size_t incY)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

- template INST_OR_DECL void fswap (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, FFLAS_ELT ∗X, const size_t incX, FFLAS_ELT ∗Y, const size_t incY)

  fswap: $X \leftrightarrow Y$.

- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗A, const size_t inca, const FFLAS_ELT ∗B, const size_t incb, FFLAS_ELT ∗C, const size_t incc)
- template INST_OR_DECL void fsub (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗A, const size_t inca, const FFLAS_ELT ∗B, const size_t incb, FFLAS_ELT ∗C, const size_t incc)
- template INST_OR_DECL void faddin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗B, const size_t incb, FFLAS_ELT ∗C, const size_t incc)
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗A, const size_t inca, const FFLAS_ELT alpha, const FFLAS_ELT ∗B, const size_t incb, FFLAS_ELT ∗C, const size_t incc)
- template INST_OR_DECL void fassign (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗B, const size_t ldb, FFLAS_ELT ∗A, const size_t lda)

  fassign : $A \leftarrow B$.

- template INST_OR_DECL void fzero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT ∗A, const size_t lda)

  fzero : $A \leftarrow 0$.

- template INST_OR_DECL bool fequal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb)

  fequal : test $A = B$.

- template INST_OR_DECL bool fiszero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT *A, const size_t lda)

  fiszero : test $A = 0$*.*
- template INST_OR_DECL void fidentity (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT *A, const size_t lda, const FFLAS_ELT &d)

  creates a diagonal matrix
- template INST_OR_DECL void fidentity (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT *A, const size_t lda)

  creates a diagonal matrix
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT *A, const size_t lda)

  freduce $A \leftarrow AmodF$*.*
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *A, const size_t lda)

  freduce $A \leftarrow BmodF$*.*
- template INST_OR_DECL void finit (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *A, const size_t lda)

  finit $A \leftarrow BmodF$*.*
- template INST_OR_DECL void fnegin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT *A, const size_t lda)

  fnegin $A \leftarrow -A$*.*
- template INST_OR_DECL void fneg (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *A, const size_t lda)

  fneg $A \leftarrow -B$*.*
- template INST_OR_DECL void fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT alpha, FFLAS_ELT *A, const size_t lda)

  fscalin $A \leftarrow a \cdot A$*.*
- template INST_OR_DECL void fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb)

  fscal $B \leftarrow a \cdot A$*.*
- template INST_OR_DECL void faxpy (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *X, const size_t ldx, FFLAS_ELT *Y, const size_t ldy)

  faxpy : $y \leftarrow \alpha \cdot x + y$*.*
- template INST_OR_DECL void fmove (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$*.*
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

  fadd : matrix addition.
- template INST_OR_DECL void fsub (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

  fsub : matrix subtraction.
- template INST_OR_DECL void fsubin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

  fsubin C = C - B
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT alpha, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

  fadd : matrix addition with scaling.
- template INST_OR_DECL void faddin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

faddin

- template INST_OR_DECL FFLAS_ELT * fgemv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE TransA, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *X, const size_t incX, const FFLAS_ELT beta, FFLAS_ELT *Y, const size_t incY)

  finite prime FFLAS_FIELD<FFLAS_ELT> GEneral Matrix Vector multiplication.
- template INST_OR_DECL void fger (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *x, const size_t incx, const FFLAS_ELT *y, const size_t incy, FFLAS_ELT *A, const size_t lda)

  fger: rank one update of a general matrix
- template INST_OR_DECL void ftrsv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *X, int incX)

  ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$
- template INST_OR_DECL void ftrsm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb)

  *ftrsm: **TR**iangular **S**ystem solve with **M**atrix.*
- template INST_OR_DECL void ftrmm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply.*
- template INST_OR_DECL FFLAS_ELT * fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT *C, const size_t ldc)

  *fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.*
- template INST_OR_DECL FFLAS_ELT * fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT *C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template INST_OR_DECL FFLAS_ELT * fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size←
_t k, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT *C, const size_t ldc, const ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoDAdaptive > par)
- template INST_OR_DECL FFLAS_ELT * fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT *C, const size_t ldc, const ParSeqHelper::Parallel< CuttingStrategy::Block, StrategyParameter::Threads > par)
- template INST_OR_DECL FFLAS_ELT * fsquare (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_TRANSPOSE ta, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT beta, FFLAS_ELT *C, const size_t ldc)

  fsquare: Squares a matrix.
- template<class Cut = CuttingStrategy::Block, class Strat = StrategyParameter::Threads>
void BlockCuts (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Single, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)

- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)
- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<class Cut = CuttingStrategy::Block, class Param = StrategyParameter::Threads>
  void BlockCuts (size_t &rowBlockSize, size_t &colBlockSize, size_t &lastRBS, size_t &lastCBS, size_t &changeRBS, size_t &changeCBS, size_t &numRowBlock, size_t &numColBlock, size_t m, size_t n, const size_t numthreads)
- template<class Field >
  void pfzero (const Field &F, size_t m, size_t n, typename Field::Element_ptr C, size_t BS=0)
- template<class Field , class RandIter >
  void pfrand (const Field &F, RandIter &G, size_t m, size_t n, typename Field::Element_ptr C, size_t BS=0)
- template<class Field , class Cut , class Param >
  Field::Element & fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element &d, const ParSeqHelper::Parallel< Cut, Param > par)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Block, StrategyParameter::Threads > > &H)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeDAdaptive > > &H)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoDAdaptive > > &H)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoD > > &H)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element_ptr pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeD > > &H)

- template<class Field , class AlgoT , class FieldTrait >
  Field::Element ∗ pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeDInPlace > > &H)
- template<class Field , class AlgoT , class FieldTrait >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_↩ t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::Threads > > &H)
- template<class Field , class AlgoT , class FieldTrait , class Cut >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_↩ t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Row, Cut > > &H)
- void parseArguments (int argc, char ∗∗argv, Argument ∗args, bool printDefaults=true)
- char ∗ getArgumentValue (int argc, char ∗∗argv, int i)

  Get the value of an argument and avoid core dump when no value was given after an argument.
- std::ostream & writeCommandString (std::ostream &os, Argument ∗args, const char ∗programName=nullptr)

  writes the values of all arguments, preceded by the programName
- template<class Field >
  std::ostream & WriteMatrix (std::ostream &c, const Field &F, size_t m, size_t n, typename Field::ConstElement_ptr A, size_t lda, FFLAS_FORMAT format, bool column_major)

  WriteMatrix: write a matrix to an output stream.
- void preamble (std::ifstream &ifs, FFLAS_FORMAT &format)
- template<class Field >
  Field::Element_ptr ReadMatrix (std::ifstream &ifs, Field &F, size_t &m, size_t &n, typename Field::Element_ptr &A, FFLAS_FORMAT format=FflasAuto)

  ReadMatrix: read a matrix from an input stream.
- template<class Field >
  Field::Element_ptr ReadMatrix (const std::string &matrix_file, Field &F, size_t &m, size_t &n, typename Field::Element_ptr &A, FFLAS_FORMAT format=FflasAuto)

  ReadMatrix: read a matrix from a file.
- template<class Field >
  void WriteMatrix (std::string &matrix_file, const Field &F, int m, int n, typename Field::ConstElement_ptr A, size_t lda, FFLAS_FORMAT format=FflasDense, bool column_major=false)

  WriteMatrix: write a matrix to a file.
- std::ostream & WritePermutation (std::ostream &c, const size_t ∗P, size_t N)

  WritePermutation: write a permutation matrix to an output stream.
- template<class Element >
  bool alignable ()
- template<> bool alignable< Givaro::Integer ∗ > ()
- template<class Field >
  Field::Element_ptr fflas_new (const Field &F, const size_t m, const Alignment align=Alignment::DEFAULT)
- template<class Field >
  Field::Element_ptr fflas_new (const Field &F, const size_t m, const size_t n, const Alignment align=Alignment::DEFAULT)
- template<class Element >
  Element ∗ fflas_new (const size_t m, const Alignment align=Alignment::DEFAULT)
- template<class Ptr , class ... Args>
  void fflas_delete (Ptr p, Args ... args)

- void prefetch (const int64_t ∗)
- void getTLBSize (int &tlb)
- void queryCacheSizes (int &l1, int &l2, int &l3)
- int queryL1CacheSize ()
- int queryTopLevelCacheSize ()
- uint64_t getSeed ()

15.1.1 Typedef Documentation

15.1.1.1 Checker_fgemm

```
using Checker_fgemm = FFLAS::Checker_Empty<Field>
```

15.1.1.2 Checker_ftrsm

```
using Checker_ftrsm = FFLAS::Checker_Empty<Field>
```

15.1.1.3 ForceCheck_fgemm

```
using ForceCheck_fgemm = CheckerImplem_fgemm<Field>
```

15.1.1.4 ForceCheck_ftrsm

```
using ForceCheck_ftrsm = CheckerImplem_ftrsm<Field>
```

15.1.1.5 ZOSparseMatrix

```
using ZOSparseMatrix = std::true_type
```

15.1.1.6 NotZOSparseMatrix

```
using NotZOSparseMatrix = std::false_type
```

15.1.1.7 SimdSparseMatrix

```
using SimdSparseMatrix = std::true_type
```

15.1.1.8 NoSimdSparseMatrix

```
using NoSimdSparseMatrix = std::false_type
```

15.1.1.9 MKLSparseMatrixFormat

```
using MKLSparseMatrixFormat = std::true_type
```

15.1.1.10 NotMKLSparseMatrixFormat

```
using NotMKLSparseMatrixFormat = std::false_type
```

15.1.1.11 has_plus

```
using has_plus = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
has_plus_impl<T> >::type
```

15.1.1.12 has_minus

```
using has_minus = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
has_minus_impl<T> >::type
```

15.1.1.13 has_equal

```
using has_equal = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
std::is_copy_assignable<T> >::type
```

15.1.1.14 has_plus_eq

```
using has_plus_eq = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
has_plus_eq_impl<T> >::type
```

15.1.1.15 has_minus_eq

```
using has_minus_eq = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
has_minus_eq_impl<T> >::type
```

15.1.1.16 has_mul

```
using has_mul = typename std::conditional<std::is_arithmetic<T>::value, std::true_type, has_mul_impl<T>
>::type
```

15.1.1.17 has_mul_eq

```
using has_mul_eq = typename std::conditional<std::is_arithmetic<T>::value, std::true_type,
has_mul_eq_impl<T> >::type
```

15.1.1.18 Timer

```
typedef Givaro::Timer Timer
```

15.1.1.19 BaseTimer

```
typedef Givaro::BaseTimer BaseTimer
```

15.1.1.20 UserTimer

```
typedef Givaro::UserTimer UserTimer
```

15.1.1.21 SysTimer

```
typedef Givaro::SysTimer SysTimer
```

15.1.2 Enumeration Type Documentation

15.1.2.1 FFLAS_ORDER

```
enum FFLAS_ORDER
```

Storage by row or col ?

Enumerator

FflasRowMajor	row major
FflasColMajor	col major

15.1.2.2 FFLAS_TRANSPOSE

`enum FFLAS_TRANSPOSE`

Is matrix transposed ?

Enumerator

FflasNoTrans	Matrix is not transposed.
FflasTrans	Matrix is transposed.

15.1.2.3 FFLAS_UPLO

`enum FFLAS_UPLO`

Is triangular matrix's shape upper ?

Enumerator

FflasUpper	Triangular matrix is Upper triangular (if $i > j$ then $T_{i,j} = 0$)
FflasLower	Triangular matrix is Lower triangular (if $i < j$ then $T_{i,j} = 0$)
FflasLeftTri	Triangular matrix is Left triangular (if $j > n - i - 1$ then $T_{i,j} = 0$)
FflasRightTri	Triangular matrix is Right triangular (if $j < n - i - 1$ then $T_{i,j} = 0$)

15.1.2.4 FFLAS_DIAG

`enum FFLAS_DIAG`

Is the triangular matrix implicitly unit diagonal ?

Enumerator

FflasNonUnit	Triangular matrix has an explicit arbitrary diagonal.
FflasUnit	Triangular matrix has an implicit unit diagonal ($T_{i,i} = 1$)

15.1.2.5 FFLAS_SIDE

`enum FFLAS_SIDE`

On what side ?

Enumerator

FflasLeft	Operator applied on the left.
FflasRight	Operator applied on the rigth.

15.1.2.6 FFLAS_BASE

`enum FFLAS_BASE`

`FFLAS_BASE` determines the type of the element representation for Matrix Mult kernel.

(deprecated, should not be used)

Enumerator

FflasDouble	to use the double precision BLAS
FflasFloat	to use the single precison BLAS
FflasGeneric	for any other domain, that can not be converted to floating point integers

15.1.2.7 number_kind

`enum number_kind`

Enumerator

zero	
one	
mone	
other	

15.1.2.8 SparseMatrix_t

`enum SparseMatrix_t [strong]`

Enumerator

CSR	
CSR_ZO	
CSC	
CSC_ZO	
COO	
COO_ZO	
ELL	
ELL_ZO	
SELL	
SELL_ZO	
ELL_simd	
ELL_simd_ZO	
CSR_HYB	
HYB_ZO	

15.1.2.9 FFLAS_FORMAT

```
enum FFLAS_FORMAT
```

Enumerator

FflasAuto	
FflasDense	
FflasSMS	
FflasBinary	
FflasMath	
FflasMaple	
FflasSageMath	

15.1.3 Function Documentation

15.1.3.1 InfNorm()

```
Givaro::Integer FFLAS::InfNorm (
            const size_t M,
            const size_t N,
            const Givaro::Integer * A,
            const size_t lda )  [inline]
```

15.1.3.2 min3()

```
const T& FFLAS::min3 (
            const T & m,
            const T & n,
            const T & k )
```

15.1.3.3 max3()

```
const T& FFLAS::max3 (
            const T & m,
            const T & n,
            const T & k )
```

15.1.3.4 min4()

```
const T& FFLAS::min4 (
            const T & m,
            const T & n,
            const T & k,
            const T & l )
```

15.1.3.5 max4()

```
const T& FFLAS::max4 (
            const T & m,
            const T & n,
            const T & k,
            const T & l )
```

15.1.3.6 fadd() [1/8]

```
void FFLAS::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc )
```

15.1.3.7 faddin() [1/5]

```
void FFLAS::faddin (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc )
```

15.1.3.8 fsub() [1/4]

```
void FFLAS::fsub (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc )
```

15.1.3.9 fsubin() [1/3]

```
void FFLAS::fsubin (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc )
```

15.1.3.10 fadd() [2/8]

```
void FFLAS::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc )
```

Todo optimise here

15.1.3.11 pfadd()

```
void FFLAS::pfadd (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc,
            const size_t numths )
```

15.1.3.12 pfsub()

```
void FFLAS::pfsub (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc,
            const size_t numths )
```

15.1.3.13 pfaddin()

```
void FFLAS::pfaddin (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc,
            size_t numths )
```

15.1.3.14 pfsubin()

```
void FFLAS::pfsubin (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc,
            size_t numths )
```

15.1.3.15 fadd() [3/8]

```
void FFLAS::fadd (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

fadd : matrix addition.

Computes C = A + B.

Parameters

F	field
M	rows
N	cols
A	dense matrix of size MxN
lda	leading dimension of A
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.16 fsub() [2/4]

```
void FFLAS::fsub (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

fsub : matrix subtraction.

Computes C = A - B.

Parameters

F	field
M	rows
N	cols

Parameters

A	dense matrix of size MxN
lda	leading dimension of A
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.17 faddin() [2/5]

```
void FFLAS::faddin (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

faddin

15.1.3.18 faddin() [3/5]

```
void FFLAS::faddin (
            const Field & F,
            const FFLAS_UPLO uplo,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

fadding for symmetric matrices

15.1.3.19 fsubin() [2/3]

```
void FFLAS::fsubin (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

fsubin C = C - B

15.1.3.20 fadd() [4/8]

```
void FFLAS::fadd (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr C,
            const size_t ldc )
```

fadd : matrix addition with scaling.

Computes C = A + alpha B.

Parameters

F	field
M	rows
N	cols
A	dense matrix of size MxN
lda	leading dimension of A
alpha	some scalar
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.21 fassign() [1/10]

```
void FFLAS::fassign (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr Y,
            const size_t incY,
            typename Field::Element_ptr X,
            const size_t incX ) [inline]
```

fassign : $x \leftarrow y$.

X is preallocated

Todo variant for triagular matrix

Parameters

	F	field

Parameters

	N	size of the vectors
out	*X*	vector in F
	incX	stride of X
in	*Y*	vector in F
	incY	stride of Y

15.1.3.22 fassign() [2/10]

```
void FFLAS::fassign (
            const Givaro::Modular< float > & F,
            const size_t N,
            const float * Y,
            const size_t incY,
            float * X,
            const size_t incX ) [inline]
```

15.1.3.23 fassign() [3/10]

```
void FFLAS::fassign (
            const Givaro::ModularBalanced< float > & F,
            const size_t N,
            const float * Y,
            const size_t incY,
            float * X,
            const size_t incX ) [inline]
```

15.1.3.24 fassign() [4/10]

```
void FFLAS::fassign (
            const Givaro::ZRing< float > & F,
            const size_t N,
            const float * Y,
            const size_t incY,
            float * X,
            const size_t incX ) [inline]
```

15.1.3.25 fassign() [5/10]

```
void FFLAS::fassign (
            const Givaro::Modular< double > & F,
            const size_t N,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX )  [inline]
```

15.1.3.26 fassign() [6/10]

```
void FFLAS::fassign (
            const Givaro::ModularBalanced< double > & F,
            const size_t N,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX )  [inline]
```

15.1.3.27 fassign() [7/10]

```
void FFLAS::fassign (
            const Givaro::ZRing< double > & F,
            const size_t N,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX )  [inline]
```

15.1.3.28 fassign() [8/10]

```
void FFLAS::fassign (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr A,
            const size_t lda )
```

fassign : $A \leftarrow B$.

Parameters

F	field
m	number of rows to copy
n	number of cols to copy
A	matrix in F
lda	stride of A
B	vector in F

15.1.3.29 faxpy() [1/6]

```
void FFLAS::faxpy (
            const Field & F,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY ) [inline]
```

faxpy : $y \leftarrow \alpha \cdot x + y$.

Parameters

	F	field
	N	size of the vectors
	alpha	scalar
in	*X*	vector in F
	incX	stride of X
in,out	*Y*	vector in F
	incY	stride of Y

15.1.3.30 faxpy() [2/6]

```
void FFLAS::faxpy (
            const Givaro::DoubleDomain & ,
            const size_t N,
            const Givaro::DoubleDomain::Element a,
            Givaro::DoubleDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::DoubleDomain::Element_ptr y,
            const size_t incy ) [inline]
```

15.1.3.31 faxpy() [3/6]

```
void FFLAS::faxpy (
            const Givaro::FloatDomain & ,
            const size_t N,
            const Givaro::FloatDomain::Element a,
            Givaro::FloatDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::FloatDomain::Element_ptr y,
            const size_t incy ) [inline]
```

15.1.3.32 faxpy() [4/6]

```
void FFLAS::faxpy (
            const Field & F,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr X,
            const size_t ldx,
            typename Field::Element_ptr Y,
            const size_t ldy ) [inline]
```

faxpy : $y \leftarrow \alpha \cdot x + y$.

Parameters

	F	field
	m	row dimension
	n	column dimension
	alpha	scalar
in	*X*	vector in F
	ldx	leading dimension of X
in,out	*Y*	vector in F
	ldy	leading dimension of Y

15.1.3.33 fdot() [1/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::DefaultTag & MT ) [inline]
```

15.1.3.34 fdot() [2/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::DelayedTag & MT ) [inline]
```

15.1.3.35 fdot() [3/11]

```
Givaro::DoubleDomain::Element FFLAS::fdot (
            const Givaro::DoubleDomain & ,
            const size_t N,
            Givaro::DoubleDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::DoubleDomain::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::DefaultTag & MT ) [inline]
```

15.1.3.36 fdot() [4/11]

```
Givaro::FloatDomain::Element FFLAS::fdot (
            const Givaro::FloatDomain & ,
            const size_t N,
            Givaro::FloatDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::FloatDomain::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::DefaultTag & MT ) [inline]
```

15.1.3.37 fdot() [5/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::ConvertTo< T > & MT ) [inline]
```

15.1.3.38 fdot() [6/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            ModeCategories::DefaultBoundedTag & dbt ) [inline]
```

15.1.3.39 fdot() [7/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            const ParSeqHelper::Sequential seq )  [inline]
```

15.1.3.40 fdot() [8/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::ConstElement_ptr Y,
            const size_t incY )  [inline]
```

fdot: dot product $x^T y$.

Parameters

F	field
N	size of the vectors
X	vector in F
incX	stride of X
Y	vector in F
incY	stride of Y

15.1.3.41 fgemm() [1/23]

```
FFPACK::RNSInteger<RNS>::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSInteger< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename FFPACK::RNSInteger< RNS >::Element alpha,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad,
            const size_t lda,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd,
            const size_t ldb,
            const typename FFPACK::RNSInteger< RNS >::Element beta,
            typename FFPACK::RNSInteger< RNS >::Element_ptr Cd,
```

```
            const size_t ldc,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag,
ParSeqHelper::Compose< ParSeqHelper::Sequential, ParSeqTrait > > & H )   [inline]
```

15.1.3.42 fgemm() [2/23]

```
FFPACK::RNSInteger<RNS>::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSInteger< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename FFPACK::RNSInteger< RNS >::Element alpha,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad,
            const size_t lda,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd,
            const size_t ldb,
            const typename FFPACK::RNSInteger< RNS >::Element beta,
            typename FFPACK::RNSInteger< RNS >::Element_ptr Cd,
            const size_t ldc,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag,
ParSeqHelper::Sequential > & H )   [inline]
```

15.1.3.43 fgemm() [3/23]

```
FFPACK::RNSInteger<RNS>::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSInteger< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename FFPACK::RNSInteger< RNS >::Element alpha,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad,
            const size_t lda,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd,
            const size_t ldb,
            const typename FFPACK::RNSInteger< RNS >::Element beta,
            typename FFPACK::RNSInteger< RNS >::Element_ptr Cd,
            const size_t ldc,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag,
ParSeqHelper::Compose< ParSeqHelper::Parallel< CuttingStrategy::RNSModulus, StrategyParameter::Threads
>, ParSeqTrait > > & H )   [inline]
```

15.1.3.44 fgemm() [4/23]

```
FFPACK::RNSInteger<RNS>::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSInteger< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename FFPACK::RNSInteger< RNS >::Element alpha,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad,
            const size_t lda,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd,
            const size_t ldb,
            const typename FFPACK::RNSInteger< RNS >::Element beta,
            typename FFPACK::RNSInteger< RNS >::Element_ptr Cd,
            const size_t ldc,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag,
ParSeqHelper::Parallel< Cut, Param > > & H )  [inline]
```

15.1.3.45 fgemm() [5/23]

```
Givaro::Integer* FFLAS::fgemm (
            const Givaro::ZRing< Givaro::Integer > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const Givaro::Integer alpha,
            const Givaro::Integer * A,
            const size_t lda,
            const Givaro::Integer * B,
            const size_t ldb,
            Givaro::Integer beta,
            Givaro::Integer * C,
            const size_t ldc,
            MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag >, ParSeq > & H )  [inline]
```

15.1.3.46 fgemm() [6/23]

```
RNS::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSInteger< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename RNS::Element alpha,
```

```
            typename RNS::ConstElement_ptr Ad,
            const size_t lda,
            typename RNS::ConstElement_ptr Bd,
            const size_t ldb,
            const typename RNS::Element beta,
            typename RNS::Element_ptr Cd,
            const size_t ldc,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Winograd, ModeT, ParSeqHelper::Sequential
> & H )  [inline]
```

15.1.3.47 fgemm() [7/23]

```
RNS::Element_ptr FFLAS::fgemm (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename RNS::Element alpha,
            typename RNS::ConstElement_ptr Ad,
            const size_t lda,
            typename RNS::ConstElement_ptr Bd,
            const size_t ldb,
            const typename RNS::Element beta,
            typename RNS::Element_ptr Cd,
            const size_t ldc,
            MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Winograd > & H )  [inline]
```

15.1.3.48 fgemm() [8/23]

```
Givaro::Integer* FFLAS::fgemm (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const Givaro::Integer alpha,
            const Givaro::Integer * A,
            const size_t lda,
            const Givaro::Integer * B,
            const size_t ldb,
            const Givaro::Integer beta,
            Givaro::Integer * C,
            const size_t ldc,
            MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag > > & H )  [inline]
```

15.1.3.49 fgemm() [9/23]

```
Givaro::Integer* FFLAS::fgemm (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const Givaro::Integer alpha,
            const Givaro::Integer * A,
            const size_t lda,
            const Givaro::Integer * B,
            const size_t ldb,
            const Givaro::Integer beta,
            Givaro::Integer * C,
            const size_t ldc,
            MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Auto, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag >, ParSeq > & H )  [inline]
```

15.1.3.50 fgemm() [10/23]

```
RecInt::ruint<K1>* FFLAS::fgemm (
            const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const RecInt::ruint< K1 > alpha,
            const RecInt::ruint< K1 > * A,
            const size_t lda,
            const RecInt::ruint< K1 > * B,
            const size_t ldb,
            RecInt::ruint< K1 > beta,
            RecInt::ruint< K1 > * C,
            const size_t ldc,
            MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic,
ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > & H )  [inline]
```

15.1.3.51 fgemm() [11/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
```

```
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, ModeT > & H )  [inline]
```

15.1.3.52 fgemm() [12/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::WinogradPar, ModeT, ParSeqHelper::Parallel< Cut,
Param > > & H )  [inline]
```

15.1.3.53 fgemm() [13/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::ConvertTo< ElementCategories::MachineFl
>, ParSeqHelper::Sequential > & H )  [inline]
```

15.1.3.54 fgemm() [14/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const ParSeqHelper::Sequential seq )  [inline]
```

15.1.3.55 fgemm() [15/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const ParSeqHelper::Parallel< Cut, Param > par )  [inline]
```

15.1.3.56 fgemm() [16/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
```

```
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc )  [inline]
```

fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.

Computes $C = \alpha \mathrm{op}(A) \times \mathrm{op}(B) + \beta C$ Automatically set Winograd recursion level

Parameters

F	field.
ta	if `ta==FflasTrans` then $\mathrm{op}(A) = A^t$, else $\mathrm{op}(A) = A$,
tb	same for matrix `B`
m	see `A`
n	see `B`
k	see `A`
alpha	scalar
beta	scalar
A	$\mathrm{op}(A)$ is $m \times k$
B	$\mathrm{op}(B)$ is $k \times n$
C	C is $m \times n$
lda	leading dimension of `A`
ldb	leading dimension of `B`
ldc	leading dimension of `C`
w	recursive levels of Winograd's algorithm are used. No argument (or -1) does auto computation of `w`.

Warning

α *must* be invertible

15.1.3.57 fgemm() [17/23]

```
Field::Element_ptr FFLAS::fgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Auto, ModeT, ParSeq > & H )  [inline]
```

15.1.3.58 fgemm() [18/23]

```
Field::Element_ptr FFLAS::fgemm (
        const Field & F,
        const FFLAS_TRANSPOSE ta,
        const FFLAS_TRANSPOSE tb,
        const size_t m,
        const size_t n,
        const size_t k,
        const typename Field::Element alpha,
        typename Field::ConstElement_ptr A,
        const size_t lda,
        typename Field::ConstElement_ptr B,
        const size_t ldb,
        const typename Field::Element beta,
        typename Field::Element_ptr C,
        const size_t ldc,
        MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential
> & H )  [inline]
```

15.1.3.59 fsquare() [1/6]

```
Field::Element_ptr FFLAS::fsquare (
        const Field & F,
        const FFLAS_TRANSPOSE ta,
        const size_t n,
        const typename Field::Element alpha,
        typename Field::ConstElement_ptr A,
        const size_t lda,
        const typename Field::Element beta,
        typename Field::Element_ptr C,
        const size_t ldc )  [inline]
```

fsquare: Squares a matrix.

compute $C \leftarrow \alpha \mathrm{op}(A)\mathrm{op}(A) + \beta C$ over a Field `F` Avoid the conversion of B

Parameters

ta	if `ta==FflasTrans`, $\mathrm{op}(A) = A^T$.
F	field
n	size of `A`
alpha	scalar
beta	scalar
A	dense matrix of size `nxn`
lda	leading dimension of `A`
C	dense matrix of size `nxn`
ldc	leading dimension of `C`

Bug why double ?

15.1.3.60 fsquare() [2/6]

```
double* FFLAS::fsquare (
            const Givaro::ModularBalanced< double > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t lda,
            const double beta,
            double * C,
            const size_t ldc )  [inline]
```

15.1.3.61 fsquare() [3/6]

```
float* FFLAS::fsquare (
            const Givaro::ModularBalanced< float > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const float alpha,
            const float * A,
            const size_t lda,
            const float beta,
            float * C,
            const size_t ldc )  [inline]
```

15.1.3.62 fsquare() [4/6]

```
double* FFLAS::fsquare (
            const Givaro::Modular< double > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t lda,
            const double beta,
            double * C,
            const size_t ldc )  [inline]
```

15.1.3.63 fsquare() [5/6]

```
float* FFLAS::fsquare (
            const Givaro::Modular< float > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const float alpha,
            const float * A,
            const size_t lda,
            const float beta,
            float * C,
            const size_t ldc )  [inline]
```

15.1.3.64 fgemv() [1/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFlo
> > & H )  [inline]
```

15.1.3.65 fgemv() [2/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > & H )  [inline]
```

15.1.3.66 fgemv() [3/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > & H )  [inline]
```

15.1.3.67 fgemv() [4/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > & H )  [inline]
```

15.1.3.68 fgemv() [5/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE TransA,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY )  [inline]
```

finite prime Field GEneral Matrix Vector multiplication.

Computes $Y \leftarrow \alpha \mathrm{op}(A) X + \beta Y$.

Parameters

	F	field
	TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
	M	rows
	N	cols
	alpha	scalar
	A	dense matrix of size `MxN`
	lda	leading dimension of `A`
	X	dense vector of size `N`
	incX	stride of `X`
	beta	scalar
out	*Y*	dense vector of size `M`
	incY	stride of `Y`

15.1.3.69 fgemv() [6/19]

```
Givaro::ZRing<int64_t>::Element_ptr FFLAS::fgemv (
            const Givaro::ZRing< int64_t > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const int64_t alpha,
            const int64_t * A,
            const size_t lda,
            const int64_t * X,
            const size_t incX,
            const int64_t beta,
            int64_t * Y,
            const size_t incY,
            MMHelper< Givaro::ZRing< int64_t >, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H )  [inline]
```

15.1.3.70 fgemv() [7/19]

```
Givaro::DoubleDomain::Element_ptr FFLAS::fgemv (
            const Givaro::DoubleDomain & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const Givaro::DoubleDomain::Element alpha,
            const Givaro::DoubleDomain::ConstElement_ptr A,
            const size_t lda,
            const Givaro::DoubleDomain::ConstElement_ptr X,
            const size_t incX,
            const Givaro::DoubleDomain::Element beta,
            Givaro::DoubleDomain::Element_ptr Y,
            const size_t incY,
            MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H )  [inline]
```

15.1.3.71 fgemv() [8/19]

```
Field::Element_ptr FFLAS::fgemv (
        const Field & F,
        const FFLAS_TRANSPOSE ta,
        const size_t M,
        const size_t N,
        const typename Field::Element alpha,
        const typename Field::ConstElement_ptr A,
        const size_t lda,
        const typename Field::ConstElement_ptr X,
        const size_t incX,
        const typename Field::Element beta,
        typename Field::Element_ptr Y,
        const size_t incY,
        MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > & H )
[inline]
```

15.1.3.72 fgemv() [9/19]

```
Givaro::FloatDomain::Element_ptr FFLAS::fgemv (
        const Givaro::FloatDomain & F,
        const FFLAS_TRANSPOSE ta,
        const size_t M,
        const size_t N,
        const Givaro::FloatDomain::Element alpha,
        const Givaro::FloatDomain::ConstElement_ptr A,
        const size_t lda,
        const Givaro::FloatDomain::ConstElement_ptr X,
        const size_t incX,
        const Givaro::FloatDomain::Element beta,
        Givaro::FloatDomain::Element_ptr Y,
        const size_t incY,
        MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H )  [inline]
```

15.1.3.73 fgemv() [10/19]

```
Field::Element_ptr FFLAS::fgemv (
        const Field & F,
        const FFLAS_TRANSPOSE ta,
        const size_t m,
        const size_t n,
        const typename Field::Element alpha,
        const typename Field::ConstElement_ptr A,
        const size_t lda,
        const typename Field::ConstElement_ptr X,
        const size_t incX,
        const typename Field::Element beta,
        typename Field::Element_ptr Y,
        const size_t incY,
        ParSeqHelper::Parallel< Cut, Param > & parH )
```

15.1.3.74 fgemv() [11/19]

```
Field::Element_ptr FFLAS::fgemv (
        const Field & F,
        const FFLAS_TRANSPOSE ta,
        const size_t m,
        const size_t n,
        const typename Field::Element alpha,
        const typename Field::ConstElement_ptr A,
        const size_t lda,
        const typename Field::ConstElement_ptr X,
        const size_t incX,
        const typename Field::Element beta,
        typename Field::Element_ptr Y,
        const size_t incY,
        ParSeqHelper::Sequential & seqH )
```

15.1.3.75 fgemv() [12/19]

```
FFPACK::rns_double::Element_ptr FFLAS::fgemv (
        const FFPACK::RNSInteger< FFPACK::rns_double > & F,
        const FFLAS_TRANSPOSE ta,
        const size_t M,
        const size_t N,
        const FFPACK::rns_double::Element alpha,
        FFPACK::rns_double::ConstElement_ptr A,
        const size_t lda,
        FFPACK::rns_double::ConstElement_ptr X,
        const size_t incX,
        const FFPACK::rns_double::Element beta,
        FFPACK::rns_double::Element_ptr Y,
        const size_t incY,
        MMHelper< FFPACK::RNSInteger< FFPACK::rns_double >, MMHelperAlgo::Classic, ModeCategories::Defau
> & H )  [inline]
```

15.1.3.76 fgemv() [13/19]

```
FFPACK::rns_double::Element_ptr FFLAS::fgemv (
        const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
        const FFLAS_TRANSPOSE ta,
        const size_t M,
        const size_t N,
        const FFPACK::rns_double::Element alpha,
        FFPACK::rns_double::ConstElement_ptr A,
        const size_t lda,
        FFPACK::rns_double::ConstElement_ptr X,
        const size_t incX,
        const FFPACK::rns_double::Element beta,
        FFPACK::rns_double::Element_ptr Y,
        const size_t incY,
        MMHelper< FFPACK::RNSIntegerMod< FFPACK::rns_double >, MMHelperAlgo::Classic,
ModeCategories::DefaultTag > & H )  [inline]
```

15.1.3.77 fgemv() [14/19]

```
Givaro::Integer* FFLAS::fgemv (
            const Givaro::ZRing< Givaro::Integer > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t m,
            const size_t n,
            const Givaro::Integer alpha,
            Givaro::Integer * A,
            const size_t lda,
            Givaro::Integer * X,
            const size_t ldx,
            Givaro::Integer beta,
            Givaro::Integer * Y,
            const size_t ldy,
            MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag > > & H ) [inline]
```

15.1.3.78 fgemv() [15/19]

```
Givaro::Integer* FFLAS::fgemv (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t m,
            const size_t n,
            const Givaro::Integer alpha,
            Givaro::Integer * A,
            const size_t lda,
            Givaro::Integer * X,
            const size_t ldx,
            Givaro::Integer beta,
            Givaro::Integer * Y,
            const size_t ldy,
            MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag > > & H ) [inline]
```

15.1.3.79 fgemv() [16/19]

```
RecInt::ruint<K1>* FFLAS::fgemv (
            const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t m,
            const size_t n,
            const RecInt::ruint< K1 > alpha,
            const RecInt::ruint< K1 > * A,
            const size_t lda,
            const RecInt::ruint< K1 > * X,
            const size_t incx,
            RecInt::ruint< K1 > beta,
            RecInt::ruint< K1 > * Y,
            const size_t incy,
            MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic,
ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > & H ) [inline]
```

15.1.3.80 fger() [1/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda )  [inline]
```

fger: rank one update of a general matrix

Computes $A \leftarrow \alpha x.y^T + A$

Parameters

	F	field
	M	rows
	N	cols
	alpha	scalar
`in,out`	*A*	dense matrix of size `MxN` and leading dimension `lda`
	lda	leading dimension of `A`
	x	dense vector of size `M`
	incx	stride of `X`
	y	dense vector of size `N`
	incy	stride of `Y`

15.1.3.81 fger() [2/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFlo
> > & H )  [inline]
```

15.1.3.82 fger() [3/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda,
            MMHelper< Field, MMHelperAlgo::Classic, AnyTag > & H )  [inline]
```

15.1.3.83 fger() [4/12]

```
void FFLAS::fger (
            const Givaro::DoubleDomain & F,
            const size_t M,
            const size_t N,
            const Givaro::DoubleDomain::Element alpha,
            const Givaro::DoubleDomain::ConstElement_ptr x,
            const size_t incx,
            const Givaro::DoubleDomain::ConstElement_ptr y,
            const size_t incy,
            Givaro::DoubleDomain::Element_ptr A,
            const size_t lda,
            MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H )  [inline]
```

15.1.3.84 fger() [5/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr x,
            const size_t incx,
            const typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > & H )
[inline]
```

15.1.3.85 fger() [6/12]

```
void FFLAS::fger (
            const Givaro::FloatDomain & F,
            const size_t M,
            const size_t N,
            const Givaro::FloatDomain::Element alpha,
            const Givaro::FloatDomain::ConstElement_ptr x,
            const size_t incx,
            const Givaro::FloatDomain::ConstElement_ptr y,
            const size_t incy,
            Givaro::FloatDomain::Element_ptr A,
            const size_t lda,
            MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H ) [inline]
```

15.1.3.86 fger() [7/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > & H ) [inline]
```

15.1.3.87 fger() [8/12]

```
void FFLAS::fger (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > & H ) [inline]
```

15.1.3.88 fger() [9/12]

```
void FFLAS::fger (
            const Givaro::Modular< Givaro::Integer > & F,
            const size_t M,
            const size_t N,
            const typename Givaro::Integer alpha,
            typename Givaro::Integer * x,
            const size_t incx,
            typename Givaro::Integer * y,
            const size_t incy,
            typename Givaro::Integer * A,
            const size_t lda,
            MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo<
ElementCategories::RNSElementTag > > & H ) [inline]
```

15.1.3.89 fger() [10/12]

```
void FFLAS::fger (
            const FFPACK::RNSInteger< RNS > & F,
            const size_t M,
            const size_t N,
            const typename FFPACK::RNSInteger< RNS >::Element alpha,
            typename FFPACK::RNSInteger< RNS >::Element_ptr x,
            const size_t incx,
            typename FFPACK::RNSInteger< RNS >::Element_ptr y,
            const size_t incy,
            typename FFPACK::RNSInteger< RNS >::Element_ptr A,
            const size_t lda,
            MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H ) [inline]
```

15.1.3.90 fger() [11/12]

```
void FFLAS::fger (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const size_t M,
            const size_t N,
            const typename FFPACK::RNSIntegerMod< RNS >::Element alpha,
            typename FFPACK::RNSIntegerMod< RNS >::Element_ptr x,
            const size_t incx,
            typename FFPACK::RNSIntegerMod< RNS >::Element_ptr y,
            const size_t incy,
            typename FFPACK::RNSIntegerMod< RNS >::Element_ptr A,
            const size_t lda,
            MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Classic > & H ) [inline]
```

15.1.3.91 freduce() [1/11]

```
void FFLAS::freduce (
            const Field & F,
            const size_t n,
            typename Field::ConstElement_ptr Y,
            const size_t incY,
            typename Field::Element_ptr X,
            const size_t incX )
```

freduce $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of `Element`
incY	stride of `Y`
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.92 freduce() [2/11]

```
void FFLAS::freduce (
            const Field & F,
            const size_t n,
            typename Field::Element_ptr X,
            const size_t incX )
```

freduce $x \leftarrow xmodF$.

Parameters

F	field
n	size of the vectors
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.93 freduce_constoverride() [1/2]

```
void FFLAS::freduce_constoverride (
            const Field & F,
```

```
            const size_t m,
            typename Field::ConstElement_ptr A,
            const size_t incX )
```

15.1.3.94 finit() [1/8]

```
void FFLAS::finit (
            const Field & F,
            const size_t n,
            ConstOtherElement_ptr Y,
            const size_t incY,
            typename Field::Element_ptr X,
            const size_t incX )
```

15.1.3.95 finit() [2/8]

```
void FFLAS::finit (
            const Field & F,
            const size_t n,
            typename Field::Element_ptr X,
            const size_t incX )
```

finit Initializes `X` in `F$`.

Parameters

F	field
n	size of the vectors
X	vector in `F`
incX	stride of `X`

15.1.3.96 freduce() [3/11]

```
void FFLAS::freduce (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

freduce $A \leftarrow AmodF$.

Parameters

F	field

Parameters

m	number of rows
n	number of cols
A	matrix in `F`
lda	stride of `A`

15.1.3.97 freduce() [4/11]

```
void FFLAS::freduce (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

freduce for square symmetric matrices

15.1.3.98 pfreduce()

```
void FFLAS::pfreduce (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t numths )
```

15.1.3.99 freduce() [5/11]

```
void FFLAS::freduce (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr A,
            const size_t lda )
```

freduce $A \leftarrow BmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in `F`
lda	stride of `A`
B	matrix in `Element`
ldb	stride of `B`

15.1.3.100 freduce_constoverride() [2/2]

```
void FFLAS::freduce_constoverride (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr A,
            const size_t lda )
```

15.1.3.101 finit() [3/8]

```
void FFLAS::finit (
            const Field & F,
            const size_t m,
            const size_t n,
            const OtherElement_ptr B,
            const size_t ldb,
            typename Field::Element_ptr A,
            const size_t lda )
```

finit $A \leftarrow BmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A
B	matrix in OtherElement
ldb	stride of B

15.1.3.102 finit() [4/8]

```
void FFLAS::finit (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

finit Initializes A in F$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A

15.1.3.103 freduce() [6/11]

```
void FFLAS::freduce (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t n,
            FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A,
            size_t inc ) [inline]
```

15.1.3.104 freduce() [7/11]

```
void FFLAS::freduce (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            FFPACK::rns_double::Element_ptr A,
            size_t lda ) [inline]
```

15.1.3.105 freivalds()

```
bool FFLAS::freivalds (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::ConstElement_ptr C,
            const size_t ldc ) [inline]
```

freivalds: **F**reivalds **GE**neral **M**atrix **M**ultiply **R**andom **C**heck.

Randomly Checks $C = \alpha \mathrm{op}(A) \times \mathrm{op}(B)$

Parameters

F	field.
ta	if `ta==FflasTrans` then $\mathrm{op}(A) = A^t$, else $\mathrm{op}(A) = A$,
tb	same for matrix `B`
m	see `A`
n	see `B`
k	see `A`
alpha	scalar
A	$\mathrm{op}(A)$ is $m \times k$
B	$\mathrm{op}(B)$ is $k \times n$
C	C is $m \times n$
lda	leading dimension of `A`
ldb	leading dimension of `B`
ldc	leading dimension of `C`

15.1.3.106 fscalin() [1/10]

```
void FFLAS::fscalin (
            const Field & F,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::Element_ptr X,
            const size_t incX )  [inline]
```

fscalin $x \leftarrow \alpha \cdot x$.

Parameters

F	field
n	size of the vectors
alpha	scalar
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

Todo check if comparison with +/-1,0 is necessary.

15.1.3.107 fscal() [1/10]

```
void FFLAS::fscal (
            const Field & F,
```

```
const size_t n,
const typename Field::Element alpha,
typename Field::ConstElement_ptr X,
const size_t incX,
typename Field::Element_ptr Y,
const size_t incY )  [inline]
```

fscal $y \leftarrow \alpha \cdot x$.

Parameters

	F	field
	n	size of the vectors
	alpha	scalar
in	*X*	vector in F
	incX	stride of X
out	*Y*	vector in F
	incY	stride of Y

Bug use cblas_(d)scal when possible

Todo check if comparison with +/-1,0 is necessary.

15.1.3.108 fscal() [2/10]

```
void FFLAS::fscal (
            const Givaro::DoubleDomain & ,
            const size_t N,
            const Givaro::DoubleDomain::Element a,
            Givaro::DoubleDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::DoubleDomain::Element_ptr y,
            const size_t incy )  [inline]
```

15.1.3.109 fscal() [3/10]

```
void FFLAS::fscal (
            const Givaro::FloatDomain & ,
            const size_t N,
            const Givaro::FloatDomain::Element a,
            Givaro::FloatDomain::ConstElement_ptr x,
            const size_t incx,
            Givaro::FloatDomain::Element_ptr y,
            const size_t incy )  [inline]
```

15.1.3.110 fscalin() [2/10]

```
void FFLAS::fscalin (
            const Givaro::DoubleDomain & ,
            const size_t N,
            const Givaro::DoubleDomain::Element a,
            Givaro::DoubleDomain::Element_ptr y,
            const size_t incy ) [inline]
```

15.1.3.111 fscalin() [3/10]

```
void FFLAS::fscalin (
            const Givaro::FloatDomain & ,
            const size_t N,
            const Givaro::FloatDomain::Element a,
            Givaro::FloatDomain::Element_ptr y,
            const size_t incy ) [inline]
```

15.1.3.112 fscalin() [4/10]

```
void FFLAS::fscalin (
            const Field & F,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda ) [inline]
```

fscalin $A \leftarrow a \cdot A$.

Parameters

F	field
m	number of rows
n	number of cols
alpha	homotecie scalar
A	matrix in `F`
lda	stride of `A`

15.1.3.113 fscal() [4/10]

```
void FFLAS::fscal (
            const Field & F,
            const size_t m,
```

```
            const size_t n,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb )  [inline]
```

fscal $B \leftarrow a \cdot A$.

Parameters

	F	field
	m	number of rows
	n	number of cols
	alpha	homotecie scalar
in	*A*	matrix in F
	lda	stride of A
out	*B*	matrix in F
	ldb	stride of B

15.1.3.114 fscalin() [5/10]

```
void FFLAS::fscalin (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::Element_ptr A,
            const size_t inc )  [inline]
```

15.1.3.115 fscal() [5/10]

```
void FFLAS::fscal (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::ConstElement_ptr A,
            const size_t Ainc,
            FFPACK::rns_double::Element_ptr B,
            const size_t Binc )  [inline]
```

15.1.3.116 fscalin() [6/10]

```
void FFLAS::fscalin (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::Element_ptr A,
            const size_t lda )  [inline]
```

15.1.3.117 fscal() [6/10]

```
void FFLAS::fscal (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::ConstElement_ptr A,
            const size_t lda,
            FFPACK::rns_double::Element_ptr B,
            const size_t ldb ) [inline]
```

15.1.3.118 fscalin() [7/10]

```
void FFLAS::fscalin (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t n,
            const typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element alpha,
            typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A,
            const size_t inc ) [inline]
```

15.1.3.119 fscal() [7/10]

```
void FFLAS::fscal (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::ConstElement_ptr A,
            const size_t Ainc,
            FFPACK::rns_double::Element_ptr B,
            const size_t Binc ) [inline]
```

15.1.3.120 fscalin() [8/10]

```
void FFLAS::fscalin (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::Element_ptr A,
            const size_t lda ) [inline]
```

15.1.3.121 fscal() [8/10]

```
void FFLAS::fscal (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const FFPACK::rns_double::Element alpha,
            FFPACK::rns_double::ConstElement_ptr A,
            const size_t lda,
            FFPACK::rns_double::Element_ptr B,
            const size_t ldb ) [inline]
```

15.1.3.122 fsyr2k()

```
Field::Element_ptr FFLAS::fsyr2k (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc ) [inline]
```

fsyr2k: Symmetric Rank 2K update

Computes the Lower or Upper triangular part of $C = \alpha(A \times B^T + B \times A^T) + \beta C$ or $C = \alpha(A^T \times B + B^T \times A) + \beta C$

Parameters

F	field.
UpLo	whether to compute the upper or the lower triangular part of the symmetric matrix `C`
trans	if `ta==FflasNoTrans` then compute $C = \alpha(A \times B^T + B \times A^T) + \beta C$, else $C = \alpha(A^T \times B + B^T \times A) + \beta C$
n	order of matrix `C`
k	see `A`
alpha	scalar
A	A is $n \times k$ (FflasNoTrans) or A is $k \times n$ (FflasTrans)
lda	leading dimension of `A`
beta	scalar
C	C is $n \times n$
ldc	leading dimension of `C`

Warning

α *must* be invertible

15.1.3.123 fsyrk() [1/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc )  [inline]
```

fsyrk: Symmetric Rank K update

Computes the Lower or Upper triangular part of $C = \alpha A \times A^T + \beta C$ or $C = \alpha A^T \times A + \beta C$

Parameters

F	field.
UpLo	whether to compute the upper or the lower triangular part of the symmetric matrix C
trans	if `ta==FflasNoTrans` then comput $C = \alpha A \times A^T + \beta C$, else $C = \alpha A^T \times A + \beta C$
n	order of matrix C
k	see A
alpha	scalar
A	A is $n \times k$ or A is $k \times n$
lda	leading dimension of A
beta	scalar
C	C is $n \times n$
ldc	leading dimension of C

Warning

α *must* be invertible

15.1.3.124 fsyrk() [2/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
```

```
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const ParSeqHelper::Sequential seq )  [inline]
```

15.1.3.125 fsyrk() [3/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > & H )  [inline]
```

15.1.3.126 fsyrk() [4/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFlo
>, ParSeqHelper::Sequential > & H )  [inline]
```

15.1.3.127 fsyrk() [5/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > & H )  [inline]
```

15.1.3.128 fsyrk() [6/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > & H )  [inline]
```

15.1.3.129 fsyrk() [7/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::DivideAndConquer, Mode > & H )  [inline]
```

15.1.3.130 fsyrk() [8/16]

```
Field::Element_ptr FFLAS::fsyrk (
        const Field & F,
        const FFLAS_UPLO UpLo,
        const FFLAS_TRANSPOSE trans,
        const size_t N,
        const size_t K,
        const typename Field::Element alpha,
        typename Field::ConstElement_ptr A,
        const size_t lda,
        const typename Field::Element beta,
        typename Field::Element_ptr C,
        const size_t ldc,
        MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > & H )
[inline]
```

15.1.3.131 fsyrk() [9/16]

```
Givaro::FloatDomain::Element_ptr FFLAS::fsyrk (
        const Givaro::FloatDomain & F,
        const FFLAS_UPLO UpLo,
        const FFLAS_TRANSPOSE trans,
        const size_t N,
        const size_t K,
        const Givaro::FloatDomain::Element alpha,
        Givaro::FloatDomain::ConstElement_ptr A,
        const size_t lda,
        const Givaro::FloatDomain::Element beta,
        Givaro::FloatDomain::Element_ptr C,
        const size_t ldc,
        MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H ) [inline]
```

15.1.3.132 fsyrk() [10/16]

```
Givaro::DoubleDomain::Element_ptr FFLAS::fsyrk (
        const Givaro::DoubleDomain & F,
        const FFLAS_UPLO UpLo,
        const FFLAS_TRANSPOSE trans,
        const size_t N,
        const size_t K,
        const Givaro::DoubleDomain::Element alpha,
        Givaro::DoubleDomain::ConstElement_ptr A,
        const size_t lda,
        const Givaro::DoubleDomain::Element beta,
        Givaro::DoubleDomain::Element_ptr C,
        const size_t ldc,
        MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag
> & H ) [inline]
```

15.1.3.133 fsyrk() [11/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr D,
            const size_t incD,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const size_t threshold = __FFLASFFPACK_FSYRK_THRESHOLD ) [inline]
```

fsyrk: Symmetric Rank K update with diagonal scaling

Computes the Lower or Upper triangular part of $C = \alpha A \times D \times A^T + \beta C$ or $C = \alpha A^T \times D \times A + \beta C$ where D is a diagonal matrix. Matrix A is updated into $D \times A$ (if trans = FflasTrans) or $A \times D$ (if trans = FflasNoTrans).

Parameters

F	field.
UpLo	whether to compute the upper or the lower triangular part of the symmetric matrix C
trans	if `ta==FflasNoTrans` then compute $C = \alpha A \times A^T + \beta C$, else $C = \alpha A^T \times A + \beta C$
n	order of matrix C
k	see A
alpha	scalar
A	A is $n \times k$ or A is $k \times n$
lda	leading dimension of A
D	D is $k \times k$ diagonal matrix, stored as a vector of k coefficients
lda	leading dimension of A
beta	scalar
C	C is $n \times n$
ldc	leading dimension of C

Warning

α *must* be invertible

15.1.3.134 fsyrk() [12/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
```

```
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr D,
            const size_t incD,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const ParSeqHelper::Sequential seq,
            const size_t threshold )  [inline]
```

15.1.3.135 fsyrk() [13/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr D,
            const size_t incD,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const ParSeqHelper::Parallel< Cut, Param > par,
            const size_t threshold )  [inline]
```

15.1.3.136 fsyrk() [14/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr D,
            const size_t incD,
            const std::vector< bool > & twoBlock,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const size_t threshold = __FFLASFFPACK_FSYRK_THRESHOLD )  [inline]
```

fsyrk: Symmetric Rank K update with diagonal scaling

Computes the Lower or Upper triangular part of $C = \alpha A \times Delta D \times A^T + \beta C$ or $C = \alpha A^T \times Delta D \times A + \beta C$ where `D` is a diagonal matrix and `Delta` is a block diagonal with either 1 on the diagonal or 2x2 swap blocks Matrix `A` is updated into $D \times A$ (if trans = FflasTrans) or $A \times D$ (if trans = FflasNoTrans).

Parameters

F	field.
UpLo	whether to compute the upper or the lower triangular part of the symmetric matrix C
trans	if ta==FflasNoTrans then compute $C = \alpha A Delta D \times A^T + \beta C$, else $C = \alpha A^T Delta D \times A + \beta C$
n	see B
k	see A
alpha	scalar
A	A is $n \times k$ or A is $k \times n$
lda	leading dimension of A
D	D is $k \times k$ diagonal matrix, stored as a vector of k coefficients
twoBlocks	a vector boolean indicating the beginning of each 2x2 blocs in Delta
lda	leading dimension of A
beta	scalar
C	C is $n \times n$
ldc	leading dimension of C

Warning

α *must* be invertible

15.1.3.137 computeS1S2()

```
void FFLAS::computeS1S2 (
            const Field & F,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element x,
            const typename Field::Element y,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr S,
            const size_t lds,
            typename Field::Element_ptr T,
            const size_t ldt,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.1.3.138 fsyrk() [15/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
```

```
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential
> & H )  [inline]
```

15.1.3.139 fsyrk() [16/16]

```
Field::Element_ptr FFLAS::fsyrk (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, Mode > & H )  [inline]
```

15.1.3.140 fsyrk_strassen() [1/2]

```
Field::Element_ptr FFLAS::fsyrk_strassen (
            const Field & F,
            const FFLAS_UPLO uplo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element y1,
            const typename Field::Element y2,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.1.3.141 ftrmm() [1/3]

```
void FFLAS::ftrmm (
            const Field & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb ) [inline]
```

ftrmm: **TR**iangular **M**atrix **M**ultiply.

Computes $B \leftarrow \alpha \mathrm{op}(A)B$ or $B \leftarrow \alpha B\mathrm{op}(A)$.

Parameters

F	field
Side	if `Side==FflasLeft` then $B \leftarrow \alpha \mathrm{op}(A)B$ is computed.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is implicitly unit.
M	rows of `B`
N	cols of `B`
alpha	scalar
A	triangular matrix. If `Side==FflasLeft` then `A` is $N \times N$, otherwise `A` is $M \times M$
lda	leading dim of `A`
B	matrix of size `MxN`
ldb	leading dim of `B`

15.1.3.142 ftrmm() [2/3]

```
void FFLAS::ftrmm (
            const Field & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
```

```
const typename Field::Element beta,
typename Field::Element_ptr C,
const size_t ldc ) [inline]
```

ftrmm: **TR**iangular **M**atrix **M**ultiply with 3 operands Computes $C \leftarrow \alpha \mathrm{op}(A)B + betaC$ or $C \leftarrow \alpha B\mathrm{op}(A) + betaC$.

Parameters

F	field
Side	if `Side==FflasLeft` then $B \leftarrow \alpha \mathrm{op}(A)B$ is computed.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is implicitly unit.
M	rows of `B`
N	cols of `B`
alpha	scalar
A	triangular matrix. If `Side==FflasLeft` then `A` is $N \times N$, otherwise `A` is $M \times M$
lda	leading dim of `A`
B	matrix of size `MxN`
ldb	leading dim of `B`
beta	scalar
C	matrix of size `MxN`
ldc	leading dim of `C`

15.1.3.143 ftrsm() [1/9]

```
void FFLAS::ftrsm (
        const Field & F,
        const FFLAS_SIDE Side,
        const FFLAS_UPLO Uplo,
        const FFLAS_TRANSPOSE TransA,
        const FFLAS_DIAG Diag,
        const size_t M,
        const size_t N,
        const typename Field::Element alpha,
        typename Field::Element_ptr A,
        const size_t lda,
        typename Field::Element_ptr B,
        const size_t ldb ) [inline]
```

15.1.3.144 ftrsm() [2/9]

```
void FFLAS::ftrsm (
        const Field & F,
        const FFLAS_SIDE Side,
        const FFLAS_UPLO Uplo,
        const FFLAS_TRANSPOSE TransA,
```

```
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const ParSeqHelper::Sequential & PSH )  [inline]
```

15.1.3.145 ftrsm() [3/9]

```
void FFLAS::ftrsm (
            const Field & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const ParSeqHelper::Parallel< Cut, Param > & PSH )  [inline]
```

15.1.3.146 ftrsm() [4/9]

```
void FFLAS::ftrsm (
            const Field & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            TRSMHelper< StructureHelper::Recursive, ParSeqTrait > & H )  [inline]
```

15.1.3.147 ftrsm() [5/9]

```
void FFLAS::ftrsm (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const Givaro::Integer alpha,
            const Givaro::Integer * A,
            const size_t lda,
            Givaro::Integer * B,
            const size_t ldb )  [inline]
```

15.1.3.148 cblas_imptrsm()

```
void FFLAS::cblas_imptrsm (
            const enum FFLAS_ORDER Order,
            const enum FFLAS_SIDE Side,
            const enum FFLAS_UPLO Uplo,
            const enum FFLAS_TRANSPOSE TransA,
            const enum FFLAS_DIAG Diag,
            const int M,
            const int N,
            const FFPACK::rns_double_elt alpha,
            FFPACK::rns_double_elt_cstptr A,
            const int lda,
            FFPACK::rns_double_elt_ptr B,
            const int ldb )  [inline]
```

15.1.3.149 ftrsv() [1/2]

```
void FFLAS::ftrsv (
            const Field & F,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            int incX )  [inline]
```

ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$

Parameters

F	field

Parameters

X	vector of size `N` on a field `F`
incX	stride of `X`
A	a matrix of leading dimension `lda` and size `N`
lda	leading dimension of `A`
N	number of rows or columns of `A` according to `TransA`
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is unit.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular

15.1.3.150 igemm_()

```
void igemm_ (
        const enum FFLAS_ORDER Order,
        const enum FFLAS_TRANSPOSE TransA,
        const enum FFLAS_TRANSPOSE TransB,
        const size_t M,
        const size_t N,
        const size_t K,
        const int64_t alpha,
        const int64_t * A,
        const size_t lda,
        const int64_t * B,
        const size_t ldb,
        const int64_t beta,
        int64_t * C,
        const size_t ldc )  [inline]
```

15.1.3.151 finit() [5/8]

```
void FFLAS::finit (
        const Field & F,
        const size_t n,
        const OtherElement_ptr Y,
        const size_t incY,
        typename Field::Element_ptr X,
        const size_t incX )
```

finit $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of `OtherElement`
incY	stride of `Y`
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.152 fconvert() [1/3]

```
void FFLAS::fconvert (
            const Field & F,
            const size_t n,
            OtherElement_ptr X,
            const size_t incX,
            typename Field::ConstElement_ptr Y,
            const size_t incY )
```

fconvert $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of `F`
incY	stride of `Y`
X	vector in `OtherElement`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.153 fnegin() [1/4]

```
void FFLAS::fnegin (
            const Field & F,
            const size_t n,
            typename Field::Element_ptr X,
            const size_t incX )
```

fnegin $x \leftarrow -x$.

Parameters

F	field
n	size of the vectors
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.154 fneg() [1/4]

```
void FFLAS::fneg (
        const Field & F,
        const size_t n,
        typename Field::ConstElement_ptr Y,
        const size_t incY,
        typename Field::Element_ptr X,
        const size_t incX )
```

fneg $x \leftarrow -y$.

Parameters

F	field
n	size of the vectors
X	vector in F
incX	stride of X
Y	vector in F
incY	stride of Y

Bug use cblas_(d)scal when possible

15.1.3.155 fzero() [1/5]

```
void FFLAS::fzero (
        const Field & F,
        const size_t n,
        typename Field::Element_ptr X,
        const size_t incX )
```

fzero : $A \leftarrow 0$.

Parameters

F	field
n	number of elements to zero
X	vector in F
incX	stride of X

15.1.3.156 frand() [1/2]

```
void FFLAS::frand (
        const Field & F,
        RandIter & G,
```

```
            const size_t n,
            typename Field::Element_ptr X,
            const size_t incX )
```

frand : $A \leftarrow random.$

Parameters

F	field
G	randomiterator
n	number of elements to randomize
X	vector in F
incX	stride of X

15.1.3.157 fiszero() [1/4]

```
bool FFLAS::fiszero (
            const Field & F,
            const size_t n,
            typename Field::ConstElement_ptr X,
            const size_t incX )
```

fiszero : test $X = 0$.

Parameters

F	field
n	vector dimension
X	vector in F
incX	increment of X

15.1.3.158 fequal() [1/4]

```
bool FFLAS::fequal (
            const Field & F,
            const size_t n,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::ConstElement_ptr Y,
            const size_t incY )
```

fequal : test $X = Y$.

Parameters

F	field
n	vector dimension

Parameters

X	vector in F
incX	increment of X
Y	vector in F
incY	increment of Y

15.1.3.159 faxpby() [1/2]

```
void FFLAS::faxpby (
            const Field & F,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY )
```

faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

Parameters

	F	field
	N	size of the vectors
	alpha	scalar
in	*X*	vector in F
	incX	stride of X
	beta	scalar
in,out	*Y*	vector in F
	incY	stride of Y

Note

this is a catlas function

15.1.3.160 fdot() [9/11]

```
Field::Element FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::ConstElement_ptr Y,
            const size_t incY,
            const ParSeqHelper::Parallel< Cut, Param > par )
```

15.1.3.161 fswap() [1/2]

```
void FFLAS::fswap (
            const Field & F,
            const size_t N,
            typename Field::Element_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY )
```

fswap: $X \leftrightarrow Y$.

Bug use cblas_dswap when double

Parameters

F	field
N	size of the vectors
X	vector in `F`
incX	stride of `X`
Y	vector in `F`
incY	stride of `Y`

15.1.3.162 fzero() [2/5]

```
void FFLAS::fzero (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

fzero : $A \leftarrow 0$.

Parameters

F	field
m	number of rows to zero
n	number of cols to zero
A	matrix in `F`
lda	stride of `A`

Warning

may be buggy if Element is larger than int

15.1.3.163 fzero() [3/5]

```
void FFLAS::fzero (
            const Field & F,
            const FFLAS_UPLO shape,
            const FFLAS_DIAG diag,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

fzero : $A \leftarrow 0$ for a triangular matrix.

Parameters

F	field
shape	shape of the triangular matrix
m	number of rows to zero
n	number of cols to zero
A	matrix in `F`
lda	stride of `A`

Warning

may be buggy if Element is larger than int

15.1.3.164 frand() [2/2]

```
void FFLAS::frand (
            const Field & F,
            RandIter & G,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

frand : $A \leftarrow random.$

Parameters

F	field
G	randomiterator
m	number of rows to randomize
n	number of cols to randomize
A	matrix in `F`
lda	stride of `A`

15.1.3.165 fequal() [2/4]

```
bool FFLAS::fequal (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb )
```

fequal : test $A = B$.

Parameters

F	field
m	row dimension
n	column dimension
A	m x n matrix in $\mathbb{F}$
lda	leading dimension of A
B	m x n matrix in $\mathbb{F}$
ldb	leading dimension of B

15.1.3.166 fiszero() [2/4]

```
bool FFLAS::fiszero (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr A,
            const size_t lda )
```

fiszero : test $A = 0$.

Parameters

F	field
m	row dimension
n	column dimension
A	m x n matrix in $\mathbb{F}$
lda	leading dimension of A

15.1.3.167 fidentity() [1/4]

```
void FFLAS::fidentity (
            const Field & F,
```

```
const size_t m,
const size_t n,
typename Field::Element_ptr A,
const size_t lda,
const typename Field::Element & d )
```

creates a diagonal matrix

15.1.3.168 fidentity() [2/4]

```
void FFLAS::fidentity (
        const Field & F,
        const size_t m,
        const size_t n,
        typename Field::Element_ptr A,
        const size_t lda )
```

creates a diagonal matrix

15.1.3.169 finit() [6/8]

```
void FFLAS::finit (
        const Field & F,
        const size_t m,
        const size_t n,
        typename Field::Element_ptr A,
        const size_t lda )
```

finit Initializes `A` in `F$`.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in `F`
lda	stride of `A`

15.1.3.170 fconvert() [2/3]

```
void FFLAS::fconvert (
        const Field & F,
        const size_t m,
        const size_t n,
        OtherElement_ptr A,
```

```
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb )
```

fconvert $A \leftarrow BmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in `OtherElement`
lda	stride of `A`
B	matrix in `F`
ldb	stride of `B`

Todo check if n == lda

15.1.3.171 fnegin() [2/4]

```
void FFLAS::fnegin (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda )
```

fnegin $A \leftarrow -A$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in `F`
lda	stride of `A`

Todo check if n == lda

15.1.3.172 fneg() [2/4]

```
void FFLAS::fneg (
            const Field & F,
            const size_t m,
```

```
const size_t n,
typename Field::ConstElement_ptr B,
const size_t ldb,
typename Field::Element_ptr A,
const size_t lda )
```

fneg $A \leftarrow -B$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A

Todo check if n == lda

15.1.3.173 faxpby() [2/2]

```
void FFLAS::faxpby (
    const Field & F,
    const size_t m,
    const size_t n,
    const typename Field::Element alpha,
    typename Field::ConstElement_ptr X,
    const size_t ldx,
    const typename Field::Element beta,
    typename Field::Element_ptr Y,
    const size_t ldy )
```

faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

Parameters

	F	field
	m	row dimension
	n	column dimension
	alpha	scalar
in	*X*	vector in F
	ldx	leading dimension of X
	beta	scalar
in,out	*Y*	vector in F
	ldy	leading dimension of Y

Note

this is a catlas function

15.1.3.174 fmove() [1/2]

```
void FFLAS::fmove (
            const Field & F,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb )
```

fmove : $A \leftarrow B$ and $B \leftarrow 0$.

Parameters

F	field
m	number of rows to copy
n	number of cols to copy
A	matrix in F
lda	stride of A
B	matrix in F
ldb	stride of B

15.1.3.175 bitsize()

```
size_t FFLAS::bitsize (
            const Field & F,
            size_t M,
            size_t N,
            const typename Field::ConstElement_ptr A,
            size_t lda )  [inline]
```

bitsize: Computes the largest bitsize of the matrix' coefficients.

If the matrix is over a modular prime field, it returns the bitsize of the largest element (in a bsolute value)

Parameters

F	field
M	rows
N	cols
incX	stride of X
A	a matrix of leading dimension `lda` and size `MxN`
lda	leading dimension of A

15.1.3.176 bitsize< Givaro::ZRing< Givaro::Integer > >()

```
size_t FFLAS::bitsize< Givaro::ZRing< Givaro::Integer > > (
```

```
const Givaro::ZRing< Givaro::Integer > & F,
size_t M,
size_t N,
const Givaro::Integer * A,
size_t lda )  [inline]
```

15.1.3.177 ftrmv()

```
void FFLAS::ftrmv (
            const Field & F,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            int incX )
```

ftrsm: TRiangular Matrix Vector prodcut Computes $X \leftarrow \mathrm{op}(A)X$

Parameters

F	field
X	vector of size `N` on a field `F`
incX	stride of `X`
A	a matrix of leading dimension `lda` and size `N`
lda	leading dimension of `A`
N	number of rows and columns of `A`
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^T$.
Diag	if `Diag==FflasUnit` then `A` is unit diagonal.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular

15.1.3.178 ftrsm() [6/9]

```
void FFLAS::ftrsm (
            const Field & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb )
```

ftrsm: **TR**iangular **S**ystem solve with **M**atrix.

Computes $B \leftarrow \alpha\mathrm{op}(A^{-1})B$ or $B \leftarrow \alpha B\mathrm{op}(A^{-1})$.

Parameters

F	field
Side	if `Side==FflasLeft` then $B \leftarrow \alpha\mathrm{op}(A^{-1})B$ is computed.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is unit.
M	rows of `B`
N	cols of `B`
alpha	scalar
A	triangular invertible matrix. If `Side==FflasLeft` then `A` is $N \times N$, otherwise `A` is $M \times M$
lda	leading dim of `A`
B	matrix of size `MxN`
ldb	leading dim of `B`

Bug α must be non zero.

15.1.3.179 fsyrk_strassen() [2/2]

```
Field::Element_ptr FFLAS::fsyrk_strassen (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element y1,
            const typename Field::Element y2,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & H )  [inline]
```

15.1.3.180 pfgemm() [1/7]

```
Field::Element_ptr FFLAS::pfgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
```

```
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            size_t numthreads = 0 )
```

15.1.3.181 pfgemm_1D_rec()

```
Field::Element* FFLAS::pfgemm_1D_rec (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element * C,
            const size_t ldc,
            size_t seuil )
```

15.1.3.182 pfgemm_2D_rec()

```
Field::Element* FFLAS::pfgemm_2D_rec (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element * C,
            const size_t ldc,
            size_t seuil )
```

15.1.3.183 pfgemm_3D_rec()

```
Field::Element* FFLAS::pfgemm_3D_rec (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            size_t seuil,
            size_t * x )
```

15.1.3.184 pfgemm_3D_rec2()

```
Field::Element_ptr FFLAS::pfgemm_3D_rec2 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            size_t seuil,
            size_t * x )
```

15.1.3.185 fgemm() [19/23]

```
std::enable_if<!std::is_same<ModeTrait,ModeCategories::ConvertTo<ElementCategories::RNSElementTag>
>::value,typename Field::Element_ptr>::type FFLAS::fgemm (
            const Field & F,
            const FFLAS::FFLAS_TRANSPOSE ta,
            const FFLAS::FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
```

```
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, ModeTrait, ParSeqHelper::Parallel< Strat,
Param > > & H )  [inline]
```

15.1.3.186 ftrsm() [7/9]

```
Field::Element_ptr FFLAS::ftrsm (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_UPLO UpLo,
            const FFLAS::FFLAS_TRANSPOSE TA,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            TRSMHelper< StructureHelper::Iterative, ParSeqHelper::Parallel< Cut, Param > > &
H )  [inline]
```

15.1.3.187 ftrsm() [8/9]

```
Field::Element_ptr FFLAS::ftrsm (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_UPLO UpLo,
            const FFLAS::FFLAS_TRANSPOSE TA,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            TRSMHelper< StructureHelper::Hybrid, ParSeqHelper::Parallel< Cut, Param > > & H
)  [inline]
```

15.1.3.188 sparse_delete() [1/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::COO > & A ) [inline]
```

15.1.3.189 sparse_delete() [2/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A ) [inline]
```

15.1.3.190 sparse_init() [1/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::COO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.191 sparse_init() [2/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.192 sparse_delete() [3/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::CSR > & A ) [inline]
```

15.1.3.193 sparse_delete() [4/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A ) [inline]
```

15.1.3.194 sparse_print() [1/3]

```
std::ostream& FFLAS::sparse_print (
            std::ostream & os,
            const Sparse< Field, SparseMatrix_t::CSR > & A ) [inline]
```

15.1.3.195 sparse_init() [3/16]

```
void FFLAS::sparse_init (
            const Givaro::Modular< Givaro::Integer > & F,
            Sparse< Givaro::Modular< Givaro::Integer >, SparseMatrix_t::CSR > & A,
            const IndexT * row,
            const IndexT * col,
            Givaro::Integer * dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.196 sparse_init() [4/16]

```
void FFLAS::sparse_init (
            const Givaro::ZRing< Givaro::Integer > & F,
            Sparse< Givaro::ZRing< Givaro::Integer >, SparseMatrix_t::CSR_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            Givaro::Integer * dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.197 sparse_init() [5/16]

```
void FFLAS::sparse_init (
            const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> & F,
            Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR_ZO >
& A,
            const IndexT * row,
            const IndexT * col,
            typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.198 sparse_init() [6/16]

```
void FFLAS::sparse_init (
            const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> & F,
            Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR > &
A,
            const IndexT * row,
            const IndexT * col,
            typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.199 sparse_init() [7/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::CSR > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.200 sparse_init() [8/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.201 sparse_delete() [5/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A )  [inline]
```

15.1.3.202 sparse_init() [9/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.203 sparse_delete() [6/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::ELL > & A ) [inline]
```

15.1.3.204 sparse_delete() [7/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A ) [inline]
```

15.1.3.205 sparse_init() [10/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::ELL > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.206 sparse_init() [11/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz ) [inline]
```

15.1.3.207 sparse_delete() [8/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A )  [inline]
```

15.1.3.208 sparse_delete() [9/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A )  [inline]
```

15.1.3.209 sparse_print() [2/3]

```
void FFLAS::sparse_print (
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A )  [inline]
```

15.1.3.210 sparse_init() [12/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.211 sparse_init() [13/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.212 sparse_delete() [10/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A )  [inline]
```

15.1.3.213 sparse_init() [14/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.214 operator<<()

```
std::ostream& FFLAS::operator<< (
            std::ostream & os,
            const Sparse< _Field, SparseMatrix_t::HYB_ZO > & A )
```

15.1.3.215 readSmsFormat()

```
void FFLAS::readSmsFormat (
            const std::string & path,
            const Field & f,
            index_t *& row,
            index_t *& col,
            typename Field::Element_ptr & val,
            index_t & rowdim,
            index_t & coldim,
            uint64_t & nnz )
```

15.1.3.216 readSprFormat()

```
void FFLAS::readSprFormat (
            const std::string & path,
            const Field & f,
            index_t *& row,
            index_t *& col,
            typename Field::Element_ptr & val,
            index_t & rowdim,
            index_t & coldim,
            uint64_t & nnz )
```

15.1.3.217 getDataType() [1/4]

```
std::enable_if<std::is_integral<T>::value,int> FFLAS::getDataType ( )
```

15.1.3.218 getDataType() [2/4]

```
std::enable_if<std::is_floating_point<T>::value,int> FFLAS::getDataType ( )
```

15.1.3.219 getDataType() [3/4]

```
std::enable_if<std::is_same<T,mpz_t>::value,int> FFLAS::getDataType ( )
```

15.1.3.220 getDataType() [4/4]

```
int FFLAS::getDataType ( )
```

15.1.3.221 readMachineType()

```
void FFLAS::readMachineType (
            const Field & F,
            typename Field::Element & modulo,
            typename Field::Element_ptr val,
            std::ifstream & file,
            const uint64_t dims,
            const mask_t data_type,
            const mask_t field_desc )
```

15.1.3.222 readDnsFormat()

```
void FFLAS::readDnsFormat (
            const std::string & path,
            const Field & F,
            index_t & rowdim,
            index_t & coldim,
            typename Field::Element_ptr & val )
```

15.1.3.223 writeDnsFormat()

```
void FFLAS::writeDnsFormat (
            const std::string & path,
            const Field & F,
            const index_t & rowdim,
            const index_t & coldim,
            typename Field::Element_ptr A,
            index_t ldA )
```

15.1.3.224 fspmv() [1/2]

```
void FFLAS::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag )  [inline]
```

15.1.3.225 sparse_delete() [11/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::SELL > & A )  [inline]
```

15.1.3.226 sparse_delete() [12/12]

```
void FFLAS::sparse_delete (
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A )  [inline]
```

15.1.3.227 sparse_print() [3/3]

```
void FFLAS::sparse_print (
            const Sparse< Field, SparseMatrix_t::SELL > & A )  [inline]
```

15.1.3.228 sparse_init() [15/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::SELL > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz,
            uint64_t sigma = 0 )  [inline]
```

15.1.3.229 sparse_init() [16/16]

```
void FFLAS::sparse_init (
            const Field & F,
            Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            const IndexT * row,
            const IndexT * col,
            typename Field::ConstElement_ptr dat,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )  [inline]
```

15.1.3.230 computeDeviation()

```
double FFLAS::computeDeviation (
            It begin,
            It end )
```

15.1.3.231 getStat()

```
StatsMatrix FFLAS::getStat (
            const Field & F,
            const index_t * row,
            const index_t * col,
            typename Field::ConstElement_ptr val,
            uint64_t rowdim,
            uint64_t coldim,
            uint64_t nnz )
```

15.1.3.232 fspmv() [2/2]

```
void FFLAS::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            const typename Field::Element & beta,
            typename Field::Element_ptr y )  [inline]
```

15.1.3.233 fspmm()

```
void FFLAS::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            const typename Field::Element & beta,
            typename Field::Element_ptr y,
            int ldy )  [inline]
```

15.1.3.234 maxCardinality()

```
Field::Residu_t maxCardinality ( )  [inline]
```

15.1.3.235 maxCardinality< Givaro::Modular< int64_t > >()

```
uint64_t FFLAS::maxCardinality< Givaro::Modular< int64_t > > ( )  [inline]
```

15.1.3.236 maxCardinality< Givaro::Modular< int32_t > >()

```
uint32_t FFLAS::maxCardinality< Givaro::Modular< int32_t > > ( )  [inline]
```

15.1.3.237 minCardinality()

```
Field::Residu_t FFLAS::minCardinality ( )  [inline]
```

15.1.3.238 fflas_delete() [1/3]

```
void FFLAS::fflas_delete (
            FFPACK::rns_double_elt_ptr A )  [inline]
```

15.1.3.239 fflas_delete() [2/3]

```
void FFLAS::fflas_delete (
            FFPACK::rns_double_elt_cstptr A )  [inline]
```

15.1.3.240 fflas_new() [1/7]

```
FFPACK::rns_double_elt_ptr FFLAS::fflas_new (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t m,
            const Alignment align )  [inline]
```

15.1.3.241 fflas_new() [2/7]

```
FFPACK::rns_double_elt_ptr FFLAS::fflas_new (
            const FFPACK::RNSIntegerMod< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const Alignment align )  [inline]
```

15.1.3.242 finit_rns() [1/2]

```
void FFLAS::finit_rns (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const size_t m,
            const size_t n,
            size_t k,
            const Givaro::Integer * B,
            const size_t ldb,
            typename RNS::Element_ptr A )
```

15.1.3.243 finit_trans_rns()

```
void FFLAS::finit_trans_rns (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const size_t m,
            const size_t n,
            size_t k,
            const Givaro::Integer * B,
            const size_t ldb,
            typename RNS::Element_ptr A )
```

15.1.3.244 fconvert_rns() [1/2]

```
void FFLAS::fconvert_rns (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const size_t m,
            const size_t n,
            Givaro::Integer alpha,
            Givaro::Integer * B,
            const size_t ldb,
            typename RNS::ConstElement_ptr A )
```

15.1.3.245 fconvert_trans_rns()

```
void FFLAS::fconvert_trans_rns (
            const FFPACK::RNSIntegerMod< RNS > & F,
            const size_t m,
            const size_t n,
            Givaro::Integer alpha,
            Givaro::Integer * B,
            const size_t ldb,
            typename RNS::ConstElement_ptr A )
```

15.1.3.246 fflas_new() [3/7]

```
FFPACK::rns_double_elt_ptr FFLAS::fflas_new (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t m,
            const Alignment align )  [inline]
```

15.1.3.247 fflas_new() [4/7]

```
FFPACK::rns_double_elt_ptr FFLAS::fflas_new (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            const size_t m,
            const size_t n,
            const Alignment align ) [inline]
```

15.1.3.248 finit_rns() [2/2]

```
void FFLAS::finit_rns (
            const FFPACK::RNSInteger< RNS > & F,
            const size_t m,
            const size_t n,
            size_t k,
            const Givaro::Integer * B,
            const size_t ldb,
            typename FFPACK::RNSInteger< RNS >::Element_ptr A )
```

15.1.3.249 fconvert_rns() [2/2]

```
void FFLAS::fconvert_rns (
            const FFPACK::RNSInteger< RNS > & F,
            const size_t m,
            const size_t n,
            Givaro::Integer alpha,
            Givaro::Integer * B,
            const size_t ldb,
            typename FFPACK::RNSInteger< RNS >::ConstElement_ptr A )
```

15.1.3.250 freduce() [8/11]

```
template INST_OR_DECL void FFLAS::freduce (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            FFLAS_ELT * X,
            const size_t incX )
```

freduce $x \leftarrow x mod F$.

Parameters

F	field
n	size of the vectors
X	vector in F
incX	stride of X

Bug use cblas_(d)scal when possible

15.1.3.251 freduce() [9/11]

```
template INST_OR_DECL void FFLAS::freduce (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            const FFLAS_ELT * Y,
            const size_t incY,
            FFLAS_ELT * X,
            const size_t incX )
```

freduce $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of `Element`
incY	stride of `Y`
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.252 finit() [7/8]

```
template INST_OR_DECL void FFLAS::finit (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            const FFLAS_ELT * Y,
            const size_t incY,
            FFLAS_ELT * X,
            const size_t incX )
```

finit $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of `OtherElement`
incY	stride of `Y`
X	vector in `F`
incX	stride of `X`

Bug use cblas_(d)scal when possible

15.1.3.253 fconvert() [3/3]

```
template INST_OR_DECL void FFLAS::fconvert (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            FFLAS_ELT * X,
            const size_t incX,
            const FFLAS_ELT * Y,
            const size_t incY )
```

fconvert $x \leftarrow ymodF$.

Parameters

F	field
n	size of the vectors
Y	vector of F
incY	stride of Y
X	vector in OtherElement
incX	stride of X

Bug use cblas_(d)scal when possible

15.1.3.254 fnegin() [3/4]

```
template INST_OR_DECL void FFLAS::fnegin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            FFLAS_ELT * X,
            const size_t incX )
```

fnegin $x \leftarrow -x$.

Parameters

F	field
n	size of the vectors
X	vector in F
incX	stride of X

Bug use cblas_(d)scal when possible

15.1.3.255 fneg() [3/4]

```
template INST_OR_DECL void FFLAS::fneg (
        const FFLAS_FIELD< FFLAS_ELT > & F,
        const size_t n,
        const FFLAS_ELT * Y,
        const size_t incY,
        FFLAS_ELT * X,
        const size_t incX )
```

fneg $x \leftarrow -y$.

Parameters

F	field
n	size of the vectors
X	vector in F
incX	stride of X
Y	vector in F
incY	stride of Y

Bug use cblas_(d)scal when possible

15.1.3.256 fzero() [4/5]

```
template INST_OR_DECL void FFLAS::fzero (
        const FFLAS_FIELD< FFLAS_ELT > & F,
        const size_t n,
        FFLAS_ELT * X,
        const size_t incX )
```

fzero : $A \leftarrow 0$.

Parameters

F	field
n	number of elements to zero
X	vector in F
incX	stride of X

15.1.3.257 fiszero() [3/4]

```
template INST_OR_DECL bool FFLAS::fiszero (
        const FFLAS_FIELD< FFLAS_ELT > & F,
        const size_t n,
```

```
const FFLAS_ELT * X,
const size_t incX )
```

fiszero : test $X = 0$.

Parameters

F	field
n	vector dimension
X	vector in F
incX	increment of X

15.1.3.258 fequal() [3/4]

```
template INST_OR_DECL bool FFLAS::fequal (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            const FFLAS_ELT * X,
            const size_t incX,
            const FFLAS_ELT * Y,
            const size_t incY )
```

fequal : test $X = Y$.

Parameters

F	field
n	vector dimension
X	vector in F
incX	increment of X
Y	vector in F
incY	increment of Y

15.1.3.259 fassign() [9/10]

```
template INST_OR_DECL void FFLAS::fassign (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * Y,
            const size_t incY,
            FFLAS_ELT * X,
            const size_t incX )
```

fassign : $x \leftarrow y$.

X is preallocated

Todo variant for triagular matrix

Parameters

	F	field
	N	size of the vectors
out	*X*	vector in F
	incX	stride of X
in	*Y*	vector in F
	incY	stride of Y

15.1.3.260 fscalin() [9/10]

```
template INST_OR_DECL void FFLAS::fscalin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            const FFLAS_ELT alpha,
            FFLAS_ELT * X,
            const size_t incX )
```

fscalin $x \leftarrow \alpha \cdot x$.

Parameters

F	field
n	size of the vectors
alpha	scalar
X	vector in F
incX	stride of X

Bug use cblas_(d)scal when possible

Todo check if comparison with +/-1,0 is necessary.

15.1.3.261 fscal() [9/10]

```
template INST_OR_DECL void FFLAS::fscal (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t n,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * X,
            const size_t incX,
            FFLAS_ELT * Y,
            const size_t incY )
```

fscal $y \leftarrow \alpha \cdot x$.

Parameters

	F	field
	n	size of the vectors
	alpha	scalar
in	*X*	vector in F
	incX	stride of X
out	*Y*	vector in F
	incY	stride of Y

Bug use cblas_(d)scal when possible

Todo check if comparison with +/-1,0 is necessary.

15.1.3.262 faxpy() [5/6]

```
template INST_OR_DECL void FFLAS::faxpy (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * X,
            const size_t incX,
            FFLAS_ELT * Y,
            const size_t incY )
```

faxpy : $y \leftarrow \alpha \cdot x + y$.

Parameters

	F	field
	N	size of the vectors
	alpha	scalar
in	*X*	vector in F
	incX	stride of X
in,out	*Y*	vector in F
	incY	stride of Y

15.1.3.263 fdot() [10/11]

```
template INST_OR_DECL FFLAS_ELT FFLAS::fdot (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * X,
            const size_t incX,
```

```
            const FFLAS_ELT * Y,
            const size_t incY )
```

faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

Parameters

	F	field
	N	size of the vectors
	alpha	scalar
in	*X*	vector in `F`
	incX	stride of `X`
	beta	scalar
in,out	*Y*	vector in `F`
	incY	stride of `Y`

Note

this is a catlas function

fdot: dot product $x^T y$.

Parameters

F	field
N	size of the vectors
X	vector in `F`
incX	stride of `X`
Y	vector in `F`
incY	stride of `Y`

15.1.3.264 fswap() [2/2]

```
template INST_OR_DECL void FFLAS::fswap (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            FFLAS_ELT * X,
            const size_t incX,
            FFLAS_ELT * Y,
            const size_t incY )
```

fswap: $X \leftrightarrow Y$.

Bug use cblas_dswap when double

Parameters

F	field

Parameters

N	size of the vectors
X	vector in F
incX	stride of X
Y	vector in F
incY	stride of Y

15.1.3.265 fadd() [5/8]

```
template INST_OR_DECL void FFLAS::fadd (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t inca,
            const FFLAS_ELT * B,
            const size_t incb,
            FFLAS_ELT * C,
            const size_t incc )
```

15.1.3.266 fsub() [3/4]

```
template INST_OR_DECL void FFLAS::fsub (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t inca,
            const FFLAS_ELT * B,
            const size_t incb,
            FFLAS_ELT * C,
            const size_t incc )
```

15.1.3.267 faddin() [4/5]

```
template INST_OR_DECL void FFLAS::faddin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * B,
            const size_t incb,
            FFLAS_ELT * C,
            const size_t incc )
```

15.1.3.268 fadd() [6/8]

```
template INST_OR_DECL void FFLAS::fadd (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t inca,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * B,
            const size_t incb,
            FFLAS_ELT * C,
            const size_t incc )
```

15.1.3.269 fassign() [10/10]

```
template INST_OR_DECL void FFLAS::fassign (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * A,
            const size_t lda )
```

fassign : $A \leftarrow B$.

Parameters

F	field
m	number of rows to copy
n	number of cols to copy
A	matrix in `F`
lda	stride of `A`
B	vector in `F`
ldb	stride of `B`

15.1.3.270 fzero() [5/5]

```
template INST_OR_DECL void FFLAS::fzero (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            FFLAS_ELT * A,
            const size_t lda )
```

fzero : $A \leftarrow 0$.

Parameters

F	field
m	number of rows to zero
n	number of cols to zero
A	matrix in F
lda	stride of A

Warning

may be buggy if Element is larger than int

15.1.3.271 fequal() [4/4]

```
template INST_OR_DECL bool FFLAS::fequal (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT * B,
            const size_t ldb )
```

fequal : test $A = B$.

Parameters

F	field
m	row dimension
n	column dimension
A	m x n matrix in F
lda	leading dimension of A
B	m x n matrix in F
ldb	leading dimension of B

15.1.3.272 fiszero() [4/4]

```
template INST_OR_DECL bool FFLAS::fiszero (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * A,
            const size_t lda )
```

fiszero : test $A = 0$.

Parameters

F	field
m	row dimension
n	column dimension
A	m x n matrix in F
lda	leading dimension of A

15.1.3.273 fidentity() [3/4]

```
template INST_OR_DECL void FFLAS::fidentity (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT & d )
```

creates a diagonal matrix

15.1.3.274 fidentity() [4/4]

```
template INST_OR_DECL void FFLAS::fidentity (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            FFLAS_ELT * A,
            const size_t lda )
```

creates a diagonal matrix

15.1.3.275 freduce() [10/11]

```
template INST_OR_DECL void FFLAS::freduce (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            FFLAS_ELT * A,
            const size_t lda )
```

freduce $A \leftarrow AmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A

15.1.3.276 freduce() [11/11]

```
template INST_OR_DECL void FFLAS::freduce (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * A,
            const size_t lda )
```

freduce $A \leftarrow BmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A
B	matrix in Element
ldb	stride of B

15.1.3.277 finit() [8/8]

```
template INST_OR_DECL void FFLAS::finit (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * A,
            const size_t lda )
```

finit $A \leftarrow BmodF$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A
B	matrix in F
ldb	stride of B

15.1.3.278 fnegin() [4/4]

```
template INST_OR_DECL void FFLAS::fnegin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            FFLAS_ELT * A,
            const size_t lda )
```

fnegin $A \leftarrow -A$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A

15.1.3.279 fneg() [4/4]

```
template INST_OR_DECL void FFLAS::fneg (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * A,
            const size_t lda )
```

fneg $A \leftarrow -B$.

Parameters

F	field
m	number of rows
n	number of cols
A	matrix in F
lda	stride of A

15.1.3.280 fscalin() [10/10]

```
template INST_OR_DECL void FFLAS::fscalin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t m,
            const size_t n,
```

```
                const FFLAS_ELT alpha,
                FFLAS_ELT * A,
                const size_t lda )
```

fscalin $A \leftarrow a \cdot A$.

Parameters

F	field
m	number of rows
n	number of cols
alpha	homotecie scalar
A	matrix in F
lda	stride of A

15.1.3.281 fscal() [10/10]

```
template INST_OR_DECL void FFLAS::fscal (
                const FFLAS_FIELD< FFLAS_ELT > & F,
                const size_t m,
                const size_t n,
                const FFLAS_ELT alpha,
                const FFLAS_ELT * A,
                const size_t lda,
                FFLAS_ELT * B,
                const size_t ldb )
```

fscal $B \leftarrow a \cdot A$.

Parameters

	F	field
	m	number of rows
	n	number of cols
	alpha	homotecie scalar
in	*A*	matrix in F
	lda	stride of A
out	*B*	matrix in F
	ldb	stride of B

15.1.3.282 faxpy() [6/6]

```
template INST_OR_DECL void FFLAS::faxpy (
                const FFLAS_FIELD< FFLAS_ELT > & F,
                const size_t m,
                const size_t n,
                const FFLAS_ELT alpha,
```

```
              const FFLAS_ELT * X,
              const size_t ldx,
              FFLAS_ELT * Y,
              const size_t ldy )
```

faxpy : $y \leftarrow \alpha \cdot x + y$.

Parameters

	F	field
	m	row dimension
	n	column dimension
	alpha	scalar
in	*X*	vector in F
	ldx	leading dimension of X
in,out	*Y*	vector in F
	ldy	leading dimension of Y

15.1.3.283 fmove() [2/2]

```
template INST_OR_DECL void FFLAS::fmove (
              const FFLAS_FIELD< FFLAS_ELT > & F,
              const size_t m,
              const size_t n,
              FFLAS_ELT * A,
              const size_t lda,
              FFLAS_ELT * B,
              const size_t ldb )
```

faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

Parameters

	F	field
	m	row dimension
	n	column dimension
	alpha	scalar
in	*X*	vector in F
	ldx	leading dimension of X
	beta	scalar
in,out	*Y*	vector in F
	ldy	leading dimension of Y

Note

this is a catlas function

fmove : $A \leftarrow B$ and $B \leftarrow 0$.

Parameters

F	field
m	number of rows to copy
n	number of cols to copy
A	matrix in F
lda	stride of A
B	vector in F
ldb	stride of B

15.1.3.284 fadd() [7/8]

```
template INST_OR_DECL void FFLAS::fadd (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * C,
            const size_t ldc )
```

fadd : matrix addition.

Computes C = A + B.

Parameters

F	field
M	rows
N	cols
A	dense matrix of size MxN
lda	leading dimension of A
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.285 fsub() [4/4]

```
template INST_OR_DECL void FFLAS::fsub (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT * A,
```

```
const size_t lda,
const FFLAS_ELT * B,
const size_t ldb,
FFLAS_ELT * C,
const size_t ldc )
```

fsub : matrix subtraction.

Computes C = A - B.

Parameters

F	field
M	rows
N	cols
A	dense matrix of size MxN
lda	leading dimension of A
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.286 fsubin() [3/3]

```
template INST_OR_DECL void FFLAS::fsubin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * C,
            const size_t ldc )
```

fsubin C = C - B

15.1.3.287 fadd() [8/8]

```
template INST_OR_DECL void FFLAS::fadd (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * C,
            const size_t ldc )
```

fadd : matrix addition with scaling.

Computes C = A + alpha B.

Parameters

F	field
M	rows
N	cols
A	dense matrix of size MxN
lda	leading dimension of A
alpha	some scalar
B	dense matrix of size MxN
ldb	leading dimension of B
C	dense matrix of size MxN
ldc	leading dimension of C

15.1.3.288 faddin() [5/5]

```
template INST_OR_DECL void FFLAS::faddin (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT * B,
            const size_t ldb,
            FFLAS_ELT * C,
            const size_t ldc )
```

faddin

15.1.3.289 fgemv() [17/19]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fgemv (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_TRANSPOSE TransA,
            const size_t M,
            const size_t N,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT * X,
            const size_t incX,
            const FFLAS_ELT beta,
            FFLAS_ELT * Y,
            const size_t incY )
```

finite prime FFLAS_FIELD<FFLAS_ELT> GEneral Matrix Vector multiplication.

Computes $Y \leftarrow \alpha \mathrm{op}(A)X + \beta Y$.

Parameters

	F	field
	TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
	M	rows
	N	cols
	alpha	scalar
	A	dense matrix of size `MxN`
	lda	leading dimension of `A`
	X	dense vector of size `N`
	incX	stride of `X`
	beta	scalar
`out`	*Y*	dense vector of size `M`
	incY	stride of `Y`

15.1.3.290 fger() [12/12]

```
template INST_OR_DECL void FFLAS::fger (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * x,
            const size_t incx,
            const FFLAS_ELT * y,
            const size_t incy,
            FFLAS_ELT * A,
            const size_t lda )
```

fger: rank one update of a general matrix

Computes $A \leftarrow \alpha x.y^T + A$

Parameters

	F	field
	M	rows
	N	cols
	alpha	scalar
`in,out`	*A*	dense matrix of size `MxN` and leading dimension `lda`
	lda	leading dimension of `A`
	x	dense vector of size `M`
	incx	stride of `X`
	y	dense vector of size `N`
	incy	stride of `Y`

15.1.3.291 ftrsv() [2/2]

```
template INST_OR_DECL void FFLAS::ftrsv (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * X,
            int incX )
```

ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$

Parameters

F	field
X	vector of size N on a field F
incX	stride of X
A	a matrix of leading dimension lda and size N
lda	leading dimension of A
N	number of rows or columns of A according to TransA
TransA	if TransA==FflasTrans then $\mathrm{op}(A) = A^t$.
Diag	if Diag==FflasUnit then A is unit.
Uplo	if Uplo==FflasUpper then A is upper triangular

15.1.3.292 ftrsm() [9/9]

```
template INST_OR_DECL void FFLAS::ftrsm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * B,
            const size_t ldb )
```

ftrsm: **TR**iangular **S**ystem solve with **M**atrix.

Computes $B \leftarrow \alpha \mathrm{op}(A^{-1})B$ or $B \leftarrow \alpha B \mathrm{op}(A^{-1})$.

Parameters

F	field
Side	if Side==FflasLeft then $B \leftarrow \alpha \mathrm{op}(A^{-1})B$ is computed.

Parameters

Uplo	if `Uplo==FflasUpper` then `A` is upper triangular
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is unit.
M	rows of `B`
N	cols of `B`
alpha	scalar
A	triangular invertible matrix. If `Side==FflasLeft` then `A` is $N \times N$, otherwise `A` is $M \times M$
lda	leading dim of `A`
B	matrix of size `MxN`
ldb	leading dim of `B`

Bug α must be non zero.

15.1.3.293 ftrmm() [3/3]

```
template INST_OR_DECL void FFLAS::ftrmm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_SIDE Side,
            const FFLAS_UPLO Uplo,
            const FFLAS_TRANSPOSE TransA,
            const FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * B,
            const size_t ldb )
```

ftrmm: **TR**iangular **M**atrix **M**ultiply.

Computes $B \leftarrow \alpha \mathrm{op}(A)B$ or $B \leftarrow \alpha B \mathrm{op}(A)$.

Parameters

F	field
Side	if `Side==FflasLeft` then $B \leftarrow \alpha \mathrm{op}(A)B$ is computed.
Uplo	if `Uplo==FflasUpper` then `A` is upper triangular
TransA	if `TransA==FflasTrans` then $\mathrm{op}(A) = A^t$.
Diag	if `Diag==FflasUnit` then `A` is implicitly unit.
M	rows of `B`
N	cols of `B`
alpha	scalar
A	triangular matrix. If `Side==FflasLeft` then `A` is $N \times N$, otherwise `A` is $M \times M$
lda	leading dim of `A`
B	matrix of size `MxN`
ldb	leading dim of `B`

15.1.3.294 fgemm() [20/23]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fgemm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT * B,
            const size_t ldb,
            const FFLAS_ELT beta,
            FFLAS_ELT * C,
            const size_t ldc )
```

fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.

Computes $C = \alpha \mathrm{op}(A) \times \mathrm{op}(B) + \beta C$ Automatically set Winograd recursion level

Parameters

F	field.
ta	if `ta==FflasTrans` then $\mathrm{op}(A) = A^t$, else $\mathrm{op}(A) = A$,
tb	same for matrix `B`
m	see `A`
n	see `B`
k	see `A`
alpha	scalar
beta	scalar
A	$\mathrm{op}(A)$ is $m \times k$
B	$\mathrm{op}(B)$ is $k \times n$
C	C is $m \times n$
lda	leading dimension of `A`
ldb	leading dimension of `B`
ldc	leading dimension of `C`
w	recursive levels of Winograd's algorithm are used. No argument (or -1) does auto computation of `w`.

Warning

α *must* be invertible

15.1.3.295 fgemm() [21/23]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fgemm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
```

```
const FFLAS_TRANSPOSE ta,
const FFLAS_TRANSPOSE tb,
const size_t m,
const size_t n,
const size_t k,
const FFLAS_ELT alpha,
const FFLAS_ELT * A,
const size_t lda,
const FFLAS_ELT * B,
const size_t ldb,
const FFLAS_ELT beta,
FFLAS_ELT * C,
const size_t ldc,
const ParSeqHelper::Sequential seq )
```

15.1.3.296 fgemm() [22/23]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fgemm (
const FFLAS_FIELD< FFLAS_ELT > & F,
const FFLAS_TRANSPOSE ta,
const FFLAS_TRANSPOSE tb,
const size_t m,
const size_t n,
const size_t k,
const FFLAS_ELT alpha,
const FFLAS_ELT * A,
const size_t lda,
const FFLAS_ELT * B,
const size_t ldb,
const FFLAS_ELT beta,
FFLAS_ELT * C,
const size_t ldc,
const ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoDAdaptive
> par )
```

15.1.3.297 fgemm() [23/23]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fgemm (
const FFLAS_FIELD< FFLAS_ELT > & F,
const FFLAS_TRANSPOSE ta,
const FFLAS_TRANSPOSE tb,
const size_t m,
const size_t n,
const size_t k,
const FFLAS_ELT alpha,
const FFLAS_ELT * A,
const size_t lda,
const FFLAS_ELT * B,
const size_t ldb,
const FFLAS_ELT beta,
FFLAS_ELT * C,
```

```
            const size_t ldc,
            const ParSeqHelper::Parallel< CuttingStrategy::Block, StrategyParameter::Threads
> par )
```

15.1.3.298 fsquare() [6/6]

```
template INST_OR_DECL FFLAS_ELT* FFLAS::fsquare (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const FFLAS_ELT alpha,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT beta,
            FFLAS_ELT * C,
            const size_t ldc )
```

fsquare: Squares a matrix.

compute $C \leftarrow \alpha \mathrm{op}(A)\mathrm{op}(A) + \beta C$ over a FFLAS_FIELD <FFLAS_ELT> F Avoid the conversion of B

Parameters

ta	if `ta==FflasTrans`, $\mathrm{op}(A) = A^T$.
F	field
n	size of `A`
alpha	scalar
beta	scalar
A	dense matrix of size `nxn`
lda	leading dimension of `A`
C	dense matrix of size `nxn`
ldc	leading dimension of `C`

15.1.3.299 BlockCuts() [1/2]

```
void FFLAS::BlockCuts (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads ) [inline]
```

15.1.3.300 BlockCuts< CuttingStrategy::Single, StrategyParameter::Threads >()

```
void FFLAS::BlockCuts< CuttingStrategy::Single, StrategyParameter::Threads > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads )  [inline]
```

15.1.3.301 BlockCuts< CuttingStrategy::Row, StrategyParameter::Fixed >()

```
void FFLAS::BlockCuts< CuttingStrategy::Row, StrategyParameter::Fixed > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads )  [inline]
```

15.1.3.302 BlockCuts< CuttingStrategy::Row, StrategyParameter::Grain >()

```
void FFLAS::BlockCuts< CuttingStrategy::Row, StrategyParameter::Grain > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t grainsize )  [inline]
```

15.1.3.303 BlockCuts< CuttingStrategy::Block, StrategyParameter::Grain >()

```
void FFLAS::BlockCuts< CuttingStrategy::Block, StrategyParameter::Grain > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t grainsize )  [inline]
```

15.1.3.304 BlockCuts< CuttingStrategy::Column, StrategyParameter::Fixed >()

```
void FFLAS::BlockCuts< CuttingStrategy::Column, StrategyParameter::Fixed > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads )  [inline]
```

15.1.3.305 BlockCuts< CuttingStrategy::Column, StrategyParameter::Grain >()

```
void FFLAS::BlockCuts< CuttingStrategy::Column, StrategyParameter::Grain > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t grainsize ) [inline]
```

15.1.3.306 BlockCuts< CuttingStrategy::Block, StrategyParameter::Fixed >()

```
void FFLAS::BlockCuts< CuttingStrategy::Block, StrategyParameter::Fixed > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads ) [inline]
```

15.1.3.307 BlockCuts< CuttingStrategy::Row, StrategyParameter::Threads >()

```
void FFLAS::BlockCuts< CuttingStrategy::Row, StrategyParameter::Threads > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads ) [inline]
```

15.1.3.308 BlockCuts< CuttingStrategy::Column, StrategyParameter::Threads >()

```
void FFLAS::BlockCuts< CuttingStrategy::Column, StrategyParameter::Threads > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads ) [inline]
```

15.1.3.309 BlockCuts< CuttingStrategy::Block, StrategyParameter::Threads >()

```
void FFLAS::BlockCuts< CuttingStrategy::Block, StrategyParameter::Threads > (
            size_t & RBLOCKSIZE,
            size_t & CBLOCKSIZE,
            const size_t m,
            const size_t n,
            const size_t numthreads ) [inline]
```

15.1.3.310 BlockCuts() [2/2]

```
void FFLAS::BlockCuts (
            size_t & rowBlockSize,
            size_t & colBlockSize,
            size_t & lastRBS,
            size_t & lastCBS,
            size_t & changeRBS,
            size_t & changeCBS,
            size_t & numRowBlock,
            size_t & numColBlock,
            size_t m,
            size_t n,
            const size_t numthreads )  [inline]
```

15.1.3.311 pfzero()

```
void FFLAS::pfzero (
            const Field & F,
            size_t m,
            size_t n,
            typename Field::Element_ptr C,
            size_t BS = 0 )
```

15.1.3.312 pfrand()

```
void FFLAS::pfrand (
            const Field & F,
            RandIter & G,
            size_t m,
            size_t n,
            typename Field::Element_ptr C,
            size_t BS = 0 )
```

15.1.3.313 fdot() [11/11]

```
Field::Element& FFLAS::fdot (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element & d,
            const ParSeqHelper::Parallel< Cut, Param > par )  [inline]
```

15.1.3.314 pfgemm() [2/7]

```
Field::Element* FFLAS::pfgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element * C,
            const size_t ldc,
            MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Block,
StrategyParameter::Threads > > & H )
```

15.1.3.315 pfgemm() [3/7]

```
Field::Element* FFLAS::pfgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr AA,
            const size_t lda,
            const typename Field::ConstElement_ptr BB,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element * C,
            const size_t ldc,
            MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::ThreeDAdaptive > > & H )
```

15.1.3.316 pfgemm() [4/7]

```
Field::Element* FFLAS::pfgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
```

```
const typename Field::ConstElement_ptr AA,
const size_t lda,
const typename Field::ConstElement_ptr BB,
const size_t ldb,
const typename Field::Element beta,
typename Field::Element * C,
const size_t ldc,
MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::TwoDAdaptive > > & H )
```

15.1.3.317 pfgemm() [5/7]

```
Field::Element* FFLAS::pfgemm (
const Field & F,
const FFLAS_TRANSPOSE ta,
const FFLAS_TRANSPOSE tb,
const size_t m,
const size_t n,
const size_t k,
const typename Field::Element alpha,
const typename Field::ConstElement_ptr AA,
const size_t lda,
const typename Field::ConstElement_ptr BB,
const size_t ldb,
const typename Field::Element beta,
typename Field::Element * C,
const size_t ldc,
MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::TwoD > > & H )
```

15.1.3.318 pfgemm() [6/7]

```
Field::Element_ptr FFLAS::pfgemm (
const Field & F,
const FFLAS_TRANSPOSE ta,
const FFLAS_TRANSPOSE tb,
const size_t m,
const size_t n,
const size_t k,
const typename Field::Element alpha,
const typename Field::ConstElement_ptr A,
const size_t lda,
const typename Field::ConstElement_ptr B,
const size_t ldb,
const typename Field::Element beta,
typename Field::Element_ptr C,
const size_t ldc,
MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::ThreeD > > & H )
```

15.1.3.319 pfgemm() [7/7]

```
Field::Element* FFLAS::pfgemm (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::ThreeDInPlace > > & H )
```

15.1.3.320 fgemv() [18/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive,
StrategyParameter::Threads > > & H )
```

15.1.3.321 fgemv() [19/19]

```
Field::Element_ptr FFLAS::fgemv (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            const typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::ConstElement_ptr X,
            const size_t incX,
```

```
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY,
            MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Row,
Cut > > & H )
```

15.1.3.322 parseArguments()

```
void parseArguments (
            int argc,
            char ** argv,
            Argument * args,
            bool printDefaults = true )
```

15.1.3.323 getArgumentValue()

```
char* FFLAS::getArgumentValue (
            int argc,
            char ** argv,
            int i )
```

Get the value of an argument and avoid core dump when no value was given after an argument.

Parameters

argv	argument value list
i	argument index

Returns

char* argument value

15.1.3.324 writeCommandString()

```
std::ostream& FFLAS::writeCommandString (
            std::ostream & os,
            Argument * args,
            const char * programName = nullptr )
```

writes the values of all arguments, preceded by the programName

15.1.3.325 WriteMatrix() [1/2]

```
std::ostream& FFLAS::WriteMatrix (
              std::ostream & c,
              const Field & F,
              size_t m,
              size_t n,
              typename Field::ConstElement_ptr A,
              size_t lda,
              FFLAS_FORMAT format,
              bool column_major )
```

WriteMatrix: write a matrix to an output stream.

Parameters

c	output stream
F	base field
m	row dimension
n	column dimension
A	matrix
format	input format (FflasAuto, FflasDense, FflasSMS, FflasBinary)
column_major	whether the matrix is stored in column or row major (row by default)

15.1.3.326 preamble()

```
void FFLAS::preamble (
              std::ifstream & ifs,
              FFLAS_FORMAT & format ) [inline]
```

15.1.3.327 ReadMatrix() [1/2]

```
Field::Element_ptr FFLAS::ReadMatrix (
              std::ifstream & ifs,
              Field & F,
              size_t & m,
              size_t & n,
              typename Field::Element_ptr & A,
              FFLAS_FORMAT format = FflasAuto )
```

ReadMatrix: read a matrix from an input stream.

Parameters

	ifs	input stream
	F	base field
out	*m*	row dimension
out	*n*	column dimension
out	*A*	output matrix
	format	input format (FflasAuto, FflasDense, FflasSMS, FflasBinary)

15.1.3.328 ReadMatrix() [2/2]

```
Field::Element_ptr FFLAS::ReadMatrix (
            const std::string & matrix_file,
            Field & F,
            size_t & m,
            size_t & n,
            typename Field::Element_ptr & A,
            FFLAS_FORMAT format = FflasAuto )  [inline]
```

ReadMatrix: read a matrix from a file.

Parameters

	matrix_file	filename
	F	base field
out	*m*	row dimension
out	*n*	column dimension
out	*A*	output matrix
	format	input format (FflasAuto, FflasDense, FflasSMS, FflasBinary)

15.1.3.329 WriteMatrix() [2/2]

```
void FFLAS::WriteMatrix (
            std::string & matrix_file,
            const Field & F,
            int m,
            int n,
            typename Field::ConstElement_ptr A,
            size_t lda,
            FFLAS_FORMAT format = FflasDense,
            bool column_major = false )
```

WriteMatrix: write a matrix to a file.

Parameters

matrix_file	file name
F	base field
m	row dimension
n	column dimension
A	matrix
format	input format (FflasAuto, FflasDense, FflasSMS, FflasBinary)
column_major	whether the matrix is stored in column or row major (row by default)

15.1.3.330 WritePermutation()

```
std::ostream& FFLAS::WritePermutation (
            std::ostream & c,
            const size_t * P,
            size_t N ) [inline]
```

WritePermutation: write a permutation matrix to an output stream.

Parameters

c	output stream
P	permutation
N	size of the permutation

15.1.3.331 alignable()

```
bool FFLAS::alignable ( ) [inline]
```

15.1.3.332 alignable< Givaro::Integer * >()

```
bool FFLAS::alignable< Givaro::Integer * > ( ) [inline]
```

15.1.3.333 fflas_new() [5/7]

```
Field::Element_ptr FFLAS::fflas_new (
            const Field & F,
            const size_t m,
            const Alignment align = Alignment::DEFAULT ) [inline]
```

15.1.3.334 fflas_new() [6/7]

```
Field::Element_ptr FFLAS::fflas_new (
            const Field & F,
            const size_t m,
            const size_t n,
            const Alignment align = Alignment::DEFAULT ) [inline]
```

15.1.3.335 fflas_new() [7/7]

```
Element* FFLAS::fflas_new (
            const size_t m,
            const Alignment align = Alignment::DEFAULT ) [inline]
```

15.1.3.336 fflas_delete() [3/3]

```
void FFLAS::fflas_delete (
            Ptr p,
            Args ... args ) [inline]
```

15.1.3.337 prefetch()

```
void FFLAS::prefetch (
            const int64_t * ) [inline]
```

15.1.3.338 getTLBSize()

```
void FFLAS::getTLBSize (
            int & tlb ) [inline]
```

15.1.3.339 queryCacheSizes()

```
void FFLAS::queryCacheSizes (
            int & l1,
            int & l2,
            int & l3 ) [inline]
```

Queries and returns the cache sizes in Bytes of the L1, L2, and L3 data caches respectively

15.1.3.340 queryL1CacheSize()

```
int FFLAS::queryL1CacheSize ( ) [inline]
```

Returns

the size in Bytes of the L1 data cache

15.1.3.341 queryTopLevelCacheSize()

```
int FFLAS::queryTopLevelCacheSize ( ) [inline]
```

Returns

the size in Bytes of the L2 or L3 cache if this later is present

15.1.3.342 getSeed()

```
uint64_t FFLAS::getSeed ( )
```

15.2 FFLAS::_ftranspose_impl Namespace Reference

Functions

- template<size_t bs, typename Field , typename BTSimd >
  void not_inplace (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)
- template<size_t bs, typename Field , typename BTSimd >
  void square_inplace (const Field &F, const BTSimd &BTS, const size_t m, typename Field::Element_ptr A, const size_t lda)
- template<size_t bs, typename Field , typename BTSimd >
  void nonsquare_inplace_v1 (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::Element_ptr A)
- template<size_t bs, typename Field , typename BTSimd >
  void nonsquare_inplace_v2 (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::Element_ptr A)

15.2.1 Function Documentation

15.2.1.1 not_inplace()

```
void FFLAS::_ftranspose_impl::not_inplace (
            const Field & F,
            const BTSimd & BTS,
            const size_t m,
            const size_t n,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb )
```

15.2.1.2 square_inplace()

```
void FFLAS::_ftranspose_impl::square_inplace (
            const Field & F,
            const BTSimd & BTS,
            const size_t m,
            typename Field::Element_ptr A,
            const size_t lda )
```

15.2.1.3 nonsquare_inplace_v1()

```
void FFLAS::_ftranspose_impl::nonsquare_inplace_v1 (
            const Field & F,
            const BTSimd & BTS,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A )
```

15.2.1.4 nonsquare_inplace_v2()

```
void FFLAS::_ftranspose_impl::nonsquare_inplace_v2 (
            const Field & F,
            const BTSimd & BTS,
            const size_t m,
            const size_t n,
            typename Field::Element_ptr A )
```

15.3 FFLAS::BLAS3 Namespace Reference

Functions

- template< class Field >
  void Bini (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t kmax, const size_t w, const FFLAS_BASE base, const size_t rec_level)
- template< class Field , class FieldTrait , class Strat , class Param >
  Field::Element_ptr WinoPar (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::WinogradPar, FieldTrait, ParSeqHelper::Parallel< Strat, Param > > &WH)
- template< class Field , class FieldTrait >
  void Winograd (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)

- template<class Field , class FieldTrait >
  void WinogradAcc_3_23 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_3_21 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_2_24 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_2_27 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_LR (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_R_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_L_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void Winograd_LR_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void Winograd_L_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void Winograd_R_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename

Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)

15.3.1 Function Documentation

15.3.1.1 Bini()

```
void FFLAS::BLAS3::Bini (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const size_t kmax,
            const size_t w,
            const FFLAS_BASE base,
            const size_t rec_level )  [inline]
```

15.3.1.2 WinoPar()

```
Field::Element_ptr FFLAS::BLAS3::WinoPar (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::WinogradPar, FieldTrait, ParSeqHelper::Parallel<
Strat, Param > > & WH )  [inline]
```

15.3.1.3 Winograd()

```
void FFLAS::BLAS3::Winograd (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.3.1.4 WinogradAcc_3_23()

```
void FFLAS::BLAS3::WinogradAcc_3_23 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.3.1.5 WinogradAcc_3_21()

```
void FFLAS::BLAS3::WinogradAcc_3_21 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
```

```
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.3.1.6 WinogradAcc_2_24()

```
void FFLAS::BLAS3::WinogradAcc_2_24 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.3.1.7 WinogradAcc_2_27()

```
void FFLAS::BLAS3::WinogradAcc_2_27 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            const typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.3.1.8 WinogradAcc_LR()

```
void FFLAS::BLAS3::WinogradAcc_LR (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH ) [inline]
```

15.3.1.9 WinogradAcc_R_S()

```
void FFLAS::BLAS3::WinogradAcc_R_S (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH ) [inline]
```

15.3.1.10 WinogradAcc_L_S()

```
void FFLAS::BLAS3::WinogradAcc_L_S (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
```

```
const typename Field::Element_ptr B,
const size_t ldb,
const typename Field::Element beta,
typename Field::Element_ptr C,
const size_t ldc,
const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH ) [inline]
```

15.3.1.11 Winograd_LR_S()

```
void FFLAS::BLAS3::Winograd_LR_S (
    const Field & F,
    const FFLAS_TRANSPOSE ta,
    const FFLAS_TRANSPOSE tb,
    const size_t mr,
    const size_t nr,
    const size_t kr,
    const typename Field::Element alpha,
    typename Field::Element_ptr A,
    const size_t lda,
    typename Field::Element_ptr B,
    const size_t ldb,
    const typename Field::Element beta,
    typename Field::Element_ptr C,
    const size_t ldc,
    const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH ) [inline]
```

15.3.1.12 Winograd_L_S()

```
void FFLAS::BLAS3::Winograd_L_S (
    const Field & F,
    const FFLAS_TRANSPOSE ta,
    const FFLAS_TRANSPOSE tb,
    const size_t mr,
    const size_t nr,
    const size_t kr,
    const typename Field::Element alpha,
    typename Field::Element_ptr A,
    const size_t lda,
    const typename Field::Element_ptr B,
    const size_t ldb,
    const typename Field::Element beta,
    typename Field::Element_ptr C,
    const size_t ldc,
    const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH ) [inline]
```

15.3.1.13 Winograd_R_S()

```
void FFLAS::BLAS3::Winograd_R_S (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            const typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > & WH )  [inline]
```

15.4 FFLAS::csr_hyb_details Namespace Reference

Data Structures

- struct Info
- struct Coo

15.5 FFLAS::CuttingStrategy Namespace Reference

Data Structures

- struct Single
- struct Row
- struct Column
- struct Block
- struct Recursive

Typedefs

- typedef Row RNSModulus

15.5.1 Typedef Documentation

15.5.1.1 RNSModulus

```
typedef Row RNSModulus
```

15.6 FFLAS::details Namespace Reference

Functions

- template<class Field , bool ADD>
  std::enable_if< FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::ModularTag)
- template<class Field , bool ADD>
  std::enable_if<!FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::ModularTag)
- template<class Field , bool ADD>
  void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::GenericTag)
- template<class Field , bool ADD>
  std::enable_if<!FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::UnparametricTag)
- template<class Field , bool ADD>
  std::enable_if< FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::UnparametricTag)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type faxpy (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FieldCategories::ModularTag)
- template<class Field , class FC >
  void faxpy (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FC)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type freduce (const Field &F, const size_t m, typename Field::Element_ptr A, const size_t incX, FieldCategories::ModularTag)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type freduce (const Field &F, const size_t m, typename Field::ConstElement_ptr B, const size_t incY, typename Field::Element_ptr A, const size_t incX, FieldCategories::ModularTag)
- template<class Field , class FC >
  void freduce (const Field &F, const size_t m, typename Field::Element_ptr A, const size_t incX, FC)
- template<class Field , class FC >
  void freduce (const Field &F, const size_t m, typename Field::ConstElement_ptr B, const size_t incY, typename Field::Element_ptr A, const size_t incX, FC)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type fscalin (const Field &F, const size_t N, const typename Field::Element a, typename Field::Element_ptr X, const size_t incX, FieldCategories::ModularTag)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type fscal (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FieldCategories::ModularTag)

- template<class Field , class FC >
  void fscalin (const Field &F, const size_t n, const typename Field::Element a, typename Field::Element_ptr X, const size_t incX, FC)
- template<class Field , class FC >
  void fscal (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FC)
- template<enum number_kind K>
  void igebb44 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebb24 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebb14 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebb41 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebb21 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebb11 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)
- template<enum number_kind K>
  void igebp (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t ∗blockA, size_t lda, const int64_t ∗blockB, size_t ldb, int64_t ∗C, size_t ldc)
- template<size_t k, bool transpose>
  void pack_lhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- template<size_t k, bool transpose>
  void pack_rhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- void gebp (size_t rows, size_t cols, size_t depth, int64_t ∗C, size_t ldc, const int64_t ∗blockA, size_t lda, const int64_t ∗BlockB, size_t ldb, int64_t ∗BlockW)
- void BlockingFactor (size_t &m, size_t &n, size_t &k)

15.6.1 Function Documentation

15.6.1.1 fadd() [1/5]

```
std::enable_if<FFLAS::support_simd_add<typename Field::Element>::value, void>::type FFLAS↩
::details::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc,
            FieldCategories::ModularTag )
```

15.6.1.2 fadd() [2/5]

```
std::enable_if<!FFLAS::support_simd_add<typename Field::Element>::value, void>::type FFLAS↩
::details::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc,
            FieldCategories::ModularTag  )
```

15.6.1.3 fadd() [3/5]

```
void FFLAS::details::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc,
            FieldCategories::GenericTag  )
```

15.6.1.4 fadd() [4/5]

```
std::enable_if<!FFLAS::support_simd_add<typename Field::Element>::value, void>::type FFLAS↩
::details::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc,
            FieldCategories::UnparametricTag  )  [inline]
```

15.6.1.5 fadd() [5/5]

```
std::enable_if<FFLAS::support_simd_add<typename Field::Element>::value, void>::type FFLAS↩
::details::fadd (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t inca,
            typename Field::ConstElement_ptr B,
            const size_t incb,
            typename Field::Element_ptr C,
            const size_t incc,
            FieldCategories::UnparametricTag ) [inline]
```

15.6.1.6 faxpy() [1/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::details::faxpy (
            const Field & F,
            const size_t N,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY,
            FieldCategories::ModularTag ) [inline]
```

15.6.1.7 faxpy() [2/2]

```
void FFLAS::details::faxpy (
            const Field & F,
            const size_t N,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY,
            FC ) [inline]
```

15.6.1.8 freduce() [1/4]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value , void>::type FFLAS↩
::details::freduce (
            const Field & F,
            const size_t m,
            typename Field::Element_ptr A,
            const size_t incX,
            FieldCategories::ModularTag ) [inline]
```

15.6.1.9 freduce() [2/4]

```
std::enable_if< FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::details::freduce (
            const Field & F,
            const size_t m,
            typename Field::ConstElement_ptr B,
            const size_t incY,
            typename Field::Element_ptr A,
            const size_t incX,
            FieldCategories::ModularTag ) [inline]
```

15.6.1.10 freduce() [3/4]

```
void FFLAS::details::freduce (
            const Field & F,
            const size_t m,
            typename Field::Element_ptr A,
            const size_t incX,
            FC ) [inline]
```

15.6.1.11 freduce() [4/4]

```
void FFLAS::details::freduce (
            const Field & F,
            const size_t m,
            typename Field::ConstElement_ptr B,
            const size_t incY,
            typename Field::Element_ptr A,
            const size_t incX,
            FC ) [inline]
```

15.6.1.12 fscalin() [1/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::details::fscalin (
            const Field & F,
            const size_t N,
            const typename Field::Element a,
            typename Field::Element_ptr X,
            const size_t incX,
            FieldCategories::ModularTag ) [inline]
```

15.6.1.13 fscal() [1/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::details::fscal (
            const Field & F,
            const size_t N,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY,
            FieldCategories::ModularTag ) [inline]
```

15.6.1.14 fscalin() [2/2]

```
void FFLAS::details::fscalin (
            const Field & F,
            const size_t n,
            const typename Field::Element a,
            typename Field::Element_ptr X,
            const size_t incX,
            FC ) [inline]
```

15.6.1.15 fscal() [2/2]

```
void FFLAS::details::fscal (
            const Field & F,
            const size_t N,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY,
            FC ) [inline]
```

15.6.1.16 igebb44()

```
void igebb44 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc ) [inline]
```

15.6.1.17 igebb24()

```
void igebb24 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc ) [inline]
```

15.6.1.18 igebb14()

```
void igebb14 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc ) [inline]
```

15.6.1.19 igebb41()

```
void igebb41 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc ) [inline]
```

bug ,B_0 dans VEC_MADD_32 ?

bug ,B_0 dans VEC_MADD_32 ?

15.6.1.20 igebb21()

```
void igebb21 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc )  [inline]
```

15.6.1.21 igebb11()

```
void igebb11 (
            size_t i,
            size_t j,
            size_t depth,
            size_t pdeth,
            const int64_t alpha,
            const int64_t * blA,
            const int64_t * blB,
            int64_t * C,
            size_t ldc )  [inline]
```

15.6.1.22 igebp()

```
void igebp (
            size_t rows,
            size_t cols,
            size_t depth,
            const int64_t alpha,
            const int64_t * blockA,
            size_t lda,
            const int64_t * blockB,
            size_t ldb,
            int64_t * C,
            size_t ldc )
```

15.6.1.23 pack_lhs()

```
void pack_lhs (
            int64_t * XX,
            const int64_t * X,
            size_t ldx,
            size_t rows,
            size_t cols )
```

Bug this is fassign

Bug this is fassign

Bug this is fassign

Bug this is fassign

15.6.1.24 pack_rhs()

```
void pack_rhs (
            int64_t * XX,
            const int64_t * X,
            size_t ldx,
            size_t rows,
            size_t cols )
```

Bug this is fassign

Bug this is fassign

Bug this is fassign

Bug this is fassign

15.6.1.25 gebp()

```
void FFLAS::details::gebp (
            size_t rows,
            size_t cols,
            size_t depth,
            int64_t * C,
            size_t ldc,
            const int64_t * blockA,
            size_t lda,
            const int64_t * BlockB,
            size_t ldb,
            int64_t * BlockW )
```

15.6.1.26 BlockingFactor()

```
void BlockingFactor (
            size_t & m,
            size_t & n,
            size_t & k ) [inline]
```

15.7 FFLAS::details_spmv Namespace Reference

Data Structures

- struct Coo

15.8 FFLAS::ElementCategories Namespace Reference

Data Structures

- struct GenericTag
  default is generic
- struct MachineFloatTag
  float or double
- struct MachineIntTag
  short, int, long, long long, and unsigned variants
- struct FixedPrecIntTag
  Fixed precision integers above machine precision: Givaro::recInt.
- struct ArbitraryPrecIntTag
  Arbitrary precision integers: GMP.
- struct RNSElementTag
  Representation in a Residue Number System.

15.9 FFLAS::FieldCategories Namespace Reference

Traits and categories will need to be placed in a proper file later.

Data Structures

- struct GenericTag
  generic ring.
- struct ModularTag
  This is a modular field like e.g. `Modular<T>` or `ModularBalanced<T>`
- struct UnparametricTag
  If the field uses a representation with infix operators.

15.9.1 Detailed Description

Traits and categories will need to be placed in a proper file later.

15.10 FFLAS::MMHelperAlgo Namespace Reference

Data Structures

- struct Auto
- struct Classic
- struct DivideAndConquer
- struct Winograd
- struct WinogradPar
- struct Bini

15.11 FFLAS::ModeCategories Namespace Reference

Specifies the mode of action for an algorithm w.r.t.

Data Structures

- struct DefaultTag

  No specific mode of action: use standard field operations.
- struct DefaultBoundedTag

  Use standard field operations, but keeps track of bounds on input and output.
- struct ConvertTo

  Force conversion to appropriate element type of ElementCategory T.
- struct DelayedTag

  Performs field operations with delayed mod reductions. Ensures result is reduced.
- struct LazyTag

  Performs field operations with delayed mod only when necessary. Result may not be reduced.

15.11.1 Detailed Description

Specifies the mode of action for an algorithm w.r.t.

its field

15.12 FFLAS::ParSeqHelper Namespace Reference

ParSeqHelper for both fgemm and ftrsm.

Data Structures

- struct Parallel
- struct Sequential
- struct Compose

15.12.1 Detailed Description

ParSeqHelper for both fgemm and ftrsm.

ParSeqHelper for both fgemm and ftrsm

15.13 FFLAS::Protected Namespace Reference

Data Structures

- class AreEqual
- class AreEqual< X, X >
- class ftrsmLeftUpperNoTransNonUnit

  Computes the maximal size for delaying the modular reduction in a triangular system resolution.
- class ftrsmLeftUpperNoTransUnit
- class ftrsmLeftUpperTransNonUnit
- class ftrsmLeftUpperTransUnit
- class ftrsmLeftLowerNoTransNonUnit
- class ftrsmLeftLowerNoTransUnit
- class ftrsmLeftLowerTransNonUnit
- class ftrsmLeftLowerTransUnit
- class ftrsmRightUpperNoTransNonUnit
- class ftrsmRightUpperNoTransUnit
- class ftrsmRightUpperTransNonUnit
- class ftrsmRightUpperTransUnit
- class ftrsmRightLowerNoTransNonUnit
- class ftrsmRightLowerNoTransUnit
- class ftrsmRightLowerTransNonUnit
- class ftrsmRightLowerTransUnit
- class ftrmmLeftUpperNoTransNonUnit
- class ftrmmLeftUpperNoTransUnit
- class ftrmmLeftUpperTransNonUnit
- class ftrmmLeftUpperTransUnit
- class ftrmmLeftLowerNoTransNonUnit
- class ftrmmLeftLowerNoTransUnit
- class ftrmmLeftLowerTransNonUnit
- class ftrmmLeftLowerTransUnit
- class ftrmmRightUpperNoTransNonUnit
- class ftrmmRightUpperNoTransUnit
- class ftrmmRightUpperTransNonUnit
- class ftrmmRightUpperTransUnit
- class ftrmmRightLowerNoTransNonUnit
- class ftrmmRightLowerNoTransUnit
- class ftrmmRightLowerTransNonUnit
- class ftrmmRightLowerTransUnit

Functions

- template< class Field >
  double computeFactorClassic (const Field &F)
- template<> double computeFactorClassic (const Givaro::ModularBalanced< double > &F)
- template<> double computeFactorClassic (const Givaro::ModularBalanced< float > &F)
- template< class Field >
  size_t DotProdBoundClassic (const Field &F, const typename Field::Element &beta)
- template< class Field >
  size_t TRSMBound (const Field &)

  TRSMBound.
- template< class Element >
  size_t TRSMBound (const Givaro::Modular< Element > &F)

  Specialization for positive modular representation over float.
- template< class Element >
  size_t TRSMBound (const Givaro::ModularBalanced< Element > &F)

  Specialization for balanced modular representation over double.
- template< class Field >
  int WinogradThreshold (const Field &F)

  Computes the number of recursive levels to perform.
- template<> int WinogradThreshold (const Givaro::Modular< float > &F)
- template<> int WinogradThreshold (const Givaro::ModularBalanced< double > &F)
- template<> int WinogradThreshold (const Givaro::ModularBalanced< float > &F)
- template< class Field >
  int WinogradSteps (const Field &F, const size_t &m)

  Computes the number of recursive levels to perform.
- template< class Field , class FieldMode >
  void DynamicPeeling (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmin, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmax)
- template< class Field , class FieldMode >
  void DynamicPeeling2 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmin, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmax)
- template< class Field , class FieldMode >
  void WinogradCalc (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H)
- template< class NewField , class Field , class FieldMode >
  Field::Element_ptr fgemm_convert (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H)

- template<class Field , class Element , class AlgoT , class ParSeqTrait >
bool NeedPreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
bool NeedPreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ParSeqTrait >
bool NeedPreSubReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
bool NeedPreSubReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ParSeqTrait >
bool NeedDoublePreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, Element beta, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
bool NeedDoublePreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, Element beta, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class Field , class AlgoT , class ParSeqTrait >
void ScalAndReduce (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr X, const size_t incX, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field , class AlgoT , class ParSeqTrait >
void ScalAndReduce (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field >
Field::Element_ptr fsquareCommon (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)
- template<typename FloatElement , class Field >
Field::Element_ptr fgemv_convert (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)
- template<class FloatElement , class Field >
void fger_convert (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda)
- template<class NewField , class Field , class FieldMode >
Field::Element_ptr fsyrk_convert (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, FieldMode > &H)
- template<class Field , class AlgoT , class ParSeqTrait >
void ScalAndReduce (const Field &F, const FFLAS_UPLO UpLo, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field , class Element , class AlgoT , class ParSeqTrait >
bool NeedPreScalReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, const Element &x, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
bool NeedPreScalReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, const Element &x, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)

- template<class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedPreAxpyReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, const Element &x, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedPreAxpyReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, const Element &x, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class DFE >
  size_t min_types (const DFE &k)
- template<> size_t min_types (const RecInt::rint< 6 > &k)
- template<> size_t min_types (const RecInt::rint< 7 > &k)
- template<> size_t min_types (const RecInt::rint< 8 > &k)
- template<> size_t min_types (const RecInt::rint< 9 > &k)
- template<> size_t min_types (const RecInt::rint< 10 > &k)
- template<> size_t min_types (const Givaro::Integer &k)
- template<class T >
  bool unfit (T x)
- template<> bool unfit (int64_t x)
- template<size_t K>
  bool unfit (RecInt::rint< K > x)
- template<> bool unfit (RecInt::rint< 6 > x)
- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, int64_t *C, size_t ldc)
- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB, enum number_kind alpha_kind>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, int64_t *C, size_t ldc)
- void igemm (const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, const int64_t beta, int64_t *C, size_t ldc)
- template<class Field >
  void MatF2MatD_Triangular (const Field &F, Givaro::DoubleDomain::Element_ptr S, const size_t lds, typename Field::ConstElement_ptr const E, const size_t lde, const size_t m, const size_t n)
- template<class Field >
  void MatF2MatFl_Triangular (const Field &F, Givaro::FloatDomain::Element_ptr S, const size_t lds, typename Field::ConstElement_ptr const E, const size_t lde, const size_t m, const size_t n)

15.13.1 Function Documentation

15.13.1.1 computeFactorClassic() [1/3]

```
double FFLAS::Protected::computeFactorClassic (
            const Field & F )   [inline]
```

15.13.1.2 computeFactorClassic() [2/3]

```
double FFLAS::Protected::computeFactorClassic (
            const Givaro::ModularBalanced< double > & F )   [inline]
```

15.13.1.3 computeFactorClassic() [3/3]

```
double FFLAS::Protected::computeFactorClassic (
            const Givaro::ModularBalanced< float > & F )  [inline]
```

15.13.1.4 DotProdBoundClassic()

```
size_t FFLAS::Protected::DotProdBoundClassic (
            const Field & F,
            const typename Field::Element & beta )  [inline]
```

15.13.1.5 TRSMBound() [1/3]

```
size_t FFLAS::Protected::TRSMBound (
            const Field & )  [inline]
```

TRSMBound.

computes the maximal size for delaying the modular reduction in a triangular system resolution

This is the default version over an arbitrary field. It is currently never used (the recursive algorithm is run until n=1 in this case)

Parameters

F	Finite Field/Ring of the computation

15.13.1.6 TRSMBound() [2/3]

```
size_t FFLAS::Protected::TRSMBound (
            const Givaro::Modular< Element > & F )  [inline]
```

Specialization for positive modular representation over float.

Computes nmax s.t. (p-1)/2∗(p^{nmax-1} + (p-2)^{nmax-1}) < 2^24 @pbi See [Dumas Giorgi Pernet 06, arXiv:cs/0601133]

15.13.1.7 TRSMBound() [3/3]

```
size_t FFLAS::Protected::TRSMBound (
            const Givaro::ModularBalanced< Element > & F )  [inline]
```

Specialization for balanced modular representation over double.

Computes nmax s.t. (p-1)/2∗(((p+1)/2)^{nmax-1}) < 2^53

Bibliography

- Dumas Giorgi Pernet 06, arXiv:cs/0601133

15.13.1.8 WinogradThreshold() [1/4]

```
int FFLAS::Protected::WinogradThreshold (
            const Field & F ) [inline]
```

Computes the number of recursive levels to perform.

Parameters

m	the common dimension in the product AxB

15.13.1.9 WinogradThreshold() [2/4]

```
int FFLAS::Protected::WinogradThreshold (
            const Givaro::Modular< float > & F ) [inline]
```

15.13.1.10 WinogradThreshold() [3/4]

```
int FFLAS::Protected::WinogradThreshold (
            const Givaro::ModularBalanced< double > & F ) [inline]
```

15.13.1.11 WinogradThreshold() [4/4]

```
int FFLAS::Protected::WinogradThreshold (
            const Givaro::ModularBalanced< float > & F ) [inline]
```

15.13.1.12 WinogradSteps()

```
int FFLAS::Protected::WinogradSteps (
            const Field & F,
            const size_t & m ) [inline]
```

Computes the number of recursive levels to perform.

Parameters

m	the common dimension in the product AxB

15.13.1.13 DynamicPeeling()

```
void FFLAS::Protected::DynamicPeeling (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > & H,
            const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::Delayed↩
Field::Element Cmin,
            const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::Delayed↩
Field::Element Cmax )  [inline]
```

15.13.1.14 DynamicPeeling2()

```
void FFLAS::Protected::DynamicPeeling2 (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > & H,
            const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::Delayed↩
Field::Element Cmin,
            const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::Delayed↩
Field::Element Cmax )  [inline]
```

15.13.1.15 WinogradCalc()

```
void FFLAS::Protected::WinogradCalc (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t mr,
            const size_t nr,
            const size_t kr,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > & H )  [inline]
```

15.13.1.16 fgemm_convert()

```
Field::Element_ptr FFLAS::Protected::fgemm_convert (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const FFLAS_TRANSPOSE tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > & H )  [inline]
```

15.13.1.17 NeedPreAddReduction() [1/2]

```
bool FFLAS::Protected::NeedPreAddReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & WH )  [inline]
```

15.13.1.18 NeedPreAddReduction() [2/2]

```
bool FFLAS::Protected::NeedPreAddReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            MMHelper< Field, AlgoT, ModeT, ParSeqTrait > & WH )  [inline]
```

15.13.1.19 NeedPreSubReduction() [1/2]

```
bool FFLAS::Protected::NeedPreSubReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & WH )  [inline]
```

15.13.1.20 NeedPreSubReduction() [2/2]

```
bool FFLAS::Protected::NeedPreSubReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            MMHelper< Field, AlgoT, ModeT, ParSeqTrait > & WH )  [inline]
```

15.13.1.21 NeedDoublePreAddReduction() [1/2]

```
bool FFLAS::Protected::NeedDoublePreAddReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            Element beta,
            MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & WH )  [inline]
```

15.13.1.22 NeedDoublePreAddReduction() [2/2]

```
bool FFLAS::Protected::NeedDoublePreAddReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            Element beta,
            MMHelper< Field, AlgoT, ModeT, ParSeqTrait > & WH ) [inline]
```

15.13.1.23 ScalAndReduce() [1/3]

```
void FFLAS::Protected::ScalAndReduce (
            const Field & F,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr X,
            const size_t incX,
            const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & H ) [inline]
```

15.13.1.24 ScalAndReduce() [2/3]

```
void FFLAS::Protected::ScalAndReduce (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & H ) [inline]
```

15.13.1.25 fsquareCommon()

```
Field::Element_ptr FFLAS::Protected::fsquareCommon (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t n,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc ) [inline]
```

15.13.1.26 fgemv_convert()

```
Field::Element_ptr FFLAS::Protected::fgemv_convert (
            const Field & F,
            const FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            const typename Field::Element beta,
            typename Field::Element_ptr Y,
            const size_t incY )  [inline]
```

15.13.1.27 fger_convert()

```
void FFLAS::Protected::fger_convert (
            const Field & F,
            const size_t M,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr x,
            const size_t incx,
            typename Field::ConstElement_ptr y,
            const size_t incy,
            typename Field::Element_ptr A,
            const size_t lda )  [inline]
```

15.13.1.28 fsyrk_convert()

```
Field::Element_ptr FFLAS::Protected::fsyrk_convert (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const FFLAS_TRANSPOSE trans,
            const size_t N,
            const size_t K,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc,
            MMHelper< Field, MMHelperAlgo::Classic, FieldMode > & H )  [inline]
```

15.13.1.29 ScalAndReduce() [3/3]

```
void FFLAS::Protected::ScalAndReduce (
            const Field & F,
            const FFLAS_UPLO UpLo,
            const size_t N,
            const typename Field::Element alpha,
            typename Field::Element_ptr A,
            const size_t lda,
            const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & H )  [inline]
```

15.13.1.30 NeedPreScalReduction() [1/2]

```
bool FFLAS::Protected::NeedPreScalReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            const Element & x,
            MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & WH )  [inline]
```

15.13.1.31 NeedPreScalReduction() [2/2]

```
bool FFLAS::Protected::NeedPreScalReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            const Element & x,
            MMHelper< Field, AlgoT, ModeT, ParSeqTrait > & WH )  [inline]
```

15.13.1.32 NeedPreAxpyReduction() [1/2]

```
bool FFLAS::Protected::NeedPreAxpyReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            const Element & x,
            MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > & WH )  [inline]
```

15.13.1.33 NeedPreAxpyReduction() [2/2]

```
bool FFLAS::Protected::NeedPreAxpyReduction (
            Element & Outmin,
            Element & Outmax,
            Element & Op1min,
            Element & Op1max,
            Element & Op2min,
            Element & Op2max,
            const Element & x,
            MMHelper< Field, AlgoT, ModeT, ParSeqTrait > & WH )  [inline]
```

15.13.1.34 min_types() [1/7]

```
size_t FFLAS::Protected::min_types (
            const DFE & k )  [inline]
```

15.13.1.35 min_types() [2/7]

```
size_t FFLAS::Protected::min_types (
            const RecInt::rint< 6 > & k )  [inline]
```

15.13.1.36 min_types() [3/7]

```
size_t FFLAS::Protected::min_types (
            const RecInt::rint< 7 > & k )  [inline]
```

15.13.1.37 min_types() [4/7]

```
size_t FFLAS::Protected::min_types (
            const RecInt::rint< 8 > & k )  [inline]
```

15.13.1.38 min_types() [5/7]

```
size_t FFLAS::Protected::min_types (
            const RecInt::rint< 9 > & k )  [inline]
```

15.13.1.39 min_types() [6/7]

```
size_t FFLAS::Protected::min_types (
            const RecInt::rint< 10 > & k )  [inline]
```

15.13.1.40 min_types() [7/7]

```
size_t FFLAS::Protected::min_types (
            const Givaro::Integer & k )  [inline]
```

15.13.1.41 unfit() [1/4]

```
bool FFLAS::Protected::unfit (
            T x )  [inline]
```

15.13.1.42 unfit() [2/4]

```
bool FFLAS::Protected::unfit (
            int64_t x )  [inline]
```

15.13.1.43 unfit() [3/4]

```
bool FFLAS::Protected::unfit (
            RecInt::rint< K > x )  [inline]
```

15.13.1.44 unfit() [4/4]

```
bool FFLAS::Protected::unfit (
            RecInt::rint< 6 > x )  [inline]
```

15.13.1.45 igemm_colmajor() [1/2]

```
void igemm_colmajor (
            size_t rows,
            size_t cols,
            size_t depth,
            const int64_t alpha,
            const int64_t * A,
            size_t lda,
            const int64_t * B,
            size_t ldb,
            int64_t * C,
            size_t ldc )
```

15.13.1.46 igemm_colmajor() [2/2]

```
void igemm_colmajor (
            size_t rows,
            size_t cols,
            size_t depth,
            const int64_t alpha,
            const int64_t * A,
            size_t lda,
            const int64_t * B,
            size_t ldb,
            int64_t * C,
            size_t ldc )
```

15.13.1.47 igemm()

```
void igemm (
            const enum FFLAS_TRANSPOSE TransA,
            const enum FFLAS_TRANSPOSE TransB,
            size_t rows,
            size_t cols,
            size_t depth,
            const int64_t alpha,
            const int64_t * A,
            size_t lda,
            const int64_t * B,
            size_t ldb,
            const int64_t beta,
            int64_t * C,
            size_t ldc )  [inline]
```

Todo use primitive (no Field()) and specialise for int64.

Todo use primitive (no Field()) and specialise for int64.

15.13.1.48 MatF2MatD_Triangular()

```
void FFLAS::Protected::MatF2MatD_Triangular (
            const Field & F,
            Givaro::DoubleDomain::Element_ptr S,
            const size_t lds,
            typename Field::ConstElement_ptr const E,
            const size_t lde,
            const size_t m,
            const size_t n )
```

15.13.1.49 MatF2MatFl_Triangular()

```
void FFLAS::Protected::MatF2MatFl_Triangular (
            const Field & F,
            Givaro::FloatDomain::Element_ptr S,
            const size_t lds,
            typename Field::ConstElement_ptr const E,
            const size_t lde,
            const size_t m,
            const size_t n )
```

Todo do finit(...,FFLAS_TRANS,FFLAS_DIAG)

do fconvert(...,FFLAS_TRANS,FFLAS_DIAG)

15.14 FFLAS::sell_details Namespace Reference

Data Structures

- struct Info
- struct Coo

15.15 FFLAS::sparse_details Namespace Reference

Functions

- template< class Field >
  void init_y (const Field &F, const size_t m, const typename Field::Element b, typename Field::Element_ptr y)
- template< class Field >
  void init_y (const Field &F, const size_t m, const size_t n, const typename Field::Element b, typename Field::Element_ptr y, const int ldy)
- template< class Field , class SM , class FC , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFlo >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)

- template< class Field , class SM , class FC , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloa >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)
- template< class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, ZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template< class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::true_type)
- template< class Field , class SM , class FCat , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFlo >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template< class Field , class SM , class FCat , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloa >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template< class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM

&A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)

- template< class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, ZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template< class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, ZOSparseMatrix)
- template< class Field , class SM , class FCat , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFlo >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type pfspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template< class Field , class SM , class FCat , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloa >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type pfspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template< class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, ZOSparseMatrix)

- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, ZOSparseMatrix)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, std::true_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, std::true_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::true_type)
- template<class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)

15.15.1 Function Documentation

15.15.1.1 init_y() [1/2]

```
void FFLAS::sparse_details::init_y (
            const Field & F,
            const size_t m,
            const typename Field::Element b,
            typename Field::Element_ptr y )  [inline]
```

15.15.1.2 init_y() [2/2]

```
void FFLAS::sparse_details::init_y (
            const Field & F,
            const size_t m,
            const size_t n,
            const typename Field::Element b,
            typename Field::Element_ptr y,
            const int ldy ) [inline]
```

15.15.1.3 fspmv_dispatch() [1/2]

```
std::enable_if< !(std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Ma
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value)>::type FFLAS::sparse_details::fspmv_dispatch (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FC fc,
            MZO mzo ) [inline]
```

15.15.1.4 fspmv_dispatch() [2/2]

```
std::enable_if< std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Mach
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value>::type FFLAS::sparse_details::fspmv_dispatch (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FC fc,
            MZO mzo ) [inline]
```

15.15.1.5 fspmv() [1/12]

```
void FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ,
            NotZOSparseMatrix ) [inline]
```

15.15.1.6 fspmv() [2/12]

```
std::enable_if<!isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details↩
::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.7 fspmv() [3/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details::fspmv
(
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.8 fspmv() [4/12]

```
std::enable_if<!isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details↩
::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.9 fspmv() [5/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details::fspmv
(
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.10 fspmv() [6/12]

```
void FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.11 fspmv() [7/12]

```
std::enable_if<!isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details↩
::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.12 fspmv() [8/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value>::type FFLAS::sparse_details::fspmv
(
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.13 fspmv() [9/12]

```
void FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            std::true_type ) [inline]
```

15.15.1.14 fspmm_dispatch() [1/2]

```
std::enable_if< !(std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Ma
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value)>::type FFLAS::sparse_details::fspmm_dispatch (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FCat ,
            MZO ) [inline]
```

15.15.1.15 fspmm_dispatch() [2/2]

```
std::enable_if< std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Mach
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value>::type FFLAS::sparse_details::fspmm_dispatch (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FCat ,
            MZO ) [inline]
```

15.15.1.16 fspmm() [1/9]

```
void FFLAS::sparse_details::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ,
            NotZOSparseMatrix ) [inline]
```

15.15.1.17 fspmm() [2/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.18 fspmm() [3/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.19 fspmm() [4/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.20 fspmm() [5/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.21 fspmm() [6/9]

```
void FFLAS::sparse_details::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ,
            ZOSparseMatrix  )  [inline]
```

15.15.1.22 fspmm() [7/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix  )  [inline]
```

15.15.1.23 fspmm() [8/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.24 fspmm() [9/9]

```
void FFLAS::sparse_details::fspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.25 pfspmm_dispatch() [1/2]

```
std::enable_if< !(std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Ma
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value)>::type FFLAS::sparse_details::pfspmm_dispatch (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FCat ,
            MZO ) [inline]
```

15.15.1.26 pfspmm_dispatch() [2/2]

```
std::enable_if< std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::Mach
::value || std::is_same<typename ElementTraits<typename Field::Element>::value, ElementCategories::MachineIntT
::value>::type FFLAS::sparse_details::pfspmm_dispatch (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FCat ,
            MZO  )  [inline]
```

15.15.1.27 pfspmm() [1/9]

```
void FFLAS::sparse_details::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.28 pfspmm() [2/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.29 pfspmm() [3/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.30 pfspmm() [4/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.31 pfspmm() [5/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix  )  [inline]
```

15.15.1.32 pfspmm() [6/9]

```
void FFLAS::sparse_details::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.33 pfspmm() [7/9]

```
std::enable_if<support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.34 pfspmm() [8/9]

```
std::enable_if<!support_simd<typename Field::Element>::value>::type FFLAS::sparse_details↩
::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.35 pfspmm() [9/9]

```
void FFLAS::sparse_details::pfspmm (
            const Field & F,
            const SM & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::ModularTag ,
            ZOSparseMatrix ) [inline]
```

15.15.1.36 pfspmv() [1/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ,
            std::false_type ) [inline]
```

15.15.1.37 pfspmv() [2/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            std::false_type ) [inline]
```

15.15.1.38 pfspmv() [3/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            std::false_type ) [inline]
```

15.15.1.39 pfspmv() [4/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ,
            std::true_type ) [inline]
```

15.15.1.40 pfspmv() [5/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            std::true_type ) [inline]
```

15.15.1.41 pfspmv() [6/6]

```
void FFLAS::sparse_details::pfspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            std::true_type ) [inline]
```

15.15.1.42 fspmv() [10/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value && support_simd<typename Field::Element>↩
::value >::type FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            NotZOSparseMatrix ) [inline]
```

15.15.1.43 fspmv() [11/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value && support_simd<typename Field::Element>↩
::value >::type FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::ModularTag ,
            NotZOSparseMatrix ) [inline]
```

15.15.1.44 fspmv() [12/12]

```
std::enable_if<isSparseMatrixSimdFormat<Field, SM>::value && support_simd<typename Field::Element>↩
::value >::type FFLAS::sparse_details::fspmv (
            const Field & F,
            const SM & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ,
            ZOSparseMatrix ) [inline]
```

15.16 FFLAS::sparse_details_impl Namespace Reference

Functions

- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void fspmm_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t block↩Size, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void fspmm_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)

- template< class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmm_mone_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmm_mone_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template< class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template< class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
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- template< class Field >
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- template<class Field >
  void pfspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_task (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const index_t iStart, const index_t iStop, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
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- template<class Field >
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- template<class Field >
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- template<class Field >
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- template<class Field >
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- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, index_t blockSize, typename Field::ConstElement_ptr x_, index_t ldx, typename Field::Element_ptr y_, index_t ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A,

size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)

- template<class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
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- template<class Field >
  void fspmm_mone_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
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- template<class Field >
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- template<class Field >
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- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, const int64_t kmax)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
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- template<class Field >
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- template<class Field >
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- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
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- template<class Field >
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- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
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- template<class Field >
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- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, const int64_t kmax)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, const int64_t kmax)
- template<class Field , class Func >
  void pfspmm_zo (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, Func &&func)
- template<class Field , class Func >
  void pfspmm_zo (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, Func &&func)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)

- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
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  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
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- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
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- template<class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
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- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)

- template<class Field >
void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
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- template<class Field >
void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
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- template<class Field >
void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
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- template<class Field >
void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)

- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
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- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_one_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, uint64_t kmax)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, uint64_t kmax)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, uint64_t kmax)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, uint64_t kmax)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

15.16.1 Function Documentation

15.16.1.1 fspmm() [1/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.2 fspmm() [2/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.3 fspmm() [3/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.4 fspmm_simd_aligned() [1/2]

```
void FFLAS::sparse_details_impl::fspmm_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.5 fspmm_simd_unaligned() [1/2]

```
void FFLAS::sparse_details_impl::fspmm_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax )  [inline]
```

15.16.1.6 fspmm_one() [1/4]

```
void FFLAS::sparse_details_impl::fspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag )  [inline]
```

15.16.1.7 fspmm_mone() [1/4]

```
void FFLAS::sparse_details_impl::fspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag )  [inline]
```

15.16.1.8 fspmm_one_simd_aligned() [1/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag )  [inline]
```

15.16.1.9 fspmm_one_simd_unaligned() [1/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.10 fspmm_mone_simd_aligned() [1/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.11 fspmm_mone_simd_unaligned() [1/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.12 fspmv() [1/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.13 fspmv() [2/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.14 fspmv() [3/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.15 fspmv_one() [1/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.16 fspmv_mone() [1/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.17 fspmv_one() [2/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.18 fspmv_mone() [2/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::COO_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.19 pfspmm() [1/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.20 pfspmm() [2/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.21 pfspmm() [3/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.22 pfspmm_one() [1/2]

```
void FFLAS::sparse_details_impl::pfspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.23 pfspmm_mone() [1/2]

```
void FFLAS::sparse_details_impl::pfspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.24 pfspmm_one() [2/2]

```
void FFLAS::sparse_details_impl::pfspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.25 pfspmm_mone() [2/2]

```
void FFLAS::sparse_details_impl::pfspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.26 pfspmv() [1/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.27 pfspmv_task()

```
void FFLAS::sparse_details_impl::pfspmv_task (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const index_t iStart,
            const index_t iStop,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.28 pfspmv() [2/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.29 pfspmv() [3/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const int64_t kmax ) [inline]
```

15.16.1.30 pfspmv_one() [1/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.31 pfspmv_mone() [1/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.32 pfspmv_one() [2/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.33 pfspmv_mone() [2/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.34 fspmm() [4/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.35 fspmm() [5/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            index_t blockSize,
            typename Field::ConstElement_ptr x_,
            index_t ldx,
            typename Field::Element_ptr y_,
            index_t ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.36 fspmm_simd_aligned() [2/2]

```
void FFLAS::sparse_details_impl::fspmm_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.37 fspmm_simd_unaligned() [2/2]

```
void FFLAS::sparse_details_impl::fspmm_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.38 fspmm() [6/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.39 fspmm_one() [2/4]

```
void FFLAS::sparse_details_impl::fspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.40 fspmm_mone() [2/4]

```
void FFLAS::sparse_details_impl::fspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.41 fspmm_one_simd_aligned() [2/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.42 fspmm_one_simd_unaligned() [2/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.43 fspmm_mone_simd_aligned() [2/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.44 fspmm_mone_simd_unaligned() [2/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.45 fspmv() [4/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.46 fspmv() [5/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.47 fspmv() [6/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const int64_t kmax ) [inline]
```

15.16.1.48 fspmv_one() [3/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.49 fspmv_mone() [3/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.50 fspmv_one() [4/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.51 fspmv_mone() [4/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.52 pfspmm() [4/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.53 pfspmm() [5/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.54 pfspmm() [6/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.55 pfspmm() [7/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.56 pfspmm() [8/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            const int64_t kmax )  [inline]
```

15.16.1.57 pfspmm() [9/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            const int64_t kmax )  [inline]
```

15.16.1.58 pfspmv() [4/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag )  [inline]
```

15.16.1.59 pfspmv() [5/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag )  [inline]
```

15.16.1.60 pfspmv() [6/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const int64_t kmax )  [inline]
```

15.16.1.61 fspmm() [7/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag  )  [inline]
```

15.16.1.62 fspmm() [8/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag  )  [inline]
```

15.16.1.63 fspmm() [9/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax )  [inline]
```

15.16.1.64 fspmv() [7/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.65 fspmv() [8/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.66 fspmv() [9/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::CSR_HYB > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.67 pfspmm() [10/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.68 pfspmm() [11/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.69 pfspmm() [12/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.70 pfspmm() [13/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.71 pfspmm() [14/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            const int64_t kmax ) [inline]
```

15.16.1.72 pfspmm() [15/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.73 pfspmm_zo() [1/2]

```
void FFLAS::sparse_details_impl::pfspmm_zo (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            Func && func ) [inline]
```

15.16.1.74 pfspmm_zo() [2/2]

```
void FFLAS::sparse_details_impl::pfspmm_zo (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            Func && func ) [inline]
```

15.16.1.75 pfspmv() [7/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.76 pfspmv() [8/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.77 pfspmv() [9/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const int64_t kmax )  [inline]
```

15.16.1.78 pfspmv_one() [3/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag  )  [inline]
```

15.16.1.79 pfspmv_mone() [3/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag  )  [inline]
```

15.16.1.80 pfspmv_one() [4/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag  )  [inline]
```

15.16.1.81 pfspmv_mone() [4/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag  )  [inline]
```

15.16.1.82 fspmm() [10/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.83 fspmm() [11/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.84 fspmm() [12/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            const int64_t kmax ) [inline]
```

15.16.1.85 fspmm_mone() [3/4]

```
void FFLAS::sparse_details_impl::fspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.86 fspmm_one() [3/4]

```
void FFLAS::sparse_details_impl::fspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.87 fspmm_mone() [4/4]

```
void FFLAS::sparse_details_impl::fspmm_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.88 fspmm_one() [4/4]

```
void FFLAS::sparse_details_impl::fspmm_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.89 fspmm_one_simd_aligned() [3/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.90 fspmm_one_simd_unaligned() [3/3]

```
void FFLAS::sparse_details_impl::fspmm_one_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.91 fspmm_mone_simd_aligned() [3/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_aligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.92 fspmm_mone_simd_unaligned() [3/3]

```
void FFLAS::sparse_details_impl::fspmm_mone_simd_unaligned (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x_,
            int ldx,
            typename Field::Element_ptr y_,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.93 fspmv() [10/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.94 fspmv() [11/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.95 fspmv() [12/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.96 fspmv_one() [5/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.97 fspmv_mone() [5/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.98 fspmv_one() [6/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.99 fspmv_mone() [6/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.100 pfspmv() [10/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.101 pfspmv() [11/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.102 pfspmv() [12/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.103 pfspmv_one() [5/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.104 pfspmv_mone() [5/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.105 pfspmv_one() [6/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.106 pfspmv_mone() [6/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.107 fspmv() [13/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.108 fspmv_simd() [1/4]

```
void FFLAS::sparse_details_impl::fspmv_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.109 fspmv() [14/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.110 fspmv_simd() [2/4]

```
void FFLAS::sparse_details_impl::fspmv_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.111 fspmv() [15/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.112 fspmv_one() [7/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.113 fspmv_mone() [7/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.114 fspmv_one() [8/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.115 fspmv_mone() [8/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.116 fspmv_one_simd() [1/2]

```
void FFLAS::sparse_details_impl::fspmv_one_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.117 fspmv_mone_simd() [1/2]

```
void FFLAS::sparse_details_impl::fspmv_mone_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.118 pfspmm() [16/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.119 pfspmm() [17/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.120 pfspmm() [18/18]

```
void FFLAS::sparse_details_impl::pfspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            uint64_t kmax ) [inline]
```

15.16.1.121 pfspmv() [13/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.122 pfspmv() [14/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.123 pfspmv() [15/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            uint64_t kmax )  [inline]
```

15.16.1.124 fspmm() [13/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::GenericTag  )  [inline]
```

15.16.1.125 fspmm() [14/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            FieldCategories::UnparametricTag  )  [inline]
```

15.16.1.126 fspmm() [15/15]

```
void FFLAS::sparse_details_impl::fspmm (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            size_t blockSize,
            typename Field::ConstElement_ptr x,
            int ldx,
            typename Field::Element_ptr y,
            int ldy,
            uint64_t kmax )  [inline]
```

15.16.1.127 fspmv() [16/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.128 fspmv() [17/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.129 fspmv() [18/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::HYB_ZO > & A,
            typename Field::ConstElement_ptr x,
            typename Field::Element_ptr y,
            uint64_t kmax ) [inline]
```

15.16.1.130 pfspmv() [16/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.131 pfspmv() [17/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.132 pfspmv() [18/18]

```
void FFLAS::sparse_details_impl::pfspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const int64_t kmax ) [inline]
```

15.16.1.133 pfspmv_one() [7/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.134 pfspmv_mone() [7/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.135 pfspmv_one() [8/8]

```
void FFLAS::sparse_details_impl::pfspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.136 pfspmv_mone() [8/8]

```
void FFLAS::sparse_details_impl::pfspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.137 fspmv() [19/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.138 fspmv_simd() [3/4]

```
void FFLAS::sparse_details_impl::fspmv_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.139 fspmv() [20/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.140 fspmv_simd() [4/4]

```
void FFLAS::sparse_details_impl::fspmv_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.141 fspmv() [21/21]

```
void FFLAS::sparse_details_impl::fspmv (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            const uint64_t kmax ) [inline]
```

15.16.1.142 fspmv_one() [9/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.143 fspmv_mone() [9/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::GenericTag ) [inline]
```

15.16.1.144 fspmv_one_simd() [2/2]

```
void FFLAS::sparse_details_impl::fspmv_one_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.145 fspmv_mone_simd() [2/2]

```
void FFLAS::sparse_details_impl::fspmv_mone_simd (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.146 fspmv_one() [10/10]

```
void FFLAS::sparse_details_impl::fspmv_one (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.16.1.147 fspmv_mone() [10/10]

```
void FFLAS::sparse_details_impl::fspmv_mone (
            const Field & F,
            const Sparse< Field, SparseMatrix_t::SELL_ZO > & A,
            typename Field::ConstElement_ptr x_,
            typename Field::Element_ptr y_,
            FieldCategories::UnparametricTag ) [inline]
```

15.17 FFLAS::StrategyParameter Namespace Reference

Data Structures

- struct Fixed
- struct Threads
- struct Grain
- struct TwoD
- struct TwoDAdaptive
- struct ThreeD
- struct ThreeDInPlace
- struct ThreeDAdaptive

15.18 FFLAS::StructureHelper Namespace Reference

StructureHelper for ftrsm.

Data Structures

- struct Recursive
- struct Iterative
- struct Hybrid

15.18.1 Detailed Description

StructureHelper for ftrsm.

15.19 FFLAS::vectorised Namespace Reference

Namespaces

- unswitch

Data Structures

- struct HelperMod
- struct HelperMod< Field, ElementCategories::MachineIntTag >
- struct HelperMod< Field, FFLAS::ElementCategories::MachineFloatTag >
- struct HelperMod< Field, FFLAS::ElementCategories::ArbitraryPrecIntTag >
- struct HelperMod< Field, FFLAS::ElementCategories::FixedPrecIntTag >

Functions

- template<class SimdT , class Element , bool positive>
  std::enable_if< is_simd< SimdT >::value, void >::type VEC_ADD (SimdT &C, SimdT &A, SimdT &B, SimdT &Q, SimdT &T, SimdT &P, SimdT &NEGP, SimdT &MIN, SimdT &MAX)
- template<bool positive, class Element , class T1 , class T2 >
  std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type addp (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n, Element p, T1 min_, T2 max_)
- template<class SimdT , class Element , bool positive>
  std::enable_if< is_simd< SimdT >::value, void >::type VEC_SUB (SimdT &C, SimdT &A, SimdT &B, SimdT &Q, SimdT &T, SimdT &P, SimdT &NEGP, SimdT &MIN, SimdT &MAX)
- template<bool positive, class Element , class T1 , class T2 >
  std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type subp (Element ∗T, const Element ∗TA, const Element ∗TB, const size_t n, const Element p, const T1 min_, const T2 max_)
- template<class Element >
  std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type add (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n)
- template<class Element >
  std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type sub (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, const size_t incX, const size_t incY)
- template<class T >
  std::enable_if< ! std::is_integral< T >::value, T >::type reduce (T A, T B)
- template<class T >
  std::enable_if< std::is_integral< T >::value, T >::type reduce (T A, T B)
- template<> Givaro::Integer reduce (Givaro::Integer A, Givaro::Integer B)
- float reduce (float A, float B, float invB, float min, float max)
- double reduce (double A, double B, double invB, double min, double max)
- int64_t reduce (int64_t A, int64_t p, double invp, double min, double max, int64_t pow50rem)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::MachineIntTag > &H)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::MachineFloatTag > &H)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::ArbitraryPrecIntTag > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, typename Field::Element_ptr T)

- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, const size_t &incX, typename Field::Element_ptr T)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, const size_t &incY)

15.19.1 Function Documentation

15.19.1.1 VEC_ADD()

```
std::enable_if<is_simd<SimdT>::value, void>::type FFLAS::vectorised::VEC_ADD (
            SimdT & C,
            SimdT & A,
            SimdT & B,
            SimdT & Q,
            SimdT & T,
            SimdT & P,
            SimdT & NEGP,
            SimdT & MIN,
            SimdT & MAX )  [inline]
```

15.19.1.2 addp()

```
std::enable_if<FFLAS::support_simd_add<Element>::value, void>::type FFLAS::vectorised::addp (
            Element * T,
            const Element * TA,
            const Element * TB,
            size_t n,
            Element p,
            T1 min_,
            T2 max_ )  [inline]
```

15.19.1.3 VEC_SUB()

```
std::enable_if<is_simd<SimdT>::value, void>::type FFLAS::vectorised::VEC_SUB (
            SimdT & C,
            SimdT & A,
            SimdT & B,
            SimdT & Q,
            SimdT & T,
            SimdT & P,
            SimdT & NEGP,
            SimdT & MIN,
            SimdT & MAX )  [inline]
```

15.19.1.4 subp()

```
std::enable_if<FFLAS::support_simd_add<Element>::value, void>::type FFLAS::vectorised::subp (
            Element * T,
            const Element * TA,
            const Element * TB,
            const size_t n,
            const Element p,
            const T1 min_,
            const T2 max_ )  [inline]
```

15.19.1.5 add()

```
std::enable_if<FFLAS::support_simd_add<Element>::value, void>::type FFLAS::vectorised::add (
            Element * T,
            const Element * TA,
            const Element * TB,
            size_t n )  [inline]
```

15.19.1.6 sub()

```
std::enable_if<FFLAS::support_simd_add<Element>::value, void>::type FFLAS::vectorised::sub (
            Element * T,
            const Element * TA,
            const Element * TB,
            size_t n )  [inline]
```

15.19.1.7 axpyp() [1/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::axpyp (
            const Field & F,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            typename Field::Element_ptr Y,
            const size_t n ) [inline]
```

15.19.1.8 axpyp() [2/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::axpyp (
            const Field & F,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            typename Field::Element_ptr Y,
            const size_t n,
            const size_t incX,
            const size_t incY ) [inline]
```

15.19.1.9 reduce() [1/9]

```
std::enable_if< ! std::is_integral<T>::value, T>::type FFLAS::vectorised::reduce (
            T A,
            T B ) [inline]
```

15.19.1.10 reduce() [2/9]

```
std::enable_if< std::is_integral<T>::value, T>::type FFLAS::vectorised::reduce (
            T A,
            T B ) [inline]
```

15.19.1.11 reduce() [3/9]

```
Givaro::Integer FFLAS::vectorised::reduce (
            Givaro::Integer A,
            Givaro::Integer B ) [inline]
```

15.19.1.12 reduce() [4/9]

```
float FFLAS::vectorised::reduce (
             float A,
             float B,
             float invB,
             float min,
             float max )  [inline]
```

15.19.1.13 reduce() [5/9]

```
double FFLAS::vectorised::reduce (
             double A,
             double B,
             double invB,
             double min,
             double max )  [inline]
```

15.19.1.14 reduce() [6/9]

```
int64_t FFLAS::vectorised::reduce (
             int64_t A,
             int64_t p,
             double invp,
             double min,
             double max,
             int64_t pow50rem )  [inline]
```

15.19.1.15 reduce() [7/9]

```
Field::Element FFLAS::vectorised::reduce (
             typename Field::Element A,
             HelperMod< Field, ElementCategories::MachineIntTag > & H )  [inline]
```

15.19.1.16 reduce() [8/9]

```
Field::Element FFLAS::vectorised::reduce (
             typename Field::Element A,
             HelperMod< Field, ElementCategories::MachineFloatTag > & H )  [inline]
```

15.19.1.17 reduce() [9/9]

```
Field::Element FFLAS::vectorised::reduce (
            typename Field::Element A,
            HelperMod< Field, ElementCategories::ArbitraryPrecIntTag > & H )  [inline]
```

15.19.1.18 modp() [1/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::modp (
            const Field & F,
            typename Field::ConstElement_ptr U,
            const size_t & n,
            typename Field::Element_ptr T )  [inline]
```

15.19.1.19 modp() [2/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::modp (
            const Field & F,
            typename Field::ConstElement_ptr U,
            const size_t & n,
            const size_t & incX,
            typename Field::Element_ptr T )  [inline]
```

15.19.1.20 scalp() [1/3]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n )  [inline]
```

15.19.1.21 scalp() [2/3]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n,
            const size_t & incX )  [inline]
```

15.19.1.22 scalp() [3/3]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↵
::vectorised::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n,
            const size_t & incX,
            const size_t & incY )  [inline]
```

15.20 FFLAS::vectorised::unswitch Namespace Reference

Functions

- template<class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, const size_t incX, const size_t incY, HelperMod< Field > &H)
- template<class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, typename Field::Element_ptr T, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, const size_t &incX, typename Field::Element_ptr T, HelperMod< Field > &H)
- template<class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, const size_t &incY, HelperMod< Field > &H)

15.20.1 Function Documentation

15.20.1.1 axpyp() [1/2]

```
std::enable_if<!FFLAS::support_simd_mod<typename Field::Element>::value && FFLAS::support_fast_mod<typename
Field::Element>::value, void>::type FFLAS::vectorised::unswitch::axpyp (
            const Field & F,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            typename Field::Element_ptr Y,
            const size_t n,
            HelperMod< Field > & H )  [inline]
```

15.20.1.2 axpyp() [2/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::unswitch::axpyp (
            const Field & F,
            const typename Field::Element a,
            typename Field::ConstElement_ptr X,
            typename Field::Element_ptr Y,
            const size_t n,
            const size_t incX,
            const size_t incY,
            HelperMod< Field > & H )  [inline]
```

15.20.1.3 modp() [1/2]

```
std::enable_if<!FFLAS::support_simd_mod<typename Field::Element>::value && FFLAS::support_fast_mod<typename
Field::Element>::value, void>::type FFLAS::vectorised::unswitch::modp (
            const Field & F,
            typename Field::ConstElement_ptr U,
            const size_t & n,
            typename Field::Element_ptr T,
            HelperMod< Field > & H )  [inline]
```

15.20.1.4 modp() [2/2]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::unswitch::modp (
            const Field & F,
            typename Field::ConstElement_ptr U,
            const size_t & n,
            const size_t & incX,
            typename Field::Element_ptr T,
            HelperMod< Field > & H )  [inline]
```

15.20.1.5 scalp() [1/3]

```
std::enable_if<!FFLAS::support_simd_mod<typename Field::Element>::value && FFLAS::support_fast_mod<typename
Field::Element>::value, void>::type FFLAS::vectorised::unswitch::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n,
            HelperMod< Field > & H )  [inline]
```

15.20.1.6 scalp() [2/3]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::unswitch::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n,
            const size_t & incX,
            HelperMod< Field > & H )  [inline]
```

15.20.1.7 scalp() [3/3]

```
std::enable_if<FFLAS::support_fast_mod<typename Field::Element>::value, void>::type FFLAS↩
::vectorised::unswitch::scalp (
            const Field & F,
            typename Field::Element_ptr T,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr U,
            const size_t n,
            const size_t & incX,
            const size_t & incY,
            HelperMod< Field > & H )  [inline]
```

15.21 FFPACK Namespace Reference

Finite **F**ield **PACK** Set of elimination based routines for dense linear algebra.

Namespaces

- Protected

Data Structures

- class CheckerImplem_charpoly
- class CheckerImplem_charpoly< Givaro::ZRing< Givaro::Integer >, Polynomial >
- class CheckerImplem_Det
- class CheckerImplem_invert
- class CheckerImplem_PLUQ
- class CharpolyFailed
- class callLUdivine_small
- class callLUdivine_small< double >
- class callLUdivine_small< float >
- class RNSInteger
- class RNSIntegerMod
- struct rns_double_elt
- struct rns_double_elt_ptr
- struct rns_double_elt_cstptr
- struct rns_double
- struct rns_double_extended
- class rnsRandIter
- class Failure

  A precondtion failed.

Typedefs

- template<class Field >
  using Checker_PLUQ = FFLAS::Checker_Empty< Field >
- template<class Field >
  using Checker_Det = FFLAS::Checker_Empty< Field >
- template<class Field >
  using Checker_invert = FFLAS::Checker_Empty< Field >
- template<class Field , class Polynomial >
  using Checker_charpoly = FFLAS::Checker_Empty< Field >
- template<class Field >
  using ForceCheck_PLUQ = CheckerImplem_PLUQ< Field >
- template<class Field >
  using ForceCheck_Det = CheckerImplem_Det< Field >
- template<class Field >
  using ForceCheck_invert = CheckerImplem_invert< Field >
- template<class Field , class Polynomial >
  using ForceCheck_charpoly = CheckerImplem_charpoly< Field, Polynomial >

Functions

- void LAPACKPerm2MathPerm (size_t ∗MathP, const size_t ∗LapackP, const size_t N)

  Conversion of a permutation from LAPACK format to Math format.
- void MathPerm2LAPACKPerm (size_t ∗LapackP, const size_t ∗MathP, const size_t N)

  Conversion of a permutation from Maths format to LAPACK format.
- template<class Field >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.

- template<class Field >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field , class Cut , class Param >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class Field >
  void MonotonicApplyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t R)

  Apply a R-monotonically increasing permutation P, to the matrix A.
- template<class Field >
  void fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t *Q, typename Field::Element_ptr B, const size_t ldb, int *info)

  Solve the system $AX = B$ or $XA = B$.
- template<class Field >
  Field::Element_ptr fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size←
  _t N, const size_t NRHS, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t *Q, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int *info)

  Solve the system A X = B or X A = B.
- template<class Field >
  size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, int *info)

  Square system solver.
- template<class Field >
  size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int *info)

  Rectangular system solver.
- template<class Field >
  void ftrtri (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG Diag, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FTRTRI_THRESHOLD)

  Compute the inverse of a triangular matrix.
- template<class Field >
  void trinv_left (const Field &F, const size_t N, typename Field::ConstElement_ptr L, const size_t ldl, typename Field::Element_ptr X, const size_t ldx)
- template<class Field >
  void ftrtrm (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Compute the product of two triangular matrices of opposite shape.
- template<class Field >
  void ftrstr (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const FFLAS::FFLAS_DIAG diagB, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const size_t threshold=__FFLASFFPACK_FTRSTR_THRESHOLD)

  Solve a triangular system with a triangular right hand side of the same shape.
- template<class Field >
  void ftrssyr2k (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size←
  _t ldb, const size_t threshold=__FFLASFFPACK_FTRSSYR2K_THRESHOLD)

  Solve a triangular system in a symmetric sum: find B upper/lower triangular such that A^T B + B^T A = C where C is symmetric.

- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOLD)

  Triangular factorization of symmetric matrices.
- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Sequential seq, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOL
- template<class Field , class Cut , class Param >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold=__FFLASFFPACK_FSYTRF_
- template<class Field >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr D, const size_t incD, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOLD)

  Triangular factorization of symmetric matrices.
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)

  Compute a PLUQ factorization of the given matrix.
- template<class Field >
  size_t pPLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFLAS::ParSeqHelper::Sequential &PSHelper, size_t BCThreshold=__FFLASFFPACK_PLUQ_THRESHOLD)
- template<class Field , class Cut , class Param >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFLAS::ParSeqHelper::Parallel< Cut, Param > &PSHelper)
- template<class Field >
  size_t LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive, const size_t cutoff=__FFLASFFPACK_LUDIVINE←_THRESHOLD)

  Compute the CUP or PLE factorization of the given matrix.
- template<class Field >
  size_t ColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, bool transform=false, const FFPACK_LU_TAG Lu←Tag=FfpackSlabRecursive)

  Compute the Column Echelon form of the input matrix in-place.
- template<class Field >
  size_t pColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t ColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
  size_t RowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_LU_TAG Lu←Tag=FfpackSlabRecursive)

  Compute the Row Echelon form of the input matrix in-place.

- template<class Field >
  size_t pRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK_↩ LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t RowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
  size_t ReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_↩ LU_TAG LuTag=FfpackSlabRecursive)

  Compute the Reduced Column Echelon form of the input matrix in-place.
- template<class Field >
  size_t pReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t ReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU↩ _TAG LuTag, const PSHelper &psH)
- template<class Field >
  size_t ReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_LU_TAG Lu↩ Tag=FfpackSlabRecursive)

  Compute the Reduced Row Echelon form of the input matrix in-place.
- template<class Field >
  size_t pReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK↩ _LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t ReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
  Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, int &nullity)

  Invert the given matrix in place or computes its nullity if it is singular.
- template<class Field >
  Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

  Invert the given matrix or computes its nullity if it is singular.
- template<class Field >
  Field::Element_ptr Invert2 (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

  Invert the given matrix or computes its nullity if it is singular.
- template<class PolRing >
  std::list< typename PolRing::Element > & CharPoly (const PolRing &R, std::list< typename PolRing::↩ Element > &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_↩ t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template<class PolRing >
  PolRing::Element & CharPoly (const PolRing &R, typename PolRing::Element &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

Compute the characteristic polynomial of the matrix A.

- template<class PolRing >
  PolRing::Element & CharPoly (const PolRing &R, typename PolRing::Element &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template<class Field , class Polynomial >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)

  Compute the minimal polynomial of the matrix A.
- template<class Field , class Polynomial , class RandIter >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, RandIter &G)

  Compute the minimal polynomial of the matrix A.
- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr v, const size_t incv)

  Compute the minimal polynomial of the matrix A and a vector v, namely the first linear dependency relation in the Krylov basis $(v, Av, ..., A^N v)$.
- template<class Field >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Computes the rank of the given matrix using a PLUQ factorization.
- template<class Field >
  size_t pRank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0)
- template<class Field , class PSHelper >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH)
- template<class Field >
  bool IsSingular (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Returns true if the given matrix is singular.
- template<class Field >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P=NULL, size_t *Q=NULL)

  Returns the determinant of the given square matrix.
- template<class Field >
  Field::Element & pDet (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0, size_t *P=NULL, size_t *Q=NULL)
- template<class Field , class PSHelper >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH, size_t *P=NULL, size_t *Q=NULL)
- template<class Field >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb)

  Solves a linear system AX = b using PLUQ factorization.
- template<class Field , class PSHelper >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, PSHelper &psH)
- template<class Field >
  Field::Element_ptr pSolve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, size_t numthreads=0)

- template<class Field >
∗void RandomNullSpaceVector (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t incX)

  Solve L X = B or X L = B in place.
- template<class Field >
size_t NullSpaceBasis (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &NS, size_t &ldn, size_↩
t &NSdim)

  Computes a basis of the Left/Right nullspace of the matrix A.
- template<class Field >
size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the row rank profile of A.
- template<class Field >
size_t pRowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- template<class Field >
size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the column rank profile of A.
- template<class Field >
size_t pColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const FFPACK_↩
LU_TAG LuTag)

  Recovers the column/row rank profile from the permutation of an LU decomposition.
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)

  Recovers the row and column rank profiles of any leading submatrix from the PLUQ decomposition.
- template<class Field >
size_t RowRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  RowRankProfileSubmatrixIndices.
- template<class Field >
size_t ColRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  Computes the indices of the submatrix r∗r X of A whose columns correspond to the column rank profile of A.
- template<class Field >
size_t RowRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Computes the r∗r submatrix X of A, by picking the row rank profile rows of A.
- template<class Field >
size_t ColRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Compute the $r \times r$ submatrix X of A, by picking the row rank profile rows of A.
- template<class Field >
void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false)

Extracts a triangular matrix from a compact storage A=L\U of rank R.

- template<class Field >
  void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda)

  Cleans up a compact storage A=L\U to reveal a triangular matrix of rank R.
- template<class Field >
  void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or Column↩ EchelonForm.
- template<class Field >
  void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Cleans up a compact storage A=L\U obtained by RowEchelonForm or ColumnEchelonForm to reveal an echelon form of rank R.
- template<class Field >
  void getEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK↩ _LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelon↩ Form or ColumnEchelonForm.
- template<class Field >
  void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG Lu↩ Tag=FfpackSlabRecursive)

  Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.
- template<class Field >
  void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_↩ LU_TAG LuTag=FfpackSlabRecursive)

  Cleans up a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelon↩ Form with transform = true.
- template<class Field >
  void getReducedEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelon↩ Form or ColumnEchelonForm.
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

  Auxiliary routine: determines the permutation that changes a PLUQ decomposition into a echelon form revealing PLUQ decomposition.
- template<class Field >
  size_t LTBruhatGen (const Field &Fi, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)

  LTBruhatGen Suppose A is Left Triangular Matrix This procedure computes the Bruhat Representation of A and return the rank of A.
- template<class Field >
  void getLTBruhatGen (const Field &Fi, const size_t N, const size_t r, const size_t ∗P, const size_t ∗Q, typename Field::Element_ptr R, const size_t ldr)

GetLTBruhatGen This procedure Computes the Rank Revealing Matrix based on the Bruhta representation of a Matrix.

- template<class Field >
  void getLTBruhatGen (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t N, const size_t r, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt)

  GetLTBruhatGen This procedure computes the matrix L or U f the Bruhat Representation Suppose that A is the bruhat representation of a matrix.
- size_t LTQSorder (const size_t N, const size_t r, const size_t ∗P, const size_t ∗Q)

  LTQSorder This procedure computes the order of quasiseparability of a matrix.
- template<class Field >
  size_t CompressToBlockBiDiagonal (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size←_t s, size_t r, const size_t ∗P, const size_t ∗Q, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t ∗K, size_t ∗M, size_t ∗T)

  CompressToBlockBiDiagonal This procedure compress a compact representation of a row echelon form or column echelon form.
- template<class Field >
  void ExpandBlockBiDiagonalToBruhat (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size←_t s, size_t r, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t NbBlocks, size_t ∗K, size_t ∗M, size_t ∗T)

  ExpandBlockBiDiagonal This procedure expand a compact representation of a row echelon form or column echelon form.
- void Bruhat2EchelonPermutation (size_t N, size_t R, const size_t ∗P, const size_t ∗Q, size_t ∗M)

  Bruhat2EchelonPermutation (N,R,P,Q) Compute M such that LM or MU is in echelon form where L or U are factors of the Bruhat Rpresentation.
- size_t ∗ TInverter (size_t ∗T, size_t r)
- template<class Field >
  void ComputeRPermutation (const Field &Fi, size_t N, size_t r, const size_t ∗P, const size_t ∗Q, size_t ∗R, size_t ∗MU, size_t ∗ML)
- template<class Field >
  void productBruhatxTS (const Field &Fi, size_t N, size_t s, size_t r, const size_t ∗P, const size_t ∗Q, const typename Field::Element_ptr Xu, size_t ldu, size_t NbBlocksU, size_t ∗Ku, size_t ∗Tu, size_t ∗MU, const typename Field::Element_ptr Xl, size_t ldl, size_t NbBlocksL, size_t ∗Kl, size_t ∗Tl, size_t ∗ML, typename Field::Element_ptr B, size_t t, size_t ldb, typename Field::Element_ptr C, size_t ldc)

  productBruhatxTS Comput the product between the CRE compact representation of a matrix A and B a tall matrix
- template<class Field >
  Field::Element_ptr LQUPtoInverseOfFullRankMinor (const Field &F, const size_t rank, typename Field::Element_ptr A_factors, const size_t lda, const size_t ∗QtPointer, typename Field::Element_ptr X, const size_t ldx)

  LQUPtoInverseOfFullRankMinor.
- template<class Field >
  void RandomNullSpaceVector (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size←_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t incX)

  Solve L X = B or X L = B in place.
- template<class Field >
  void solveLB (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr L, const size_t ldl, const size_t ∗Q, typename Field::Element_ptr B, const size_t ldb)
- template<class Field >
  void solveLB2 (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr L, const size_t ldl, const size_t ∗Q, typename Field::Element_ptr B, const size_t ldb)
- size_t ∗ TInverter (const size_t ∗T, size_t r)
- template<class Field >
  void ComputeRPermutation (const Field &Fi, size_t N, size_t r, const size_t ∗P, const size_t ∗Q, size_t ∗R, const size_t ∗MU, const size_t ∗ML)

- template< class Field >
  Field::Element_ptr expandLCRE (const Field &Fi, size_t N, size_t s, size_t r, size_t *R, size_t i, typename Field::ConstElement_ptr Xu, size_t ldu, size_t NbBlocksU, const size_t *Ku, const size_t *Tuinv, typename Field::ConstElement_ptr Xl, size_t ldl, size_t NbBlocksL, const size_t *Kl, const size_t *Tlinv, typename Field::Element_ptr CRE, size_t ldcre)

  Expands an anti-diagonal block of a left triangular matrix from its compact Bruhat representation.
- template< class Field >
  void productBruhatxTS (const Field &Fi, size_t N, size_t s, size_t r, size_t t, const size_t *P, const size_t *Q, typename Field::ConstElement_ptr Xu, size_t ldu, size_t NbBlocksU, const size_t *Ku, const size_t *Tu, const size_t *MU, typename Field::ConstElement_ptr Xl, size_t ldl, size_t NbBlocksL, const size_t *Kl, const size_t *Tl, const size_t *ML, typename Field::Element_ptr B, size_t ldb, const typename Field::Element beta, typename Field::Element_ptr D, size_t ldd)

  Compute the product of a left-triangular quasi-separable matrix A, represented by a compact Bruhat generator, with a dense rectangular matrix B: $C \leftarrow A \times B + betaC$.
- template< class Field , class Polynomial >
  std::list< Polynomial > & Danilevski (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)
- template< class Field >
  Field::Element_ptr buildMatrix (const Field &F, typename Field::ConstElement_ptr E, typename Field::ConstElement_ptr C, const size_t lda, const size_t *B, const size_t *T, const size_t me, const size_t mc, const size_t lambda, const size_t mu)
- FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr CharPoly (const FFPACK::RNSInteger< FFPACK::rns_double > &F, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr charp, const size_t N, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A, const size_t lda, Givaro::ZRing< Givaro::Integer >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, size_t degree)
- template<> Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > >::Element & CharPoly (const Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > > &R, Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > >::Element &charp, const size_t N, Givaro::Integer *A, const size_t lda, Givaro::ZRing< Givaro::Integer >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, size_t degree)
- template< class PSHelper >
  FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr & Det (const FFPACK::RNSInteger< FFPACK::rns_double > &F, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr &det, const size_t N, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A, const size_t lda, const PSHelper &psH)
- template< class PSHelper >
  Givaro::Integer & Det (const Givaro::ZRing< Givaro::Integer > &F, Givaro::Integer &det, const size_t N, Givaro::Integer *A, const size_t lda, const PSHelper &psH, size_t *P, size_t *Q)
- template< class Field >
  bool fsytrf_BC_Crout (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv)
- template< class Field >
  size_t fsytrf_BC_RL (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv)
- template< class Field >
  size_t fsytrf_UP_RPM_BC_RL (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template< class Field >
  size_t fsytrf_LOW_RPM_BC_Crout (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template< class Field >
  size_t fsytrf_UP_RPM_BC_Crout (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template< class Field >
  size_t fsytrf_UP_RPM (const Field &Fi, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P, size_t BCThreshold)
- template< class Field >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename

Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, FFLAS::ParSeqHelper::Sequential seq, size_t threshold)

- template< class Field , class Cut , class Param >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, FFLAS::ParSeqHelper::Parallel< Cut, Param > par, size_t threshold)
- template< class Field >
  size_t fsytrf_RPM (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t threshold)
- template< class Field >
  void getTridiagonal (const Field &F, const size_t N, const size_t R, typename Field::ConstElement_ptr A, const size_t lda, size_t *P, typename Field::Element_ptr T, const size_t ldt)
- template< class Field >
  size_t LUdivine_gauss (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)
- template< class Field >
  size_t LUdivine_small (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)
- template< class Field >
  size_t LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag, const size_t cutoff)
- template<> size_t LUdivine (const Givaro::Modular< Givaro::Integer > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Givaro::Integer *A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag, const size_t cutoff)
- template< class Field >
  void MonotonicCompress (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t *MathP, const size_t R, const size_t maxpiv, const size_t rowstomove, const std::vector< bool > &ispiv)
- template< class Field >
  void MonotonicCompressMorePivots (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t *MathP, const size_t R, const size_t rowstomove, const size_t lenP)
- template< class Field >
  void MonotonicCompressCycles (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t *MathP, const size_t lenP)
- template< class Field >
  void MonotonicExpand (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t *MathP, const size_t R, const size_t maxpiv, const size_t rowstomove, const std::vector< bool > &ispiv)
- template< class Field >
  void applyP_block (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P)
- template< class Field >
  void doApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template< class Field >
  void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template< class Field >
  void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Sequential seq)

- template<class Field , class Cut , class Param >
  void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
  t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class T >
  void PermApplyS (T ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
  void doApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
  void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
  void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
  t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field , class Cut , class Param >
  void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
  t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class T >
  void PermApplyT (T ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void composePermutationsLLL (size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.
- void composePermutationsLLM (size_t ∗MathP, const size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in MathP as a MathPermutation format.
- void composePermutationsMLM (size_t ∗MathP1, const size_t ∗P2, const size_t R, const size_t N)

  Computes MathP1 x Diag (I_R, P2) where MathP1 is a MathPermutation and P2 a LAPACK permutation and store the result in MathP1 as a MathPermutation format.
- void cyclic_shift_mathPerm (size_t ∗P, const size_t s)
- template<class Field >
  void cyclic_shift_row_col (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  void cyclic_shift_row (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<typename T >
  void cyclic_shift_row (const RNSIntegerMod< T > &F, typename T::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  void cyclic_shift_col (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<typename T >
  void cyclic_shift_col (const RNSIntegerMod< T > &F, typename T::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  size_t PLUQ_basecaseV3 (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element ∗A, const size_t lda, size_t ∗P, size_t ∗Q)
- template<class Field >
  size_t PLUQ_basecaseV2 (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element ∗A, const size_t lda, size_t ∗P, size_t ∗Q)
- template<class Field >
  size_t PLUQ_basecaseCrout (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size↩
  _t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)

- template<class Field >
  size_t _PLUQ (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, size_t BCThreshold)
- template<class Cut , class Param >
  size_t PLUQ (const Givaro::Modular< Givaro::Integer > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Givaro::Integer *A, const size_t lda, size_t *P, size_t *Q, size_t BCThreshold, FFLAS::ParSeqHelper::Parallel< Cut, Param > &PSHelper)
- template<class Field >
  void threads_fgemm (const size_t m, const size_t n, const size_t r, int nbthreads, size_t *W1, size_t *W2, size_t *W3, size_t gamma)
- template<class Field >
  void threads_ftrsm (const size_t m, const size_t n, int nbthreads, size_t *t1, size_t *t2)
- template<class Field >
  size_t PLUQ (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter::Threads > &PSHelper)
- template<> rns_double_elt_ptr fflas_const_cast (rns_double_elt_cstptr x)
- template<> rns_double_elt_cstptr fflas_const_cast (rns_double_elt_ptr x)
- template<typename Base_t >
  void cyclic_shift_row_col (Base_t *A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void cyclic_shift_row (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT *A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void cyclic_shift_col (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT *A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void applyP (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, FFLAS_ELT *A, const size_t lda, const size_t *P)
- template INST_OR_DECL void fgetrs (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT *A, const size_t lda, const size_t *P, const size_t *Q, FFLAS_ELT *B, const size_t ldb, int *info)
- template INST_OR_DECL FFLAS_ELT * fgetrs (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, const size_t R, FFLAS_ELT *A, const size_t lda, const size_t *P, const size_t *Q, FFLAS_ELT *X, const size_t ldx, const FFLAS_ELT *B, const size_t ldb, int *info)
- template INST_OR_DECL size_t fgesv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT *A, const size_t lda, FFLAS_ELT *B, const size_t ldb, int *info)
- template INST_OR_DECL size_t fgesv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, FFLAS_ELT *A, const size_t lda, FFLAS_ELT *X, const size_t ldx, const FFLAS_ELT *B, const size_t ldb, int *info)
- template INST_OR_DECL void ftrtri (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG Diag, const size_t N, FFLAS_ELT *A, const size_t lda, const size_↩ t threshold)
- template INST_OR_DECL void trinv_left (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *L, const size_t ldl, FFLAS_ELT *X, const size_t ldx)
- template INST_OR_DECL void ftrtrm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_DIAG diag, const size_t N, FFLAS_ELT *A, const size_t lda)
- template INST_OR_DECL size_t PLUQ (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, FFLAS_ELT *A, const size_t lda, size_t *P, size_t *Q)
- template INST_OR_DECL size_t LUdivine (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, FFLAS_ELT *A, const size↩ _t lda, size_t *P, size_t *Qt, const FFPACK_LU_TAG LuTag, const size_t cutoff)
- template INST_OR_DECL size_t LUdivine_small (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, FFLAS_ELT *A, const size_t lda, size_t *P, size_t *Q, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t LUdivine_gauss (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, FFLAS_ELT *A, const size_t lda, size_t *P, size_t *Q, const FFPACK_LU_TAG LuTag)

- template INST_OR_DECL size_t RowEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ReducedRowEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ColumnEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ReducedColumnEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL FFLAS_ELT ∗ Invert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, int &nullity)
- template INST_OR_DECL FFLAS_ELT ∗ Invert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t ldx, int &nullity)
- template INST_OR_DECL FFLAS_ELT ∗ Invert2 (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t ldx, int &nullity)
- template INST_OR_DECL std::list< Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element > & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, std::list< Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element > &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MatVecMinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗V, const size_t incv)
- template INST_OR_DECL size_t KrylovElim (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const size_t deg, size_t ∗iterates, size_t ∗inviterates, const size_t maxit, size_t virt)
- template INST_OR_DECL size_t SpecRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, const size_t deg, size_t ∗rankProfile)
- template INST_OR_DECL size_t Rank (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL bool IsSingular (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL FFLAS_ELT & Det (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT &det, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q)
- template INST_OR_DECL FFLAS_ELT & Det (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT &det, const size_t N, FFLAS_ELT ∗A, const size_t lda, const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter::Threads > &parH, size_t ∗P, size_t ∗Q)
- template INST_OR_DECL FFLAS_ELT ∗ Solve (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗x, const int incx, const FFLAS_ELT ∗b, const int incb)
- template INST_OR_DECL void solveLB (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗L, const size_t ldl, const size_t ∗Q, FFLAS_ELT ∗B, const size_t ldb)

- template INST_OR_DECL void solveLB2 (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗L, const size_t ldl, const size_t ∗Q, FFLAS_ELT ∗B, const size_t ldb)
- template INST_OR_DECL void RandomNullSpaceVector (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t incX)
- template INST_OR_DECL size_t NullSpaceBasis (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&NS, size_t &ldn, size_t &NSdim)
- template INST_OR_DECL size_t RowRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ColumnRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size←_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t RowRankProfileSubmatrixIndices (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)
- template INST_OR_DECL size_t ColRankProfileSubmatrixIndices (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)
- template INST_OR_DECL size_t RowRankProfileSubmatrix (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&X, size_t &R)
- template INST_OR_DECL size_t ColRankProfileSubmatrix (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&X, size_t &R)
- template INST_OR_DECL void getTriangular< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors)
- template INST_OR_DECL void getTriangular< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL void getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, FFLAS_ELT ∗A, const size_t lda, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, FFLAS_ELT ∗A, const size_t lda, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getReducedEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL FFLAS_ELT ∗ LQUPtoInverseOfFullRankMinor (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t rank, FFLAS_ELT ∗A_factors, const size_t lda, const size_t ∗QtPointer, FFLAS_ELT ∗X, const size_t ldx)
- template<class T , class CT = const T>
  T fflas_const_cast (CT x)

- Failure & failure ()
- template<class T >
  bool isOdd (const T &a)
- bool isOdd (const float &a)
- bool isOdd (const double &a)
- template<class Field , class RandIter >
  Field::Element_ptr NonZeroRandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random non-zero Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr NonZeroRandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda)

  Random non-zero Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix.
- template<class Field >
  Field::Element_ptr RandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda)

  Random Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomTriangularMatrix (const Field &F, size_t m, size_t n, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_DIAG Diag, bool nonsingular, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Triangular Matrix.
- template<class Field >
  Field::Element_ptr RandomTriangularMatrix (const Field &F, size_t m, size_t n, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_DIAG Diag, bool nonsingular, typename Field::Element_ptr A, size_t lda)

  Random Triangular Matrix.
- size_t RandInt (size_t a, size_t b)
- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrix (const Field &F, size_t n, bool nonsingular, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Symmetric Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRank (const Field &F, size_t m, size_t n, size_t r, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed rank.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRank (const Field &F, size_t m, size_t n, size_t r, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed rank.
- size_t * RandomIndexSubset (size_t N, size_t R, size_t *P)

  Pick uniformly at random a sequence of R distinct elements from the set $\{0, \ldots, N-1\}$ using Knuth's shuffle.
- size_t * RandomPermutation (size_t N, size_t *P)

  Pick uniformly at random a permutation of size N stored in LAPACK format using Knuth's shuffle.
- void RandomRankProfileMatrix (size_t M, size_t N, size_t R, size_t *rows, size_t *cols)

  Pick uniformly at random an R-subpermutation of dimension M x N : a matrix with only R non-zeros equal to one, in a random rook placement.
- void swapval (size_t k, size_t N, size_t *P, size_t val)
- void RandomSymmetricRankProfileMatrix (size_t N, size_t R, size_t *rows, size_t *cols)

  Pick uniformly at random a symmetric R-subpermutation of dimension N x N : a symmetric matrix with only R non-zeros, all equal to one, in a random rook placement.

- void RandomLTQSRankProfileMatrix (size_t n, size_t r, size_t t, size_t ∗rows, size_t ∗cols)
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP, RandIter &G)

  Random Matrix with prescribed rank and rank profile matrix Creates an m x n matrix with random entries and rank r.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP)

  Random Matrix with prescribed rank and rank profile matrix Creates an m x n matrix with random entries and rank r.
- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP, RandIter &G)

  Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an n x n symmetric matrix with random entries and rank r.
- template<class Field >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP)

  Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an n x n symmetric matrix with random entries and rank r.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRankandRandomRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRankandRandomRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRandomRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an n x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRandomRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda)

  Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an n x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomMatrixWithDet (const Field &F, size_t n, const typename Field::Element d, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed det.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithDet (const Field &F, size_t n, const typename Field::Element d, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed det.
- template<class Field , class RandIter >
  Field::Element_ptr RandomLTQSMatrixWithRankandQSorder (Field &F, size_t n, size_t r, size_t t, typename Field::Element_ptr A, size_t lda, RandIter &G)
- template<typename Field >
  Field ∗ chooseField (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< int32_t > ∗ chooseField< Givaro::ZRing< int32_t > > (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< int64_t > ∗ chooseField< Givaro::ZRing< int64_t > > (Givaro::Integer q, uint64_t b, uint64_t seed)

- template<> Givaro::ZRing< float > * chooseField< Givaro::ZRing< float > > (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< double > * chooseField< Givaro::ZRing< double > > (Givaro::Integer q, uint64_t b, uint64_t seed)

15.21.1 Detailed Description

Finite **F**ield **PACK** Set of elimination based routines for dense linear algebra.

This namespace enlarges the set of BLAS routines of the class FFLAS, with higher level routines based on elimination.

15.21.2 Typedef Documentation

15.21.2.1 Checker_PLUQ

```
using Checker_PLUQ = FFLAS::Checker_Empty<Field>
```

15.21.2.2 Checker_Det

```
using Checker_Det = FFLAS::Checker_Empty<Field>
```

15.21.2.3 Checker_invert

```
using Checker_invert = FFLAS::Checker_Empty<Field>
```

15.21.2.4 Checker_charpoly

```
using Checker_charpoly = FFLAS::Checker_Empty<Field>
```

15.21.2.5 ForceCheck_PLUQ

```
using ForceCheck_PLUQ = CheckerImplem_PLUQ<Field>
```

15.21.2.6 ForceCheck_Det

```
using ForceCheck_Det = CheckerImplem_Det<Field>
```

15.21.2.7 ForceCheck_invert

```
using ForceCheck_invert = CheckerImplem_invert<Field>
```

15.21.2.8 ForceCheck_charpoly

```
using ForceCheck_charpoly = CheckerImplem_charpoly<Field,Polynomial>
```

15.21.3 Function Documentation

15.21.3.1 LAPACKPerm2MathPerm()

```
void LAPACKPerm2MathPerm (
            size_t * MathP,
            const size_t * LapackP,
            const size_t N )  [inline]
```

Conversion of a permutation from LAPACK format to Math format.

15.21.3.2 MathPerm2LAPACKPerm()

```
void MathPerm2LAPACKPerm (
            size_t * LapackP,
            const size_t * MathP,
            const size_t N )  [inline]
```

Conversion of a permutation from Maths format to LAPACK format.

15.21.3.3 applyP() [1/4]

```
void FFPACK::applyP (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P )
```

Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.

Parameters

in,out	*P1*	a LAPACK permutation of size N
	P2	a LAPACK permutation of size N-R

Applies a permutation P to the matrix A. Apply a permutation P, stored in the LAPACK format (a sequence of transpositions) between indices ibeg and iend of P to (iend-ibeg) vectors of size M stored in A (as column for NoTrans and rows for Trans). Side==FFLAS::FflasLeft for row permutation Side==FFLAS::FflasRight for a column permutation Trans==FFLAS::FflasTrans for the inverse permutation of P

Parameters

F	base field
Side	decides if rows (FflasLeft) or columns (FflasRight) are permuted
Trans	decides if the matrix is seen as columns (FflasTrans) or rows (FflasNoTrans)
M	size of the elements to permute
ibeg	first index to consider in P
iend	last index to consider in P
A	input matrix
lda	leading dimension of A
P	permutation in LAPACK format
psh	(optional): a sequential or parallel helper, to choose between sequential or parallel execution

Warning

not sure the submatrix is still a permutation and the one we expect in all cases... examples for iend=2, ibeg=1 and P=[2,2,2]

15.21.3.4 applyP() [2/4]

```
void FFPACK::applyP (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t m,
            const size_t ibeg,
            const size_t iend,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P,
            const FFLAS::ParSeqHelper::Sequential seq )
```

15.21.3.5 applyP() [3/4]

```
void FFPACK::applyP (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t m,
            const size_t ibeg,
            const size_t iend,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P,
            const FFLAS::ParSeqHelper::Parallel< Cut, Param > par )
```

15.21.3.6 MonotonicApplyP()

```
void FFPACK::MonotonicApplyP (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P,
            const size_t R )
```

Apply a R-monotonically increasing permutation P, to the matrix A.

MonotonicApplyP Apply a permutation defined by the first R entries of the vector P (the pivots).

The permutation represented by P is defined as follows:

- the first R values of P is a LAPACK reprensentation (a sequence of transpositions)
- the remaining iend-ibeg-R values of the permutation are in a monotonically increasing progression Side==FFLAS::FflasLeft for row permutation Side==FFLAS::FflasRight for a column permutation Trans==FFLAS::FflasTrans for the inverse permutation of P

Parameters

F	base field
Side	selects if it is a row (FflasLeft) or column (FflasRight) permutation
Trans	inverse permutation (FflasTrans/NoTrans)
M	
ibeg	
iend	
A	input matrix
lda	leading dimension of A
P	LAPACK permuation
R	first values of P

The non pivot elements, are located in montonically increasing order.

15.21.3.7 fgetrs() [1/4]

```
void FFPACK::fgetrs (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            typename Field::Element_ptr B,
            const size_t ldb,
            int * info )
```

Solve the system $AX = B$ or $XA = B$.

Solving using the `PLUQ` decomposition of `A` already computed inplace with `PLUQ` (FFLAS::FflasNonUnit). Version for A square. If A is rank deficient, a solution is returned if the system is consistent, Otherwise an info is 1

Parameters

F	base field
Side	Determine wheter the resolution is left (FflasLeft) or right (FflasRight) looking.
M	row dimension of `B`
N	col dimension of `B`
R	rank of `A`
A	input matrix
lda	leading dimension of `A`
P	row permutation of the `PLUQ` decomposition of `A`
Q	column permutation of the `PLUQ` decomposition of `A`
B	Right/Left hand side matrix. Initially stores `B`, finally stores the solution `X`.
ldb	leading dimension of `B`
info	Success of the computation: 0 if successfull, $>$0 if system is inconsistent

15.21.3.8 fgetrs() [2/4]

```
Field::Element_ptr FFPACK::fgetrs (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
```

```
            const size_t R,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            typename Field::Element_ptr X,
            const size_t ldx,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            int * info )
```

Solve the system A X = B or X A = B.

Solving using the PLUQ decomposition of A already computed inplace with PLUQ(FFLAS::FflasNonUnit). Version for A rectangular. If A is rank deficient, a solution is returned if the system is consistent, Otherwise an info is 1

Parameters

F	base field
Side	Determine wheter the resolution is left (FflasLeft) or right (FflasRight) looking.
M	row dimension of A
N	col dimension of A
NRHS	number of columns (if Side = FFLAS::FflasLeft) or row (if Side = FFLAS::FflasRight) of the matrices X and B
R	rank of A
A	input matrix
lda	leading dimension of A
P	row permutation of the PLUQ decomposition of A
Q	column permutation of the PLUQ decomposition of A
X	solution matrix
ldx	leading dimension of X
B	Right/Left hand side matrix.
ldb	leading dimension of B
info	Succes of the computation: 0 if successfull, >0 if system is inconsistent

15.21.3.9 fgesv() [1/4]

```
size_t FFPACK::fgesv (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            int * info )
```

Square system solver.

Parameters

F	The computation domain
Side	Determine wheter the resolution is left (FflasLeft) or right (FflasRight) looking
M	row dimension of B
N	col dimension of B
A	input matrix
lda	leading dimension of A
B	Right/Left hand side matrix. Initially contains B, finally contains the solution X.
ldb	leading dimension of B
info	Success of the computation: 0 if successfull, $>$0 if system is inconsistent

Returns

the rank of the system

Solve the system A X = B or X A = B. Version for A square. If A is rank deficient, a solution is returned if the system is consistent, Otherwise an info is 1

15.21.3.10 fgesv() [2/4]

```
size_t FFPACK::fgesv (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            int * info )
```

Rectangular system solver.

Parameters

F	The computation domain
Side	Determine wheter the resolution is left (FflasLeft) or right (FflasRight) looking
M	row dimension of A
N	col dimension of A
NRHS	number of columns (if Side = FFLAS::FflasLeft) or row (if Side = FFLAS::FflasRight) of the matrices X and B
A	input matrix
lda	leading dimension of A
B	Right/Left hand side matrix. Initially contains B, finally contains the solution X.
ldb	leading dimension of B
X	
ldx	
info	Success of the computation: 0 if successfull, $>$0 if system is inconsistent

Returns

the rank of the system

Solve the system A X = B or X A = B. Version for A square. If A is rank deficient, a solution is returned if the system is consistent, Otherwise an info is 1

15.21.3.11 ftrtri() [1/2]

```
void FFPACK::ftrtri (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t threshold = __FFLASFFPACK_FTRTRI_THRESHOLD )
```

Compute the inverse of a triangular matrix.

Parameters

F	base field
Uplo	whether the matrix is upper or lower triangular
Diag	whether the matrix is unit diagonal (FflasUnit/NoUnit)
N	input matrix order
A	the input matrix
lda	leading dimension of A

15.21.3.12 trinv_left() [1/2]

```
void FFPACK::trinv_left (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr L,
            const size_t ldl,
            typename Field::Element_ptr X,
            const size_t ldx )
```

15.21.3.13 ftrtrm() [1/2]

```
void FFPACK::ftrtrm (
            const Field & F,
            const FFLAS::FFLAS_SIDE side,
            const FFLAS::FFLAS_DIAG diag,
            const size_t N,
```

```
            typename Field::Element_ptr A,
            const size_t lda )
```

Compute the product of two triangular matrices of opposite shape.

Product UL or LU of the upper, resp lower triangular matrices U and L stored one above the other in the square matrix A.

Parameters

F	base field
Side	set to FflasLeft to compute the product UL, FflasRight to compute LU
diag	whether the matrix U is unit diagonal (FflasUnit/NoUnit)
N	input matrix order
A	the input matrix
lda	leading dimension of A

15.21.3.14 ftrstr()

```
void FFPACK::ftrstr (
            const Field & F,
            const FFLAS::FFLAS_SIDE side,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diagA,
            const FFLAS::FFLAS_DIAG diagB,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const size_t threshold = __FFLASFFPACK_FTRSTR_THRESHOLD )
```

Solve a triangular system with a triangular right hand side of the same shape.

Parameters

F	base field
Side	set to FflasLeft to compute U1^-1*U2 or L1^-1*L2, FflasRight to compute U1*U2^-1 or L1*L2^-1
Uplo	whether the matrix A is upper or lower triangular
diag1	whether the matrix U1 or L2 is unit diagonal (FflasUnit/NoUnit)
diag2	whether the matrix U2 or L2 is unit diagonal (FflasUnit/NoUnit)
N	order of the input matrices
A	the input matrix to be inverted (U1 or L1)
lda	leading dimension of A
B	the input right hand side (U2 or L2)
ldb	leading dimension of B

15.21.3.15 ftrssyr2k()

```
void FFPACK::ftrssyr2k (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diagA,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr B,
            const size_t ldb,
            const size_t threshold = __FFLASFFPACK_FTRSSYR2K_THRESHOLD )
```

Solve a triangular system in a symmetric sum: find B upper/lower triangular such that A^T B + B^T A = C where C is symmetric.

C is overwritten by B.

Parameters

	F	base field
	Side	set to FflasLeft to compute U1^-1∗U2 or L1^-1∗L2, FflasRight to compute U1∗U2^-1 or L1∗L2^-1
	Uplo	whether the matrix A is upper or lower triangular
	diagA	whether the matrix A is unit diagonal (FflasUnit/NoUnit)
	N	order of the input matrices
	A	the input matrix
	lda	leading dimension of A
in,out	*B*	the input right hand side where the output is written
	ldb	leading dimension of B

15.21.3.16 fsytrf() [1/3]

```
bool FFPACK::fsytrf (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t threshold = __FFLASFFPACK_FSYTRF_THRESHOLD )
```

Triangular factorization of symmetric matrices.

Parameters

	F	The computation domain
	UpLo	Determine wheter to store the upper (FflasUpper) or lower (FflasLower) triangular factor
	N	order of the matrix A
in,out	*A*	input matrix
	lda	leading dimension of A

Returns

false if the A does not have generic rank profile, making the computation fail.

Compute the a triangular factorization of the matrix A: $A = L \times D \times L^T$ if UpLo = FflasLower or $A = U^T \times D \times U$ otherwise. D is a diagonal matrix. The matrices L and U are unit diagonal lower (resp. upper) triangular and overwrite the input matrix A. The matrix D is stored on the diagonal of A, as the diagonal of L or U is known to be all ones. If A does not have generic rank profile, the LDLT or UTDU factorizations is not defined, and the algorithm returns false.

15.21.3.17 fsytrf() [2/3]

```
bool FFPACK::fsytrf (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const FFLAS::ParSeqHelper::Sequential seq,
            const size_t threshold = __FFLASFFPACK_FSYTRF_THRESHOLD )
```

15.21.3.18 fsytrf() [3/3]

```
bool FFPACK::fsytrf (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const FFLAS::ParSeqHelper::Parallel< Cut, Param > par,
            const size_t threshold = __FFLASFFPACK_FSYTRF_THRESHOLD )
```

15.21.3.19 fsytrf_nonunit() [1/3]

```
bool FFPACK::fsytrf_nonunit (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr D,
            const size_t incD,
            const size_t threshold = __FFLASFFPACK_FSYTRF_THRESHOLD )
```

Triangular factorization of symmetric matrices.

Parameters

	F	The computation domain
	UpLo	Determine wheter to store the upper (FflasUpper) or lower (FflasLower) triangular factor
	N	order of the matrix A
in,out	*A*	input matrix
in,out	*D*	
	lda	leading dimension of A

Returns

false if the A does not have generic rank profile, making the computation fail.

Compute the a triangular factorization of the matrix A: $A = L \times Dinv \times L^T$ if UpLo = FflasLower or $A = U^T \times D \times U$ otherwise. D is a diagonal matrix. The matrices L and U are lower (resp. upper) triangular and overwrite the input matrix A. The matrix D need to be stored separately, as the diagonal of L or U are not unit. If A does not have generic rank profile, the LDLT or UTDU factorizations is not defined, and the algorithm returns false.

15.21.3.20 PLUQ() [1/6]

```
size_t FFPACK::PLUQ (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q )
```

Compute a PLUQ factorization of the given matrix.

Return its rank. The permutations P and Q are represented using LAPACK's convention.

Parameters

F	base field
Diag	whether U should have a unit diagonal (FflasUnit) or not (FflasNoUnit)
M	matrix row dimension
N	matrix column dimension
A	input matrix
lda	leading dimension of A
P	the row permutation
Q	the column permutation

Returns

the rank of A

Bibliography
- Dumas J-G., Pernet C., and Sultan Z. `Simultaneous` *computation of the row and column rank profiles* , ISSAC'13, 2013

15.21.3.21 pPLUQ()

```
size_t FFPACK::pPLUQ (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
```

```
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q )
```

15.21.3.22 PLUQ() [2/6]

```
size_t FFPACK::PLUQ (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFLAS::ParSeqHelper::Sequential & PSHelper,
            size_t BCThreshold = __FFLASFFPACK_PLUQ_THRESHOLD )
```

15.21.3.23 PLUQ() [3/6]

```
size_t FFPACK::PLUQ (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFLAS::ParSeqHelper::Parallel< Cut, Param > & PSHelper )
```

15.21.3.24 LUdivine() [1/4]

```
size_t FFPACK::LUdivine (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive,
            const size_t cutoff = __FFLASFFPACK_LUDIVINE_THRESHOLD )
```

Compute the CUP or PLE factorization of the given matrix.

Using a block algorithm and return its rank. The permutations P and Q are represented using LAPACK's convention.

Parameters

F	base field
Diag	whether the transformation matrix (U of the CUP, L of the PLE) should have a unit diagonal (FflasUnit) or not (FflasNoUnit)
trans	whether to compute the CUP decomposition (FflasNoTrans) or the PLE decomposition (FflasTrans)
M	matrix row dimension
N	matrix column dimension
A	input matrix
lda	leading dimension of `A`
P	the factor of CUP or PLE
Q	a permutation indicating the pivot position in the echelon form C or E in its first r positions
LuTag	flag for setting the earling termination if the matrix is singular
cutoff	threshold to basecase

Returns

the rank of `A`

Bibliography

- Jeannerod C-P, Pernet, C. and Storjohann, A. `Rank-profile` *revealing Gaussian elimination and the CUP matrix decomposition* , J. of Symbolic Comp., 2013
- Pernet C, Brassel M `LUdivine`*, une divine factorisation* `LU`, 2002

15.21.3.25 ColumnEchelonForm() [1/3]

```
size_t ColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )  [inline]
```

Compute the Column Echelon form of the input matrix in-place.

If LuTag == FfpackTileRecursive, then after the computation A = [M \ V] such that AU = C is a column echelon decomposition of A, with U = P^T [V] and C = M + Q [Ir] [0 In-r] [0] If LuTag == FfpackTileRecursive then A = [N \ V] such that the same holds with M = Q N

Qt = Q^T If transform=false, the matrix V is not computed. See also test-colechelon for an example of use

Parameters

	F	base field
	M	number of rows
	N	number of columns
`in`	*A*	input matrix
	lda	leading dimension of A
	P	the column permutation
	Qt	the row position of the pivots in the echelon form
	transform	decides whether V is computed

15.21.3.26 pColumnEchelonForm()

```
size_t pColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform = false,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )  [inline]
```

15.21.3.27 ColumnEchelonForm() [2/3]

```
size_t ColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag,
            const PSHelper & psH )  [inline]
```

15.21.3.28 RowEchelonForm() [1/3]

```
size_t RowEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )  [inline]
```

Compute the Row Echelon form of the input matrix in-place.

If LuTag == FfpackTileRecursive, then after the computation A = [L \ M] such that X A = R is a row echelon decomposition of A, with X = [L 0] P and R = M + [Ir 0] Q^T [In-r] If LuTag == FfpackTileRecursive then A = [L \ N] such that the same holds with M = N Q^T Qt = Q^T If transform=false, the matrix L is not computed. See also test-rowechelon for an example of use

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	the input matrix
	lda	leading dimension of A
	P	the row permutation
	Qt	the column position of the pivots in the echelon form
	transform	decides whether L is computed
	LuTag	chooses the elimination algorithm. SlabRecursive for LUdivine, TileRecursive for PLUQ

15.21.3.29 pRowEchelonForm()

```
size_t pRowEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )  [inline]
```

15.21.3.30 RowEchelonForm() [2/3]

```
size_t RowEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag,
            const PSHelper & psH )  [inline]
```

15.21.3.31 ReducedColumnEchelonForm() [1/3]

```
size_t ReducedColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )  [inline]
```

Compute the Reduced Column Echelon form of the input matrix in-place.

After the computation A = [V] such that AX = R is a reduced col echelon [M 0] decomposition of A, where X = P^T [V] and R = Q [Ir] [0 In-r] [M 0] Qt = Q^T If transform=false, the matrix X is not computed and the matrix A = R

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix
	lda	leading dimension of A
	P	the column permutation
	Qt	the row position of the pivots in the echelon form
	transform	decides whether X is computed
	LuTag	chooses the elimination algorithm. SlabRecursive for LUdivine, TileRecursive for PLUQ

15.21.3.32 pReducedColumnEchelonForm()

```
size_t pReducedColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )  [inline]
```

15.21.3.33 ReducedColumnEchelonForm() [2/3]

```
size_t ReducedColumnEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag,
            const PSHelper & psH )  [inline]
```

15.21.3.34 ReducedRowEchelonForm() [1/3]

```
size_t ReducedRowEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )  [inline]
```

Compute the Reduced Row Echelon form of the input matrix in-place.

After the computation A = [V1 M] such that X A = R is a reduced row echelon [V2 0] decomposition of A, where X = [V1 0] P and R = [Ir M] Q^T [V2 In-r] [0] Qt = Q^T If transform=false, the matrix X is not computed and the matrix A = R

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix
	lda	leading dimension of A
	P	the row permutation
	Qt	the column position of the pivots in the echelon form
	transform	decides whether X is computed
	LuTag	chooses the elimination algorithm. SlabRecursive for LUdivine, TileRecursive for PLUQ

15.21.3.35 pReducedRowEchelonForm()

```
size_t pReducedRowEchelonForm (
            const Field & F,
```

```
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform = false,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )  [inline]
```

15.21.3.36 ReducedRowEchelonForm() [2/3]

```
size_t ReducedRowEchelonForm (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag,
            const PSHelper & psH )  [inline]
```

15.21.3.37 Invert() [1/4]

```
Field::Element_ptr FFPACK::Invert (
            const Field & F,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            int & nullity )
```

Invert the given matrix in place or computes its nullity if it is singular.

An inplace $2n^3$ algorithm is used.

Parameters

	F	The computation domain
	M	order of the matrix
in,out	*A*	input matrix ($M \times M$)
	lda	leading dimension of A
	nullity	dimension of the kernel of A

Returns

pointer to A and $A \leftarrow A^{-1}$

15.21.3.38 Invert() [2/4]

```
Field::Element_ptr FFPACK::Invert (
            const Field & F,
            const size_t M,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            int & nullity )
```

Invert the given matrix or computes its nullity if it is singular.

Precondition

X is preallocated and should be large enough to store the $m \times m$ matrix A.

Parameters

	F	The computation domain
	M	order of the matrix
in	*A*	input matrix ($M \times M$)
	lda	leading dimension of A
out	*X*	this is the inverse of A if A is invertible (non NULL and **nullity** $= 0$). It is untouched otherwise.
	ldx	leading dimension of X
	nullity	dimension of the kernel of A

Returns

pointer to $X = A^{-1}$

15.21.3.39 Invert2() [1/2]

```
Field::Element_ptr FFPACK::Invert2 (
            const Field & F,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            int & nullity )
```

Invert the given matrix or computes its nullity if it is singular.

An $2n^3 f$ algorithm is used. This routine can be % faster than FFPACK::Invert but is not totally inplace.

Precondition

X is preallocated and should be large enough to store the $m \times m$ matrix A.

Warning

A is overwritten here !

Bug not tested.

Parameters

	F	the computation domain
	M	order of the matrix
in,out	*A*	input matrix ($M \times M$). On output, A is modified and represents a "psycological" factorisation LU.
	lda	leading dimension of A
out	*X*	this is the inverse of A if A is invertible (non NULL and $\texttt{nullity} = 0$). It is untouched otherwise.
	ldx	leading dimension of X
	nullity	dimension of the kernel of A

Returns

pointer to $X = A^{-1}$

Todo this init is not all necessary (done after ftrtri)

15.21.3.40 CharPoly() [1/8]

```
std::list< typename PolRing::Element > & CharPoly (
            const PolRing & R,
            std::list< typename PolRing::Element > & charp,
            const size_t N,
            typename PolRing::Domain_t::Element_ptr A,
            const size_t lda,
            typename PolRing::Domain_t::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag = FfpackAuto,
            const size_t degree = __FFLASFFPACK_ARITHPROG_THRESHOLD )  [inline]
```

Compute the characteristic polynomial of the matrix A.

Parameters

	R	the polynomial ring of charp (contains the base field)
out	*charp*	the characteristic polynomial of as a list of factors
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$) (could be overwritten in some algorithmic variants)
	lda	leading dimension of A
	CharpTag	the algorithmic variant
	G	a random iterator (required for the randomized variants LUKrylov and ArithProg)

15.21.3.41 CharPoly() [2/8]

```
PolRing::Element & CharPoly (
            const PolRing & R,
            typename PolRing::Element & charp,
            const size_t N,
            typename PolRing::Domain_t::Element_ptr A,
            const size_t lda,
            typename PolRing::Domain_t::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag = FfpackAuto,
            const size_t degree = __FFLASFFPACK_ARITHPROG_THRESHOLD )  [inline]
```

Compute the characteristic polynomial of the matrix A.

Parameters

	R	the polynomial ring of charp (contains the base field)
out	*charp*	the characteristic polynomial of as a single polynomial
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$) (could be overwritten in some algorithmic variants)
	lda	leading dimension of A
	CharpTag	the algorithmic variant
	G	a random iterator (required for the randomized variants LUKrylov and ArithProg)

15.21.3.42 CharPoly() [3/8]

```
PolRing::Element& FFPACK::CharPoly (
            const PolRing & R,
            typename PolRing::Element & charp,
            const size_t N,
            typename PolRing::Domain_t::Element_ptr A,
            const size_t lda,
            const FFPACK_CHARPOLY_TAG CharpTag = FfpackAuto,
            const size_t degree = __FFLASFFPACK_ARITHPROG_THRESHOLD )  [inline]
```

Compute the characteristic polynomial of the matrix A.

Parameters

	R	the polynomial ring of charp (contains the base field)
out	*charp*	the characteristic polynomial of as a single polynomial
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$) (could be overwritten in some algorithmic variants)
	lda	leading dimension of A
	CharpTag	the algorithmic variant

15.21.3.43 MinPoly() [1/4]

```
Polynomial& FFPACK::MinPoly (
            const Field & F,
            Polynomial & minP,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda )
```

Compute the minimal polynomial of the matrix A.

The algorithm is randomized probabilistic, and computes the minimal polynomial of the Krylov iterates of a random vector: (v, Av, .., A^kv)

Parameters

	F	the base field
out	*minP*	the minimal polynomial of A
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$)
	lda	leading dimension of A

15.21.3.44 MinPoly() [2/4]

```
Polynomial& FFPACK::MinPoly (
            const Field & F,
            Polynomial & minP,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            RandIter & G )
```

Compute the minimal polynomial of the matrix A.

The algorithm is randomized probabilistic, and computes the minimal polynomial of the Krylov iterates of a random vector: (v, Av, .., A^kv)

Parameters

	F	the base field
out	*minP*	the minimal polynomial of A
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$)
	lda	leading dimension of A
	G	a random iterator

15.21.3.45 MatVecMinPoly() [1/2]

```
Polynomial& FFPACK::MatVecMinPoly (
            const Field & F,
            Polynomial & minP,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr v,
            const size_t incv )
```

Compute the minimal polynomial of the matrix A and a vector v, namely the first linear dependency relation in the Krylov basis $(v, Av, ..., A^N v)$.

Parameters

	F	the base field
out	*minP*	the minimal polynomial of A and v
	N	order of the matrix A
in	*A*	the input matrix ($N \times N$)
	lda	leading dimension of A
	K	an $N \times (N+1)$ matrix containing the vector v on its first row
	ldk	leading dimension of K
	P	[out] (optional) the permutation used in the elimination of the Krylov matrix K

15.21.3.46 Rank() [1/3]

```
size_t FFPACK::Rank (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

Computes the rank of the given matrix using a PLUQ factorization.

The input matrix is modified.

Parameters

	F	base field
	M	row dimension of the matrix
	N	column dimension of the matrix
in	*A*	input matrix
	lda	leading dimension of A
	psH	(optional) a ParSeqHelper to choose between sequential and parallel execution

15.21.3.47 pRank()

```
size_t FFPACK::pRank (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t numthreads = 0 )
```

15.21.3.48 Rank() [2/3]

```
size_t FFPACK::Rank (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const PSHelper & psH )
```

15.21.3.49 IsSingular() [1/2]

```
bool FFPACK::IsSingular (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

Returns true if the given matrix is singular.

The method is a block elimination with early termination

using LQUP factorization with early termination. If `M != N`, then the matrix is virtually padded with zeros to make it square and it's determinant is zero.

Warning

The input matrix is modified.

Parameters

	F	base field
	M	row dimension of the matrix
	N	column dimension of the matrix.
in,out	*A*	input matrix
	lda	leading dimension of A

15.21.3.50 Det() [1/6]

```
Field::Element& FFPACK::Det (
        const Field & F,
        typename Field::Element & det,
        const size_t N,
        typename Field::Element_ptr A,
        const size_t lda,
        size_t * P = NULL,
        size_t * Q = NULL )
```

Returns the determinant of the given square matrix.

The method is a block elimination using PLUQ factorization. The input matrix A is overwritten.

Warning

The input matrix is modified.

Parameters

	F	base field
out	*det*	the determinant of A
	N	the order of the square matrix A.
in,out	*A*	input matrix
	lda	leading dimension of A
	psH	(optional) a ParSeqHelper to choose between sequential and parallel execution
	P,Q	(optional) row and column permutations to be used by the PLUQ factorization. randomized checkers (see cherckes/checker_det.inl) need them for certification

15.21.3.51 pDet()

```
Field::Element& FFPACK::pDet (
        const Field & F,
        typename Field::Element & det,
        const size_t N,
        typename Field::Element_ptr A,
        const size_t lda,
        size_t numthreads = 0,
        size_t * P = NULL,
        size_t * Q = NULL )
```

15.21.3.52 Det() [2/6]

```
Field::Element& FFPACK::Det (
        const Field & F,
        typename Field::Element & det,
        const size_t N,
        typename Field::Element_ptr A,
        const size_t lda,
        const PSHelper & psH,
        size_t * P = NULL,
        size_t * Q = NULL )
```

15.21.3.53 Solve() [1/3]

```
Field::Element_ptr FFPACK::Solve (
        const Field & F,
        const size_t M,
        typename Field::Element_ptr A,
        const size_t lda,
        typename Field::Element_ptr x,
        const int incx,
        typename Field::ConstElement_ptr b,
        const int incb )
```

Solves a linear system AX = b using PLUQ factorization.

@oaram F base field @oaram M matrix order

Parameters

in	*A*	input matrix
	lda	leading dimension of A
out	*x*	output solution vector
	incx	increment of x
	b	input right hand side of the system
	incb	increment of b

15.21.3.54 Solve() [2/3]

```
Field::Element_ptr FFPACK::Solve (
        const Field & F,
        const size_t M,
        typename Field::Element_ptr A,
        const size_t lda,
        typename Field::Element_ptr x,
        const int incx,
        typename Field::ConstElement_ptr b,
```

```
            const int incb,
            PSHelper & psH )
```

15.21.3.55 pSolve()

```
Field::Element_ptr FFPACK::pSolve (
            const Field & F,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr x,
            const int incx,
            typename Field::ConstElement_ptr b,
            const int incb,
            size_t numthreads = 0 )
```

15.21.3.56 RandomNullSpaceVector() [1/3]

```
* void FFPACK::RandomNullSpaceVector (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t incX )
```

Solve L X = B or X L = B in place.

L is M∗M if Side == FFLAS::FflasLeft and N∗N if Side == FFLAS::FflasRight, B is M∗N. Only the R non trivial column of L are stored in the M∗R matrix L Requirement : so that L could be expanded in-place Computes a vector of the Left/Right nullspace of the matrix A.

Parameters

	F	The computation domain
	Side	decides whether it computes the left (FflasLeft) or right (FflasRight) nullspace
	M	number of rows
	N	number of columns
in,out	*A*	input matrix of dimension M x N, A is modified to its LU version
	lda	leading dimension of A
out	*X*	output vector
	incX	increment of X

15.21.3.57 NullSpaceBasis() [1/2]

```
size_t FFPACK::NullSpaceBasis (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr & NS,
            size_t & ldn,
            size_t & NSdim )
```

Computes a basis of the Left/Right nullspace of the matrix A.

return the dimension of the nullspace.

Parameters

	F	The computation domain
	Side	decides whether it computes the left (FflasLeft) or right (FflasRight) nullspace
	M	number of rows
	N	number of columns
in,out	*A*	input matrix of dimension M x N, A is modified
	lda	leading dimension of A
out	*NS*	output matrix of dimension N x NSdim (allocated here)
out	*ldn*	leading dimension of NS
out	*NSdim*	the dimension of the Nullspace (N-rank(A))

15.21.3.58 RowRankProfile() [1/3]

```
size_t FFPACK::RowRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Computes the row rank profile of A.

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix of dimension M x N
	lda	leading dimension of A
out	*rkprofile*	return the rank profile as an array of row indexes, of dimension r=rank(A)
	LuTag	chooses the elimination algorithm. SlabRecursive for LUdivine, TileRecursive for PLUQ

A is modified rkprofile is allocated during the computation.

Returns

R

15.21.3.59 pRowRankProfile()

```
size_t FFPACK::pRowRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )
```

15.21.3.60 RowRankProfile() [2/3]

```
size_t FFPACK::RowRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag,
            PSHelper & psH )
```

15.21.3.61 ColumnRankProfile() [1/3]

```
size_t FFPACK::ColumnRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Computes the column rank profile of A.

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix of dimension
	lda	leading dimension of A
out	*rkprofile*	return the rank profile as an array of row indexes, of dimension r=rank(A)

A is modified rkprofile is allocated during the computation.

Returns

R

15.21.3.62 pColumnRankProfile()

```
size_t FFPACK::pColumnRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            size_t numthreads = 0,
            const FFPACK_LU_TAG LuTag = FfpackTileRecursive )
```

15.21.3.63 ColumnRankProfile() [2/3]

```
size_t FFPACK::ColumnRankProfile (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag,
            PSHelper & psH )
```

15.21.3.64 RankProfileFromLU()

```
void RankProfileFromLU (
            const size_t * P,
            const size_t N,
            const size_t R,
            size_t * rkprofile,
            const FFPACK_LU_TAG LuTag )  [inline]
```

Recovers the column/row rank profile from the permutation of an LU decomposition.

Works with both the CUP/PLE decompositions (obtained by LUdivine) or the PLUQ decomposition. Assumes that the output vector containing the rank profile is already allocated.

Parameters

	P	the permutation carrying the rank profile information
	N	the row/col dimension for a row/column rank profile
	R	the rank of the matrix
out	*rkprofile*	return the rank profile as an array of indices
	LuTag	chooses the elimination algorithm. SlabRecursive for LUdivine, TileRecursive for PLUQ

15.21.3.65 LeadingSubmatrixRankProfiles()

```
size_t LeadingSubmatrixRankProfiles (
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t LSm,
            const size_t LSn,
            const size_t * P,
            const size_t * Q,
            size_t * RRP,
            size_t * CRP )  [inline]
```

Recovers the row and column rank profiles of any leading submatrix from the PLUQ decomposition.

Only works with the PLUQ decomposition Assumes that the output vectors containing the rank profiles are already allocated.

Parameters

P	the permutation carrying the rank profile information
M	the row dimension of the initial matrix
N	the column dimension of the initial matrix
R	the rank of the initial matrix
LSm	the row dimension of the leading submatrix considered
LSn	the column dimension of the leading submatrix considered
P	the row permutation of the PLUQ decomposition
Q	the column permutation of the PLUQ decomposition
RRP	return the row rank profile of the leading submatrix

Returns

the rank of the LSm x LSn leading submatrix

A is modified

Bibliography
- Dumas J-G., Pernet C., and Sultan Z. `Simultaneous` *computation of the row and column rank profiles* , ISSAC'13.

15.21.3.66 RowRankProfileSubmatrixIndices() [1/2]

```
size_t FFPACK::RowRankProfileSubmatrixIndices (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rowindices,
            size_t *& colindices,
            size_t & R )
```

RowRankProfileSubmatrixIndices.

Computes the indices of the submatrix r*r X of A whose rows correspond to the row rank profile of A.

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix of dimension
	rowindices	array of the row indices of X in A
	colindices	array of the col indices of X in A
	lda	leading dimension of A
out	*R*	list of indices

rowindices and colindices are allocated during the computation. A is modified

Returns

R

15.21.3.67 ColRankProfileSubmatrixIndices() [1/2]

```
size_t FFPACK::ColRankProfileSubmatrixIndices (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t *& rowindices,
            size_t *& colindices,
            size_t & R )
```

Computes the indices of the submatrix r*r X of A whose columns correspond to the column rank profile of A.

Parameters

	F	base field
	M	number of rows

Parameters

	N	number of columns
in	*A*	input matrix of dimension
	rowindices	array of the row indices of X in A
	colindices	array of the col indices of X in A
	lda	leading dimension of A
out	*R*	list of indices

rowindices and colindices are allocated during the computation.

Warning

A is modified

Returns

R

15.21.3.68 RowRankProfileSubmatrix() [1/2]

```
size_t FFPACK::RowRankProfileSubmatrix (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr & X,
            size_t & R )
```

Computes the r*r submatrix X of A, by picking the row rank profile rows of A.

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix of dimension M x N
	lda	leading dimension of A
out	*X*	the output matrix
out	*R*	list of indices

A is not modified X is allocated during the computation.

Returns

R

15.21.3.69 ColRankProfileSubmatrix() [1/2]

```
size_t FFPACK::ColRankProfileSubmatrix (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr & X,
            size_t & R )
```

Compute the $r \times r$ submatrix X of A, by picking the row rank profile rows of A.

Parameters

	F	base field
	M	number of rows
	N	number of columns
in	*A*	input matrix of dimension M x N
	lda	leading dimension of A
out	*X*	the output matrix
out	*R*	list of indices

A is not modified X is allocated during the computation.

Returns

R

15.21.3.70 getTriangular() [1/2]

```
void FFPACK::getTriangular (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr T,
            const size_t ldt,
            const bool OnlyNonZeroVectors = false )
```

Extracts a triangular matrix from a compact storage A=L\U of rank R.

if OnlyNonZeroVectors is false, then T and A have the same dimensions Otherwise, T is R x N if UpLo = FflasUpper, else T is M x R

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is returned
	diag	selects if the triangular matrix unit-diagonal (FflasUnit/NoUnit)
	M	row dimension of T
	N	column dimension of T
	R	rank of the triangular matrix (how many rows/columns need to be copied)
in	*A*	input matrix
	lda	leading dimension of A
out	*T*	output matrix
	ldt	leading dimension of T
	OnlyNonZeroVectors	decides whether the last zero rows/columns should be ignored

Todo just one triangular fzero+fassign ?

15.21.3.71 getTriangular() [2/2]

```
void FFPACK::getTriangular (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            typename Field::Element_ptr A,
            const size_t lda )
```

Cleans up a compact storage A=L\U to reveal a triangular matrix of rank R.

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is revealed
	diag	selects if the triangular matrix unit-diagonal (FflasUnit/NoUnit)
	M	row dimension of A
	N	column dimension of A
	R	rank of the triangular matrix
in,out	*A*	input/output matrix
	lda	leading dimension of A

Todo just one triangular fzero+fassign ?

15.21.3.72 getEchelonForm() [1/2]

```
void FFPACK::getEchelonForm (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr T,
            const size_t ldt,
            const bool OnlyNonZeroVectors = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or ColumnEchelonForm.

Either L or U is in Echelon form (depending on Uplo) The echelon structure is defined by the first R values of the array P. row and column dimension of T are greater or equal to that of A

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is returned
	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of T
	N	column dimension of T
	R	rank of the triangular matrix (how many rows/columns need to be copied)
	P	positions of the R pivots
in	*A*	input matrix
	lda	leading dimension of A
out	*T*	output matrix
	ldt	leading dimension of T
	OnlyNonZeroVectors	decides whether the last zero rows/columns should be ignored
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)

15.21.3.73 getEchelonForm() [2/2]

```
void FFPACK::getEchelonForm (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
```

```
            const size_t * P,
            typename Field::Element_ptr A,
            const size_t lda,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Cleans up a compact storage A=L\U obtained by RowEchelonForm or ColumnEchelonForm to reveal an echelon form of rank R.

Either L or U is in Echelon form (depending on Uplo) The echelon structure is defined by the first R values of the array P.

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is returned
	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of A
	N	column dimension of A
	R	rank of the triangular matrix (how many rows/columns need to be copied)
	P	positions of the R pivots
in,out	*A*	input/output matrix
	lda	leading dimension of A
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)

15.21.3.74 getEchelonTransform()

```
void FFPACK::getEchelonTransform (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr T,
            const size_t ldt,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by Row↩EchelonForm or ColumnEchelonForm.

If Uplo == FflasLower: T is N x N (already allocated) such that A T = C is a transformation of A in Column echelon form Else T is M x M (already allocated) such that T A = E is a transformation of A in Row Echelon form

Parameters

	F	base field
	UpLo	Lower (FflasLower) means Transformation to Column Echelon Form, Upper (FflasUpper), to Row Echelon Form

Parameters

	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of A
	N	column dimension of A
	R	rank of the triangular matrix
	P	permutation matrix
in	*A*	input matrix
	lda	leading dimension of A
out	*T*	output matrix
	ldt	leading dimension of T
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)

15.21.3.75 getReducedEchelonForm() [1/2]

```
void FFPACK::getReducedEchelonForm (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr T,
            const size_t ldt,
            const bool OnlyNonZeroVectors = false,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.

Either L or U is in Echelon form (depending on Uplo) The echelon structure is defined by the first R values of the array P. row and column dimension of T are greater or equal to that of A

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is returned
	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of T
	N	column dimension of T
	R	rank of the triangular matrix (how many rows/columns need to be copied)
	P	positions of the R pivots
in	*A*	input matrix
	lda	leading dimension of A
	ldt	leading dimension of T
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)
	OnlyNonZeroVectors	decides whether the last zero rows/columns should be ignored

15.21.3.76 getReducedEchelonForm() [2/2]

```
void FFPACK::getReducedEchelonForm (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            typename Field::Element_ptr A,
            const size_t lda,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Cleans up a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumn↩ EchelonForm with transform = true.

Either L or U is in Echelon form (depending on Uplo) The echelon structure is defined by the first R values of the array P.

Parameters

	F	base field
	UpLo	selects if the upper (FflasUpper) or lower (FflasLower) triangular matrix is returned
	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of A
	N	column dimension of A
	R	rank of the triangular matrix (how many rows/columns need to be copied)
	P	positions of the R pivots
in,out	*A*	input/output matrix
	lda	leading dimension of A
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)

15.21.3.77 getReducedEchelonTransform()

```
void FFPACK::getReducedEchelonTransform (
            const Field & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr T,
            const size_t ldt,
            const FFPACK_LU_TAG LuTag = FfpackSlabRecursive )
```

Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by Row←EchelonForm or ColumnEchelonForm.

If Uplo == FflasLower: T is N x N (already allocated) such that A T = C is a transformation of A in Column echelon form Else T is M x M (already allocated) such that T A = E is a transformation of A in Row Echelon form

Parameters

	F	base field
	UpLo	selects Col (FflasLower) or Row (FflasUpper) Echelon Form
	diag	selects if the echelon matrix has unit pivots (FflasUnit/NoUnit)
	M	row dimension of A
	N	column dimension of A
	R	rank of the triangular matrix
	P	permutation matrix
in	*A*	input matrix
	lda	leading dimension of A
out	*T*	output matrix
	ldt	leading dimension of T
	LuTag	which factorized form (CUP/PLE if FfpackSlabRecursive, PLUQ if FfpackTileRecursive)

15.21.3.78 PLUQtoEchelonPermutation()

```
void PLUQtoEchelonPermutation (
             const size_t N,
             const size_t R,
             const size_t * P,
             size_t * outPerm )  [inline]
```

Auxiliary routine: determines the permutation that changes a PLUQ decomposition into a echelon form revealing PLUQ decomposition.

15.21.3.79 LTBruhatGen()

```
size_t FFPACK::LTBruhatGen (
             const Field & Fi,
             const FFLAS::FFLAS_DIAG diag,
             const size_t N,
             typename Field::Element_ptr A,
             const size_t lda,
             size_t * P,
             size_t * Q )
```

LTBruhatGen Suppose A is Left Triangular Matrix This procedure computes the Bruhat Representation of A and return the rank of A.

Parameters

Fi	base Field
diag	
N	size of A
A	the matrix we search the Bruhat representation
lda	the leading dimension of A
P	a permutation matrix
Q	a permutation matrix

15.21.3.80 getLTBruhatGen() [1/2]

```
void FFPACK::getLTBruhatGen (
            const Field & Fi,
            const size_t N,
            const size_t r,
            const size_t * P,
            const size_t * Q,
            typename Field::Element_ptr R,
            const size_t ldr )
```

GetLTBruhatGen This procedure Computes the Rank Revealing Matrix based on the Bruhta representation of a Matrix.

Parameters

Fi	base Field
N	size of the matrix
r	the rank of the matrix
P	a permutation matrix
Q	a permutation matrix
R	the matrix that will contain the rank revealing matrix
ldr	the leading fimension of R

15.21.3.81 getLTBruhatGen() [2/2]

```
void FFPACK::getLTBruhatGen (
            const Field & Fi,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t N,
            const size_t r,
            const size_t * P,
            const size_t * Q,
            typename Field::ConstElement_ptr A,
            const size_t lda,
```

```
typename Field::Element_ptr T,
const size_t ldt )
```

GetLTBruhatGen This procedure computes the matrix L or U f the Bruhat Representation Suppose that A is the bruhat representation of a matrix.

Parameters

Fi	base Field
Uplo	choose if the procedure return L or U
diag	
N	size of A
r	rank of A
P	permutaion matrix
Q	permutation matrix
A	a bruhat representation
lda	leading dimension of A
T	matrix that will contains L or U
ldt	leading dimension of T

15.21.3.82 LTQSorder()

```
size_t LTQSorder (
            const size_t N,
            const size_t r,
            const size_t * P,
            const size_t * Q )  [inline]
```

LTQSorder This procedure computes the order of quasiseparability of a matrix.

Parameters

N	size of the matrix
r	rank of the matrix
P	permutation matrix
Q	permutation matrix

15.21.3.83 CompressToBlockBiDiagonal()

```
size_t FFPACK::CompressToBlockBiDiagonal (
            const Field & Fi,
            const FFLAS::FFLAS_UPLO Uplo,
            size_t N,
            size_t s,
            size_t r,
```

```
const size_t * P,
const size_t * Q,
typename Field::Element_ptr A,
size_t lda,
typename Field::Element_ptr X,
size_t ldx,
size_t * K,
size_t * M,
size_t * T )
```

CompressToBlockBiDiagonal This procedure compress a compact representation of a row echelon form or column echelon form.

Parameters

Fi	base Field
Uplo	chosse if the procedure is based on row or column
N	size of the matrix
s	order of qausiseparability
r	rank
P	permutation matrix
Q	permutation matrix
A	the matrix to compact
lda	leading dimension of A
X	matrix that will stock the representation
ldx	leading dimension of X
K	stock the position of the blocks in A
M	permutation matrix
T	stock the operation done in the procedure

15.21.3.84 ExpandBlockBiDiagonalToBruhat()

```
void FFPACK::ExpandBlockBiDiagonalToBruhat (
            const Field & Fi,
            const FFLAS::FFLAS_UPLO Uplo,
            size_t N,
            size_t s,
            size_t r,
            typename Field::Element_ptr A,
            size_t lda,
            typename Field::Element_ptr X,
            size_t ldx,
            size_t NbBlocks,
            size_t * K,
            size_t * M,
            size_t * T )
```

ExpandBlockBiDiagonal This procedure expand a compact representation of a row echelon form or column echelon form.

Parameters

Fi	base Field
Uplo	chosse if the procedure is based on row or column
N	size of the matrix
s	order of qausiseparability
r	rank
A	the matrix that will sotck the expanded representation
lda	leading dimension of A
X	matrix to expand
ldx	leading dimension of X
K	stock the position of the blocks in A
M	permutation matrix
T	stock the operation done in the procedure

15.21.3.85 Bruhat2EchelonPermutation()

```
void Bruhat2EchelonPermutation (
            size_t N,
            size_t R,
            const size_t * P,
            const size_t * Q,
            size_t * M )  [inline]
```

Bruhat2EchelonPermutation (N,R,P,Q) Compute M such that LM or MU is in echelon form where L or U are factors of the Bruhat Rpresentation.

Parameters

in	*N*	size of the matrix
in	*R*	rank
in	*P*	permutation Matrix
in	*Q*	permutation Matrix
out	*M*	output permutation matrix

15.21.3.86 TInverter() [1/2]

```
size_t* FFPACK::TInverter (
            size_t * T,
            size_t r )
```

15.21.3.87 ComputeRPermutation() [1/2]

```
void FFPACK::ComputeRPermutation (
            const Field & Fi,
            size_t N,
            size_t r,
            const size_t * P,
            const size_t * Q,
            size_t * R,
            size_t * MU,
            size_t * ML )
```

15.21.3.88 productBruhatxTS() [1/2]

```
void FFPACK::productBruhatxTS (
            const Field & Fi,
            size_t N,
            size_t s,
            size_t r,
            const size_t * P,
            const size_t * Q,
            const typename Field::Element_ptr Xu,
            size_t ldu,
            size_t NbBlocksU,
            size_t * Ku,
            size_t * Tu,
            size_t * MU,
            const typename Field::Element_ptr Xl,
            size_t ldl,
            size_t NbBlocksL,
            size_t * Kl,
            size_t * Tl,
            size_t * ML,
            typename Field::Element_ptr B,
            size_t t,
            size_t ldb,
            typename Field::Element_ptr C,
            size_t ldc )
```

productBruhatxTS Comput the product between the CRE compact representation of a matrix A and B a tall matrix

15.21.3.89 LQUPtoInverseOfFullRankMinor() [1/2]

```
Field::Element_ptr FFPACK::LQUPtoInverseOfFullRankMinor (
            const Field & F,
            const size_t rank,
            typename Field::Element_ptr A_factors,
            const size_t lda,
            const size_t * QtPointer,
            typename Field::Element_ptr X,
            const size_t ldx )
```

LQUPtoInverseOfFullRankMinor.

Suppose A has been factorized as L.Q.U.P, with rank r. Then Qt.A.Pt has an invertible leading principal r x r submatrix This procedure efficiently computes the inverse of this minor and puts it into X.

Note

It changes the lower entries of A_factors in the process (NB: unless A was nonsingular and square)

Parameters

F	base field
rank	rank of the matrix.
A_factors	matrix containing the L and U entries of the factorization
lda	leading dimension of A
QtPointer	theLQUP->getQ()->getPointer() (note: getQ returns Qt!)
X	desired location for output
ldx	leading dimension of X

15.21.3.90 RandomNullSpaceVector() [2/3]

```
void FFPACK::RandomNullSpaceVector (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t incX )
```

Solve L X = B or X L = B in place.

L is M∗M if Side == FFLAS::FflasLeft and N∗N if Side == FFLAS::FflasRight, B is M∗N. Only the R non trivial column of L are stored in the M∗R matrix L Requirement : so that L could be expanded in-place Computes a vector of the Left/Right nullspace of the matrix A.

Parameters

	F	The computation domain
	Side	decides whether it computes the left (FflasLeft) or right (FflasRight) nullspace
	M	number of rows
	N	number of columns
in,out	*A*	input matrix of dimension M x N, A is modified to its LU version
	lda	leading dimension of A
out	*X*	output vector
	incX	increment of X

15.21.3.91 solveLB() [1/2]

```
void FFPACK::solveLB (
            const Field & F,
```

```
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            typename Field::Element_ptr L,
            const size_t ldl,
            const size_t * Q,
            typename Field::Element_ptr B,
            const size_t ldb )
```

15.21.3.92 solveLB2() [1/2]

```
void FFPACK::solveLB2 (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            typename Field::Element_ptr L,
            const size_t ldl,
            const size_t * Q,
            typename Field::Element_ptr B,
            const size_t ldb )
```

15.21.3.93 TInverter() [2/2]

```
size_t* FFPACK::TInverter (
            const size_t * T,
            size_t r )  [inline]
```

15.21.3.94 ComputeRPermutation() [2/2]

```
void FFPACK::ComputeRPermutation (
            const Field & Fi,
            size_t N,
            size_t r,
            const size_t * P,
            const size_t * Q,
            size_t * R,
            const size_t * MU,
            const size_t * ML )  [inline]
```

15.21.3.95 expandLCRE()

```
Field::Element_ptr FFPACK::expandLCRE (
            const Field & Fi,
            size_t N,
            size_t s,
            size_t r,
            size_t * R,
            size_t i,
            typename Field::ConstElement_ptr Xu,
            size_t ldu,
            size_t NbBlocksU,
            const size_t * Ku,
            const size_t * Tuinv,
            typename Field::ConstElement_ptr Xl,
            size_t ldl,
            size_t NbBlocksL,
            const size_t * Kl,
            const size_t * Tlinv,
            typename Field::Element_ptr CRE,
            size_t ldcre ) [inline]
```

Expands an anti-diagonal block of a left triangular matrix from its compact Bruhat representation.

15.21.3.96 productBruhatxTS() [2/2]

```
void FFPACK::productBruhatxTS (
            const Field & Fi,
            size_t N,
            size_t s,
            size_t r,
            size_t t,
            const size_t * P,
            const size_t * Q,
            typename Field::ConstElement_ptr Xu,
            size_t ldu,
            size_t NbBlocksU,
            const size_t * Ku,
            const size_t * Tu,
            const size_t * MU,
            typename Field::ConstElement_ptr Xl,
            size_t ldl,
            size_t NbBlocksL,
            const size_t * Kl,
            const size_t * Tl,
            const size_t * ML,
            typename Field::Element_ptr B,
            size_t ldb,
            const typename Field::Element beta,
            typename Field::Element_ptr D,
            size_t ldd ) [inline]
```

Compute the product of a left-triangular quasi-separable matrix A, represented by a compact Bruhat generator, with a dense rectangular matrix B: $C \leftarrow A \times B + betaC$.

Parameters

	F	the base field
	N	the order of `A`
	s	the order of quasiseparability of `A`
	r	the number of pivots in the left-triangular par of the rank profile matrix of `A`
	t	the number of columns of `B`
	P	the row indices of the pivots of `A`
	Q	the column indices of the pivots of `A`
	Xu	the compact storage of U: Du blocks in the first s rows, Su blocks in the last s rows
	ldxu	the leading dimension of `Xu`
	NbBlocksU	the number of diagonal blocks in the compact storage of U
	Ku	the list of starting column positions for each block of the storage of U
	Tu	the folding matrix for the compact storage of U: $Du + TuSu$ is in row echelon form
	Mu	a permutation matrix such that $Mu(Du + TuSu)$ is the U factor of the Bruhat generator
	Xl	the compact storage of L: Dl blocks in the first s columns, Sl blocks in the last s columns
	ldxl	the leading dimension of `Xl`
	NbBlocksL	the number of diagonal blocks in the compact storage of L
	Kl	the list of starting row positions for each block of the storage of L
	Tl	the folding matrix for the compact storage of L: $Dl + SlTl$ is in column echelon form
	Ml	a permutation matrix such that $(Dl + TlSl)Ml$ is the L factor of the Bruhat generator
	B	an $N \times t$ dense matrix
	ldb	leading dimension of `B`
	beta	scaling constant
`in,out`	*C*	output matrix
	ldc	leading dimension of `C`

Bibliography Pernet C. and Storjohann A. `Time` *and space efficient generators for quasiseparable matrices* , JSC (85), 2018, doi:10.1016/j.jsc.2017.07.010

15.21.3.97 Danilevski()

```
std::list<Polynomial>& FFPACK::Danilevski (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

15.21.3.98 buildMatrix()

```
Field::Element_ptr FFPACK::buildMatrix (
            const Field & F,
            typename Field::ConstElement_ptr E,
            typename Field::ConstElement_ptr C,
            const size_t lda,
            const size_t * B,
            const size_t * T,
            const size_t me,
            const size_t mc,
            const size_t lambda,
            const size_t mu )
```

Bug is this :

15.21.3.99 CharPoly() [4/8]

```
FFPACK::RNSInteger<FFPACK::rns_double>::Element_ptr FFPACK::CharPoly (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr charp,
            const size_t N,
            typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A,
            const size_t lda,
            Givaro::ZRing< Givaro::Integer >::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag,
            size_t degree )  [inline]
```

15.21.3.100 CharPoly() [5/8]

```
Givaro::Poly1Dom<Givaro::ZRing<Givaro::Integer> >::Element& FFPACK::CharPoly (
            const Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > > & R,
            Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > >::Element & charp,
            const size_t N,
            Givaro::Integer * A,
            const size_t lda,
            Givaro::ZRing< Givaro::Integer >::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag,
            size_t degree )  [inline]
```

15.21.3.101 Det() [3/6]

```
FFPACK::RNSInteger<FFPACK::rns_double>::Element_ptr& FFPACK::Det (
            const FFPACK::RNSInteger< FFPACK::rns_double > & F,
            typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr & det,
            const size_t N,
            typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A,
            const size_t lda,
            const PSHelper & psH )  [inline]
```

15.21.3.102 Det() [4/6]

```
Givaro::Integer& FFPACK::Det (
            const Givaro::ZRing< Givaro::Integer > & F,
            Givaro::Integer & det,
            const size_t N,
            Givaro::Integer * A,
            const size_t lda,
            const PSHelper & psH,
            size_t * P,
            size_t * Q )  [inline]
```

15.21.3.103 fsytrf_BC_Crout()

```
bool FFPACK::fsytrf_BC_Crout (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv )  [inline]
```

15.21.3.104 fsytrf_BC_RL()

```
size_t FFPACK::fsytrf_BC_RL (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv )  [inline]
```

15.21.3.105 fsytrf_UP_RPM_BC_RL()

```
size_t FFPACK::fsytrf_UP_RPM_BC_RL (
            const Field & F,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            size_t * P )  [inline]
```

15.21.3.106 fsytrf_LOW_RPM_BC_Crout()

```
size_t FFPACK::fsytrf_LOW_RPM_BC_Crout (
            const Field & F,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            size_t * P )  [inline]
```

15.21.3.107 fsytrf_UP_RPM_BC_Crout()

```
size_t FFPACK::fsytrf_UP_RPM_BC_Crout (
            const Field & F,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            size_t * P )  [inline]
```

15.21.3.108 fsytrf_UP_RPM()

```
size_t FFPACK::fsytrf_UP_RPM (
            const Field & Fi,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            size_t * P,
            size_t BCThreshold )  [inline]
```

MathP <-[[I] x P1 |] [I_(N1+R2)] [P2^T] |] x [P3^T] [-------------—|--—] [| Q2^T]

Changing [U1 V1 | E1 E21 E22] into [U1 E11 E12 V1 E∗ E∗] [0 | L2 \ U2 V21 V22] [U4 V41 0 V42 V43] [0 | M2 0 0] [U3 0 0 V3] [---—|--------------—] [0 0 0] [0 | H1 H21 H22] [0 | U3 V3] [0 | 0] where U4 is the 2R2 x 2R2 matrix formed by interleaving U2, L2^T and H1

15.21.3.109 fsytrf_nonunit() [2/3]

```
bool FFPACK::fsytrf_nonunit (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            FFLAS::ParSeqHelper::Sequential seq,
            size_t threshold )  [inline]
```

15.21.3.110 fsytrf_nonunit() [3/3]

```
bool FFPACK::fsytrf_nonunit (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr Dinv,
            const size_t incDinv,
            FFLAS::ParSeqHelper::Parallel< Cut, Param > par,
            size_t threshold ) [inline]
```

15.21.3.111 fsytrf_RPM()

```
size_t FFPACK::fsytrf_RPM (
            const Field & F,
            const FFLAS::FFLAS_UPLO UpLo,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t threshold ) [inline]
```

15.21.3.112 getTridiagonal()

```
void FFPACK::getTridiagonal (
            const Field & F,
            const size_t N,
            const size_t R,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            size_t * P,
            typename Field::Element_ptr T,
            const size_t ldt ) [inline]
```

15.21.3.113 LUdivine_gauss() [1/2]

```
size_t FFPACK::LUdivine_gauss (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag ) [inline]
```

15.21.3.114 LUdivine_small() [1/2]

```
size_t FFPACK::LUdivine_small (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag )  [inline]
```

15.21.3.115 LUdivine() [2/4]

```
size_t FFPACK::LUdivine (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag,
            const size_t cutoff )  [inline]
```

Todo std::swap ?

15.21.3.116 LUdivine() [3/4]

```
size_t FFPACK::LUdivine (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            typename Givaro::Integer * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag,
            const size_t cutoff )  [inline]
```

15.21.3.117 MonotonicCompress()

```
void FFPACK::MonotonicCompress (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t incA,
            const size_t * MathP,
            const size_t R,
            const size_t maxpiv,
            const size_t rowstomove,
            const std::vector< bool > & ispiv ) [inline]
```

15.21.3.118 MonotonicCompressMorePivots()

```
void FFPACK::MonotonicCompressMorePivots (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t incA,
            const size_t * MathP,
            const size_t R,
            const size_t rowstomove,
            const size_t lenP ) [inline]
```

15.21.3.119 MonotonicCompressCycles()

```
void FFPACK::MonotonicCompressCycles (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t incA,
            const size_t * MathP,
            const size_t lenP ) [inline]
```

15.21.3.120 MonotonicExpand()

```
void FFPACK::MonotonicExpand (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t incA,
            const size_t * MathP,
            const size_t R,
            const size_t maxpiv,
            const size_t rowstomove,
            const std::vector< bool > & ispiv )
```

15.21.3.121 applyP_block()

```
void FFPACK::applyP_block (
            const Field & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t * P )  [inline]
```

15.21.3.122 doApplyS()

```
void FFPACK::doApplyS (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.123 MatrixApplyS() [1/3]

```
void FFPACK::MatrixApplyS (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.124 MatrixApplyS() [2/3]

```
void FFPACK::MatrixApplyS (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            const FFLAS::ParSeqHelper::Sequential seq )  [inline]
```

15.21.3.125 MatrixApplyS() [3/3]

```
void FFPACK::MatrixApplyS (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            const FFLAS::ParSeqHelper::Parallel< Cut, Param > par )  [inline]
```

15.21.3.126 PermApplyS()

```
void FFPACK::PermApplyS (
            T * A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.127 doApplyT()

```
void FFPACK::doApplyT (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.128 MatrixApplyT() [1/3]

```
void FFPACK::MatrixApplyT (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.129 MatrixApplyT() [2/3]

```
void FFPACK::MatrixApplyT (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t N2,
```

```
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            const FFLAS::ParSeqHelper::Sequential seq )  [inline]
```

15.21.3.130 MatrixApplyT() [3/3]

```
void FFPACK::MatrixApplyT (
            const Field & F,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            const FFLAS::ParSeqHelper::Parallel< Cut, Param > par )  [inline]
```

15.21.3.131 PermApplyT()

```
void FFPACK::PermApplyT (
            T * A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )  [inline]
```

15.21.3.132 composePermutationsLLL()

```
void composePermutationsLLL (
            size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N )  [inline]
```

Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.

Parameters

in,out	*P1*	a LAPACK permutation of size N
	P2	a LAPACK permutation of size N-R

15.21.3.133 composePermutationsLLM()

```
void composePermutationsLLM (
            size_t * MathP,
            const size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N ) [inline]
```

Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in MathP as a MathPermutation format.

Parameters

out		

15.21.3.134 composePermutationsMLM()

```
void composePermutationsMLM (
            size_t * MathP1,
            const size_t * P2,
            const size_t R,
            const size_t N ) [inline]
```

Computes MathP1 x Diag (I_R, P2) where MathP1 is a MathPermutation and P2 a LAPACK permutation and store the result in MathP1 as a MathPermutation format.

Parameters

in,out	*MathP1*	a MathPermutation of size N
	P2	a LAPACK permutation of size N-R

15.21.3.135 cyclic_shift_mathPerm()

```
void cyclic_shift_mathPerm (
            size_t * P,
            const size_t s ) [inline]
```

15.21.3.136 cyclic_shift_row_col() [1/2]

```
void FFPACK::cyclic_shift_row_col (
            const Field & F,
            typename Field::Element_ptr A,
            size_t m,
            size_t n,
            size_t lda ) [inline]
```

15.21.3.137 cyclic_shift_row() [1/3]

```
void FFPACK::cyclic_shift_row (
            const Field & F,
            typename Field::Element_ptr A,
            size_t m,
            size_t n,
            size_t lda ) [inline]
```

15.21.3.138 cyclic_shift_row() [2/3]

```
void FFPACK::cyclic_shift_row (
            const RNSIntegerMod< T > & F,
            typename T::Element_ptr A,
            size_t m,
            size_t n,
            size_t lda ) [inline]
```

15.21.3.139 cyclic_shift_col() [1/3]

```
void FFPACK::cyclic_shift_col (
            const Field & F,
            typename Field::Element_ptr A,
            size_t m,
            size_t n,
            size_t lda ) [inline]
```

15.21.3.140 cyclic_shift_col() [2/3]

```
void FFPACK::cyclic_shift_col (
            const RNSIntegerMod< T > & F,
            typename T::Element_ptr A,
            size_t m,
            size_t n,
            size_t lda ) [inline]
```

15.21.3.141 PLUQ_basecaseV3()

```
size_t FFPACK::PLUQ_basecaseV3 (
            const Field & Fi,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element * A,
            const size_t lda,
            size_t * P,
            size_t * Q )  [inline]
```

15.21.3.142 PLUQ_basecaseV2()

```
size_t FFPACK::PLUQ_basecaseV2 (
            const Field & Fi,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element * A,
            const size_t lda,
            size_t * P,
            size_t * Q )  [inline]
```

15.21.3.143 PLUQ_basecaseCrout()

```
size_t FFPACK::PLUQ_basecaseCrout (
            const Field & Fi,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q )  [inline]
```

15.21.3.144 _PLUQ()

```
size_t FFPACK::_PLUQ (
            const Field & Fi,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            size_t BCThreshold )  [inline]
```

15.21.3.145 PLUQ() [4/6]

```
size_t FFPACK::PLUQ (
            const Givaro::Modular< Givaro::Integer > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Givaro::Integer * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            size_t BCThreshold,
            FFLAS::ParSeqHelper::Parallel< Cut, Param > & PSHelper )  [inline]
```

15.21.3.146 threads_fgemm()

```
void FFPACK::threads_fgemm (
            const size_t m,
            const size_t n,
            const size_t r,
            int nbthreads,
            size_t * W1,
            size_t * W2,
            size_t * W3,
            size_t gamma )
```

15.21.3.147 threads_ftrsm()

```
void FFPACK::threads_ftrsm (
            const size_t m,
            const size_t n,
            int nbthreads,
            size_t * t1,
            size_t * t2 )
```

15.21.3.148 PLUQ() [5/6]

```
size_t FFPACK::PLUQ (
            const Field & Fi,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter:
> & PSHelper )  [inline]
```

15.21.3.149 fflas_const_cast() [1/3]

```
rns_double_elt_ptr FFPACK::fflas_const_cast (
            rns_double_elt_cstptr x ) [inline]
```

15.21.3.150 fflas_const_cast() [2/3]

```
rns_double_elt_cstptr FFPACK::fflas_const_cast (
            rns_double_elt_ptr x ) [inline]
```

15.21.3.151 cyclic_shift_row_col() [2/2]

```
void FFPACK::cyclic_shift_row_col (
            Base_t * A,
            size_t m,
            size_t n,
            size_t lda )
```

15.21.3.152 cyclic_shift_row() [3/3]

```
template INST_OR_DECL void FFPACK::cyclic_shift_row (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            FFLAS_ELT * A,
            size_t m,
            size_t n,
            size_t lda )
```

15.21.3.153 cyclic_shift_col() [3/3]

```
template INST_OR_DECL void FFPACK::cyclic_shift_col (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            FFLAS_ELT * A,
            size_t m,
            size_t n,
            size_t lda )
```

15.21.3.154 applyP() [4/4]

```
template INST_OR_DECL void FFPACK::applyP (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            FFLAS_ELT * A,
            const size_t lda,
            const size_t * P )
```

15.21.3.155 fgetrs() [3/4]

```
template INST_OR_DECL void FFPACK::fgetrs (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            FFLAS_ELT * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            FFLAS_ELT * B,
            const size_t ldb,
            int * info )
```

15.21.3.156 fgetrs() [4/4]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::fgetrs (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            const size_t R,
            FFLAS_ELT * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            FFLAS_ELT * X,
            const size_t ldx,
            const FFLAS_ELT * B,
            const size_t ldb,
            int * info )
```

15.21.3.157 fgesv() [3/4]

```
template INST_OR_DECL size_t FFPACK::fgesv (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * B,
            const size_t ldb,
            int * info )
```

15.21.3.158 fgesv() [4/4]

```
template INST_OR_DECL size_t FFPACK::fgesv (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * X,
            const size_t ldx,
            const FFLAS_ELT * B,
            const size_t ldb,
            int * info )
```

15.21.3.159 ftrtri() [2/2]

```
template INST_OR_DECL void FFPACK::ftrtri (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            const size_t threshold )
```

15.21.3.160 trinv_left() [2/2]

```
template INST_OR_DECL void FFPACK::trinv_left (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t N,
            const FFLAS_ELT * L,
            const size_t ldl,
            FFLAS_ELT * X,
            const size_t ldx )
```

15.21.3.161 ftrtrm() [2/2]

```
template INST_OR_DECL void FFPACK::ftrtrm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE side,
            const FFLAS::FFLAS_DIAG diag,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda )
```

15.21.3.162 PLUQ() [6/6]

```
template INST_OR_DECL size_t FFPACK::PLUQ (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Q )
```

15.21.3.163 LUdivine() [4/4]

```
template INST_OR_DECL size_t FFPACK::LUdivine (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const FFPACK_LU_TAG LuTag,
            const size_t cutoff )
```

15.21.3.164 LUdivine_small() [2/2]

```
template INST_OR_DECL size_t FFPACK::LUdivine_small (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.165 LUdivine_gauss() [2/2]

```
template INST_OR_DECL size_t FFPACK::LUdivine_gauss (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.166 RowEchelonForm() [3/3]

```
template INST_OR_DECL size_t FFPACK::RowEchelonForm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.167 ReducedRowEchelonForm() [3/3]

```
template INST_OR_DECL size_t FFPACK::ReducedRowEchelonForm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.168 ColumnEchelonForm() [3/3]

```
template INST_OR_DECL size_t FFPACK::ColumnEchelonForm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.169 ReducedColumnEchelonForm() [3/3]

```
template INST_OR_DECL size_t FFPACK::ReducedColumnEchelonForm (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.170 Invert() [3/4]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::Invert (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            FFLAS_ELT * A,
            const size_t lda,
            int & nullity )
```

15.21.3.171 Invert() [4/4]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::Invert (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * X,
            const size_t ldx,
            int & nullity )
```

15.21.3.172 Invert2() [2/2]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::Invert2 (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * X,
            const size_t ldx,
            int & nullity )
```

15.21.3.173 CharPoly() [6/8]

```
template INST_OR_DECL std::list<Givaro::Poly1Dom<FFLAS_FIELD<FFLAS_ELT> >::Element>& FFPACK↩
::CharPoly (
            const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > & R,
            std::list< Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element > & charp,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_FIELD< FFLAS_ELT >::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag,
            const size_t degree )
```

15.21.3.174 CharPoly() [7/8]

```
template INST_OR_DECL Givaro::Poly1Dom<FFLAS_FIELD<FFLAS_ELT> >::Element& FFPACK::CharPoly (
            const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > & R,
            Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & charp,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_FIELD< FFLAS_ELT >::RandIter & G,
            const FFPACK_CHARPOLY_TAG CharpTag,
            const size_t degree )
```

15.21.3.175 CharPoly() [8/8]

```
template INST_OR_DECL Givaro::Poly1Dom<FFLAS_FIELD<FFLAS_ELT> >::Element& FFPACK::CharPoly (
            const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > & R,
            Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & charp,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            const FFPACK_CHARPOLY_TAG CharpTag,
            const size_t degree )
```

15.21.3.176 MinPoly() [3/4]

```
template INST_OR_DECL std::vector<FFLAS_ELT>& FFPACK::MinPoly (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            std::vector< FFLAS_ELT > & minP,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_FIELD< FFLAS_ELT >::RandIter & G )
```

15.21.3.177 MinPoly() [4/4]

```
template INST_OR_DECL std::vector<FFLAS_ELT>& FFPACK::MinPoly (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            std::vector< FFLAS_ELT > & minP,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda )
```

15.21.3.178 MatVecMinPoly() [2/2]

```
template INST_OR_DECL std::vector<FFLAS_ELT>& FFPACK::MatVecMinPoly (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            std::vector< FFLAS_ELT > & minP,
            const size_t N,
            const FFLAS_ELT * A,
            const size_t lda,
            const FFLAS_ELT * V,
            const size_t incv )
```

15.21.3.179 KrylovElim()

```
template INST_OR_DECL size_t FFPACK::KrylovElim (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const size_t deg,
            size_t * iterates,
            size_t * inviterates,
            const size_t maxit,
            size_t virt )
```

15.21.3.180 SpecRankProfile()

```
template INST_OR_DECL size_t FFPACK::SpecRankProfile (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            const size_t deg,
            size_t * rankProfile )
```

15.21.3.181 Rank() [3/3]

```
template INST_OR_DECL size_t FFPACK::Rank (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda )
```

15.21.3.182 IsSingular() [2/2]

```
template INST_OR_DECL bool FFPACK::IsSingular (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda )
```

15.21.3.183 Det() [5/6]

```
template INST_OR_DECL FFLAS_ELT& FFPACK::Det (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            FFLAS_ELT & det,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t * P,
            size_t * Q )
```

15.21.3.184 Det() [6/6]

```
template INST_OR_DECL FFLAS_ELT& FFPACK::Det (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            FFLAS_ELT & det,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter:
> & parH,
            size_t * P,
            size_t * Q )
```

15.21.3.185 Solve() [3/3]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::Solve (
              const FFLAS_FIELD< FFLAS_ELT > & F,
              const size_t M,
              FFLAS_ELT * A,
              const size_t lda,
              FFLAS_ELT * x,
              const int incx,
              const FFLAS_ELT * b,
              const int incb )
```

15.21.3.186 solveLB() [2/2]

```
template INST_OR_DECL void FFPACK::solveLB (
              const FFLAS_FIELD< FFLAS_ELT > & F,
              const FFLAS::FFLAS_SIDE Side,
              const size_t M,
              const size_t N,
              const size_t R,
              FFLAS_ELT * L,
              const size_t ldl,
              const size_t * Q,
              FFLAS_ELT * B,
              const size_t ldb )
```

15.21.3.187 solveLB2() [2/2]

```
template INST_OR_DECL void FFPACK::solveLB2 (
              const FFLAS_FIELD< FFLAS_ELT > & F,
              const FFLAS::FFLAS_SIDE Side,
              const size_t M,
              const size_t N,
              const size_t R,
              FFLAS_ELT * L,
              const size_t ldl,
              const size_t * Q,
              FFLAS_ELT * B,
              const size_t ldb )
```

15.21.3.188 RandomNullSpaceVector() [3/3]

```
template INST_OR_DECL void FFPACK::RandomNullSpaceVector (
              const FFLAS_FIELD< FFLAS_ELT > & F,
              const FFLAS::FFLAS_SIDE Side,
              const size_t M,
              const size_t N,
              FFLAS_ELT * A,
              const size_t lda,
              FFLAS_ELT * X,
              const size_t incX )
```

15.21.3.189 NullSpaceBasis() [2/2]

```
template INST_OR_DECL size_t FFPACK::NullSpaceBasis (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT *& NS,
            size_t & ldn,
            size_t & NSdim )
```

15.21.3.190 RowRankProfile() [3/3]

```
template INST_OR_DECL size_t FFPACK::RowRankProfile (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.191 ColumnRankProfile() [3/3]

```
template INST_OR_DECL size_t FFPACK::ColumnRankProfile (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t *& rkprofile,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.192 RowRankProfileSubmatrixIndices() [2/2]

```
template INST_OR_DECL size_t FFPACK::RowRankProfileSubmatrixIndices (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t *& rowindices,
            size_t *& colindices,
            size_t & R )
```

15.21.3.193 ColRankProfileSubmatrixIndices() [2/2]

```
template INST_OR_DECL size_t FFPACK::ColRankProfileSubmatrixIndices (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            size_t *& rowindices,
            size_t *& colindices,
            size_t & R )
```

15.21.3.194 RowRankProfileSubmatrix() [2/2]

```
template INST_OR_DECL size_t FFPACK::RowRankProfileSubmatrix (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT *& X,
            size_t & R )
```

15.21.3.195 ColRankProfileSubmatrix() [2/2]

```
template INST_OR_DECL size_t FFPACK::ColRankProfileSubmatrix (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t M,
            const size_t N,
            FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT *& X,
            size_t & R )
```

15.21.3.196 getTriangular< FFLAS_FIELD< FFLAS_ELT > >() [1/2]

```
template INST_OR_DECL void FFPACK::getTriangular< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors )
```

15.21.3.197 getTriangular< FFLAS_FIELD< FFLAS_ELT > >() [2/2]

```
template INST_OR_DECL void FFPACK::getTriangular< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            FFLAS_ELT * A,
            const size_t lda )
```

15.21.3.198 getEchelonForm< FFLAS_FIELD< FFLAS_ELT > >() [1/2]

```
template INST_OR_DECL void FFPACK::getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.199 getEchelonForm< FFLAS_FIELD< FFLAS_ELT > >() [2/2]

```
template INST_OR_DECL void FFPACK::getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            FFLAS_ELT * A,
            const size_t lda,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.200 getEchelonTransform< FFLAS_FIELD< FFLAS_ELT > >()

```
template INST_OR_DECL void FFPACK::getEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const FFLAS::FFLAS_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * T,
            const size_t ldt,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.201 getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > >() [1/2]

```
template INST_OR_DECL void FFPACK::getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.202 getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > >() [2/2]

```
template INST_OR_DECL void FFPACK::getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            FFLAS_ELT * A,
            const size_t lda,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.203 getReducedEchelonTransform< FFLAS_FIELD< FFLAS_ELT > >()

```
template INST_OR_DECL void FFPACK::getReducedEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            const FFLAS_ELT * A,
            const size_t lda,
            FFLAS_ELT * T,
            const size_t ldt,
            const FFPACK_LU_TAG LuTag )
```

15.21.3.204 LQUPtoInverseOfFullRankMinor() [2/2]

```
template INST_OR_DECL FFLAS_ELT* FFPACK::LQUPtoInverseOfFullRankMinor (
            const FFLAS_FIELD< FFLAS_ELT > & F,
            const size_t rank,
            FFLAS_ELT * A_factors,
            const size_t lda,
            const size_t * QtPointer,
            FFLAS_ELT * X,
            const size_t ldx )
```

15.21.3.205 fflas_const_cast() [3/3]

```
T FFPACK::fflas_const_cast (
            CT x )
```

15.21.3.206 failure()

```
Failure& FFPACK::failure ( )  [inline]
```

15.21.3.207 isOdd() [1/3]

```
bool FFPACK::isOdd (
            const T & a )  [inline]
```

15.21.3.208 isOdd() [2/3]

```
bool FFPACK::isOdd (
            const float & a )  [inline]
```

15.21.3.209 isOdd() [3/3]

```
bool FFPACK::isOdd (
            const double & a )  [inline]
```

15.21.3.210 NonZeroRandomMatrix() [1/2]

```
Field::Element_ptr FFPACK::NonZeroRandomMatrix (
            const Field & F,
            size_t m,
            size_t n,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G )  [inline]
```

Random non-zero Matrix.

Creates a `m` x `n` matrix with random entries, and at least one of them is non zero.

Parameters

	F	field
	m	number of rows in `A`
	n	number of cols in `A`
out	*A*	the matrix (preallocated to at least `m` x `lda` field elements)
	lda	leading dimension of `A`
	G	a random iterator

Returns

`A`.

15.21.3.211 NonZeroRandomMatrix() [2/2]

```
Field::Element_ptr FFPACK::NonZeroRandomMatrix (
            const Field & F,
            size_t m,
            size_t n,
```

```
            typename Field::Element_ptr A,
            size_t lda )  [inline]
```

Random non-zero Matrix.

Creates a m x n matrix with random entries, and at least one of them is non zero.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A

Returns

A.

15.21.3.212 RandomMatrix() [1/2]

```
Field::Element_ptr FFPACK::RandomMatrix (
            const Field & F,
            size_t m,
            size_t n,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G )  [inline]
```

Random Matrix.

Creates a m x n matrix with random entries.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A
	G	a random iterator

Returns

A.

15.21.3.213 RandomMatrix() [2/2]

```
Field::Element_ptr FFPACK::RandomMatrix (
            const Field & F,
            size_t m,
            size_t n,
            typename Field::Element_ptr A,
            size_t lda ) [inline]
```

Random Matrix.

Creates a m x n matrix with random entries.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A

Returns

A.

15.21.3.214 RandomTriangularMatrix() [1/2]

```
Field::Element_ptr FFPACK::RandomTriangularMatrix (
            const Field & F,
            size_t m,
            size_t n,
            const FFLAS::FFLAS_UPLO UpLo,
            const FFLAS::FFLAS_DIAG Diag,
            bool nonsingular,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G ) [inline]
```

Random Triangular Matrix.

Creates a m x n triangular matrix with random entries. The UpLo parameter defines wether it is upper or lower triangular.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
	UpLo	whether A is upper or lower triangular
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A
	G	a random iterator

Returns

A.

15.21.3.215 RandomTriangularMatrix() [2/2]

```
Field::Element_ptr FFPACK::RandomTriangularMatrix (
            const Field & F,
            size_t m,
            size_t n,
            const FFLAS::FFLAS_UPLO UpLo,
            const FFLAS::FFLAS_DIAG Diag,
            bool nonsingular,
            typename Field::Element_ptr A,
            size_t lda ) [inline]
```

Random Triangular Matrix.

Creates a m x n triangular matrix with random entries. The UpLo parameter defines wether it is upper or lower triangular.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
	UpLo	whether A is upper or lower triangular
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A

Returns

A.

15.21.3.216 RandInt()

```
size_t FFPACK::RandInt (
            size_t a,
            size_t b ) [inline]
```

15.21.3.217 RandomSymmetricMatrix()

```
Field::Element_ptr FFPACK::RandomSymmetricMatrix (
              const Field & F,
              size_t n,
              bool nonsingular,
              typename Field::Element_ptr A,
              size_t lda,
              RandIter & G )  [inline]
```

Random Symmetric Matrix.

Creates a `m` x `n` triangular matrix with random entries. The `UpLo` parameter defines wether it is upper or lower triangular.

Parameters

	F	field
	n	order of `A`
out	*A*	the matrix (preallocated to at least `n` x `lda` field elements)
	lda	leading dimension of `A`
	G	a random iterator

Returns

`A`.

15.21.3.218 RandomMatrixWithRank() [1/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRank (
              const Field & F,
              size_t m,
              size_t n,
              size_t r,
              typename Field::Element_ptr A,
              size_t lda,
              RandIter & G )  [inline]
```

Random Matrix with prescribed rank.

Creates an `m` x `n` matrix with random entries and rank `r`.

Parameters

F	field
m	number of rows in `A`
n	number of cols in `A`
r	rank of the matrix to build
A	the matrix (preallocated to at least `m` x `lda` field elements)
lda	leading dimension of `A`
G	a random iterator

Returns

A.

15.21.3.219 RandomMatrixWithRank() [2/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRank (
            const Field & F,
            size_t m,
            size_t n,
            size_t r,
            typename Field::Element_ptr A,
            size_t lda ) [inline]
```

Random Matrix with prescribed rank.

Creates an m x n matrix with random entries and rank r.

Parameters

	F	field
	m	number of rows in A
	n	number of cols in A
	r	rank of the matrix to build
out	*A*	the matrix (preallocated to at least m x lda field elements)
	lda	leading dimension of A

Returns

A.

15.21.3.220 RandomIndexSubset()

```
size_t* FFPACK::RandomIndexSubset (
            size_t N,
            size_t R,
            size_t * P ) [inline]
```

Pick uniformly at random a sequence of R distinct elements from the set $\{0, \ldots, N-1\}$ using Knuth's shuffle.

Parameters

	N	the cardinality of the sampling set
	R	the number of elements to sample
out	*P*	the output sequence (pre-allocated to at least R indices)

15.21.3.221 RandomPermutation()

```
size_t* FFPACK::RandomPermutation (
            size_t N,
            size_t * P )  [inline]
```

Pick uniformly at random a permutation of size `N` stored in LAPACK format using Knuth's shuffle.

Parameters

	N	the length of the permutation
out	*P*	the output permutation (pre-allocated to at least N indices)

15.21.3.222 RandomRankProfileMatrix()

```
void FFPACK::RandomRankProfileMatrix (
            size_t M,
            size_t N,
            size_t R,
            size_t * rows,
            size_t * cols )  [inline]
```

Pick uniformly at random an R-subpermutation of dimension `M` x `N` : a matrix with only R non-zeros equal to one, in a random rook placement.

Parameters

	M	row dimension
	N	column dimension
out	*rows*	the row position of each non zero element (pre-allocated)
out	*cols*	the column position of each non zero element (pre-allocated)

15.21.3.223 swapval()

```
void FFPACK::swapval (
            size_t k,
            size_t N,
            size_t * P,
            size_t val )  [inline]
```

15.21.3.224 RandomSymmetricRankProfileMatrix()

```
void FFPACK::RandomSymmetricRankProfileMatrix (
            size_t N,
            size_t R,
            size_t * rows,
            size_t * cols )  [inline]
```

Pick uniformly at random a symmetric R-subpermutation of dimension `N` x `N` : a symmetric matrix with only R non-zeros, all equal to one, in a random rook placement.

Parameters

	N	matrix order
out	*rows*	the row position of each non zero element (pre-allocated)
out	*cols*	the column position of each non zero element (pre-allocated)

15.21.3.225 RandomLTQSRankProfileMatrix()

```
void FFPACK::RandomLTQSRankProfileMatrix (
            size_t n,
            size_t r,
            size_t t,
            size_t * rows,
            size_t * cols )  [inline]
```

15.21.3.226 RandomMatrixWithRankandRPM() [1/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRankandRPM (
            const Field & F,
            size_t M,
            size_t N,
            size_t R,
            typename Field::Element_ptr A,
            size_t lda,
            const size_t * RRP,
            const size_t * CRP,
            RandIter & G )  [inline]
```

Random Matrix with prescribed rank and rank profile matrix Creates an `m` x `n` matrix with random entries and rank `r`.

Parameters

F	field
m	number of rows in `A`
n	number of cols in `A`
r	rank of the matrix to build

Parameters

A	the matrix (preallocated to at least m x lda field elements)
lda	leading dimension of A
RRP	the R dimensional array with row positions of the rank profile matrix' pivots
CRP	the R dimensional array with column positions of the rank profile matrix' pivots
G	a random iterator

Returns

A.

15.21.3.227 RandomMatrixWithRankandRPM() [2/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRankandRPM (
            const Field & F,
            size_t M,
            size_t N,
            size_t R,
            typename Field::Element_ptr A,
            size_t lda,
            const size_t * RRP,
            const size_t * CRP )  [inline]
```

Random Matrix with prescribed rank and rank profile matrix Creates an m x n matrix with random entries and rank r.

Parameters

F	field
m	number of rows in A
n	number of cols in A
r	rank of the matrix to build
A	the matrix (preallocated to at least m x lda field elements)
lda	leading dimension of A
RRP	the R dimensional array with row positions of the rank profile matrix' pivots
CRP	the R dimensional array with column positions of the rank profile matrix' pivots

Returns

A.

15.21.3.228 RandomSymmetricMatrixWithRankandRPM() [1/2]

```
Field::Element_ptr FFPACK::RandomSymmetricMatrixWithRankandRPM (
            const Field & F,
```

```
size_t N,
size_t R,
typename Field::Element_ptr A,
size_t lda,
const size_t * RRP,
const size_t * CRP,
RandIter & G )  [inline]
```

Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an `n` x `n` symmetric matrix with random entries and rank `r`.

Parameters

F	field
n	order of `A`
r	rank of `A`
A	the matrix (preallocated to at least `n` x `lda` field elements)
lda	leading dimension of `A`
RRP	the R dimensional array with row positions of the rank profile matrix' pivots
CRP	the R dimensional array with column positions of the rank profile matrix' pivots
G	a random iterator

Returns

`A`.

15.21.3.229 RandomSymmetricMatrixWithRankandRPM() [2/2]

```
Field::Element_ptr FFPACK::RandomSymmetricMatrixWithRankandRPM (
        const Field & F,
        size_t M,
        size_t N,
        size_t R,
        typename Field::Element_ptr A,
        size_t lda,
        const size_t * RRP,
        const size_t * CRP )  [inline]
```

Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an `n` x `n` symmetric matrix with random entries and rank `r`.

Parameters

F	field
n	order of `A`
r	rank of `A`
A	the matrix (preallocated to at least `n` x `lda` field elements)
lda	leading dimension of `A`
RRP	the R dimensional array with row positions of the rank profile matrix' pivots
CRP	the R dimensional array with column positions of the rank profile matrix' pivots

Returns

A.

15.21.3.230 RandomMatrixWithRankandRandomRPM() [1/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRankandRandomRPM (
            const Field & F,
            size_t M,
            size_t N,
            size_t R,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G )  [inline]
```

Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.

Parameters

F	field
m	number of rows in A
n	number of cols in A
r	rank of the matrix to build
A	the matrix (preallocated to at least m x lda field elements)
lda	leading dimension of A
G	a random iterator

Returns

A.

15.21.3.231 RandomMatrixWithRankandRandomRPM() [2/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithRankandRandomRPM (
            const Field & F,
            size_t M,
            size_t N,
            size_t R,
            typename Field::Element_ptr A,
            size_t lda )  [inline]
```

Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.

Parameters

F	field

Parameters

m	number of rows in A
n	number of cols in A
r	rank of the matrix to build
A	the matrix (preallocated to at least m x lda field elements)
lda	leading dimension of A

Returns

A.

15.21.3.232 RandomSymmetricMatrixWithRankandRandomRPM() [1/2]

```
Field::Element_ptr FFPACK::RandomSymmetricMatrixWithRankandRandomRPM (
            const Field & F,
            size_t N,
            size_t R,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G )  [inline]
```

Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an n x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.

Parameters

F	field
n	order of A
r	rank of A
A	the matrix (preallocated to at least n x lda field elements)
lda	leading dimension of A
G	a random iterator

Returns

A.

15.21.3.233 RandomSymmetricMatrixWithRankandRandomRPM() [2/2]

```
Field::Element_ptr FFPACK::RandomSymmetricMatrixWithRankandRandomRPM (
            const Field & F,
            size_t N,
            size_t R,
```

```
typename Field::Element_ptr A,
size_t lda ) [inline]
```

Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an `n x n` matrix with random entries, rank `r` and with a rank profile matrix chosen uniformly at random.

Parameters

F	field
n	order of `A`
r	rank of `A`
A	the matrix (preallocated to at least `n` x `lda` field elements)
lda	leading dimension of `A`

Returns

`A`.

15.21.3.234 RandomMatrixWithDet() [1/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithDet (
            const Field & F,
            size_t n,
            const typename Field::Element d,
            typename Field::Element_ptr A,
            size_t lda ) [inline]
```

Random Matrix with prescribed det.

Creates a `m` x `n` matrix with random entries and rank `r`.

Parameters

F	field
d	the prescribed value for the determinant of A
n	number of cols in `A`
A	the matrix to be generated (preallocated to at least `n` x `lda` field elements)
lda	leading dimension of `A`

Returns

`A`.

15.21.3.235 RandomMatrixWithDet() [2/2]

```
Field::Element_ptr FFPACK::RandomMatrixWithDet (
            const Field & F,
            size_t n,
            const typename Field::Element d,
            typename Field::Element_ptr A,
```

```
size_t lda,
RandIter & G )  [inline]
```

Random Matrix with prescribed det.

Creates a `m` x `n` matrix with random entries and rank `r`.

Parameters

F	field
d	the prescribed value for the determinant of A
n	number of cols in `A`
A	the matrix to be generated (preallocated to at least `n` x `lda` field elements)
lda	leading dimension of `A`

Returns

`A`.

15.21.3.236 RandomLTQSMatrixWithRankandQSorder()

```
Field::Element_ptr FFPACK::RandomLTQSMatrixWithRankandQSorder (
            Field & F,
            size_t n,
            size_t r,
            size_t t,
            typename Field::Element_ptr A,
            size_t lda,
            RandIter & G )  [inline]
```

15.21.3.237 chooseField()

```
Field* FFPACK::chooseField (
            Givaro::Integer q,
            uint64_t b,
            uint64_t seed )
```

15.21.3.238 chooseField< Givaro::ZRing< int32_t > >()

```
Givaro::ZRing<int32_t>* FFPACK::chooseField< Givaro::ZRing< int32_t > > (
            Givaro::Integer q,
            uint64_t b,
            uint64_t seed )
```

15.21.3.239 chooseField< Givaro::ZRing< int64_t > >()

```
Givaro::ZRing<int64_t>* FFPACK::chooseField< Givaro::ZRing< int64_t > > (
            Givaro::Integer q,
            uint64_t b,
            uint64_t seed )
```

15.21.3.240 chooseField< Givaro::ZRing< float > >()

```
Givaro::ZRing<float>* FFPACK::chooseField< Givaro::ZRing< float > > (
            Givaro::Integer q,
            uint64_t b,
            uint64_t seed )
```

15.21.3.241 chooseField< Givaro::ZRing< double > >()

```
Givaro::ZRing<double>* FFPACK::chooseField< Givaro::ZRing< double > > (
            Givaro::Integer q,
            uint64_t b,
            uint64_t seed )
```

15.22 FFPACK::Protected Namespace Reference

Functions

- template< class Field >
  size_t LUdivine_construct (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::Element_ptr u, const size_t incu, size_t *P, bool computeX, const FFPACK_MINPOLY_TAG MinTag=FfpackDense, const size_t kg_mc=0, const size_t kg_mb=0, const size_t kg_j=0)
- template< class Field >
  size_t GaussJordan (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t colbeg, const size_t rowbeg, const size_t colsize, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)

  Gauss-Jordan algorithm computing the Reduced Row echelon form and its transform matrix.
- template< class Field , class Polynomial >
  std::list< Polynomial > & KellerGehrig (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)
- template< class Field , class Polynomial >
  int KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *kg_mc, size_t *kg_mb, size_t *kg_j)
- template< class Field , class Polynomial >
  std::list< Polynomial > & KGFast_generalized (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)
- template< class Field >
  void fgemv_kgf (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, const size_t kg_mc, const size_t kg_mb, const size_t kg_j)
- template< class Field , class Polynomial , class RandIter >
  std::list< Polynomial > & LUKrylov (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr U, const size_t ldu, RandIter &G)
- template< class Field , class Polynomial >
  std::list< Polynomial > & Danilevski (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)
- template< class PolRing >
  void RandomKrylovPrecond (const PolRing &PR, std::list< typename PolRing::Element > &completed↩Factors, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, size_t &Nb, typename PolRing::Domain_t::Element_ptr &B, size_t &ldb, typename PolRing::Domain_t::RandIter &g, const size_↩t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

- template<class PolRing >
  std::list< typename PolRing::Element > & ArithProg (const PolRing &PR, std::list< typename PolRing::↩ Element > &frobeniusForm, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, const size_t degree)
- template<class Field , class Polynomial >
  std::list< Polynomial > & LUKrylov_KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx)
- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr v, const size_t incv, typename Field::Element_ptr K, const size_t ldk, size_t *P)
- template<class Field , class Polynomial >
  Polynomial & Hybrid_KGF_LUK_MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, size_t *P, const FFPACK_MINPOLY_TAG MinTag=FFPACK::FfpackDense, const size_t kg_mc=0, const size_t kg_↩ mb=0, const size_t kg_j=0)
- template<class Field >
  size_t updateD (const Field &F, size_t *d, size_t k, std::vector< std::vector< typename Field::Element > > &minpt)
- template<class Field >
  size_t newD (const Field &F, size_t *d, bool &KeepOn, const size_t l, const size_t N, typename Field::Element_ptr X, const size_t *Q, std::vector< std::vector< typename Field::Element > > &minpt)
- template<class Field >
  void CompressRows (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class Field >
  void CompressRowsQK (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t deg, const size_t nb_blocs)
- template<class Field >
  void DeCompressRows (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size↩ _t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class Field >
  void DeCompressRowsQK (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t deg, const size_t nb_blocs)
- template<class Field >
  void CompressRowsQA (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class Field >
  void DeCompressRowsQA (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class Field >
  size_t LUdivine_construct (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size↩ _t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::Element_ptr u, const size_t incu, size_t *P, bool computeX, const FFPACK::FFPACK↩ _MINPOLY_TAG MinTag, const size_t kg_mc, const size_t kg_mb, const size_t kg_j)

15.22.1 Function Documentation

15.22.1.1 LUdivine_construct() [1/2]

```
size_t FFPACK::Protected::LUdivine_construct (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            typename Field::Element_ptr u,
            const size_t incu,
            size_t * P,
            bool computeX,
            const FFPACK_MINPOLY_TAG MinTag = FfpackDense,
            const size_t kg_mc = 0,
            const size_t kg_mb = 0,
            const size_t kg_j = 0 )
```

15.22.1.2 GaussJordan()

```
size_t GaussJordan (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            const size_t colbeg,
            const size_t rowbeg,
            const size_t colsize,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag )  [inline]
```

Gauss-Jordan algorithm computing the Reduced Row echelon form and its transform matrix.

Bibliography

- Algorithm 2.8 of A. Storjohann Thesis 2000,
- Algorithm 11 of Jeannerod C-P., Pernet, C. and Storjohann, A. `Rank-profile` *revealing Gaussian elimination and the CUP matrix decomposition* , J. of Symbolic Comp., 2013

Parameters

	M	row dimension of A
	N	column dimension of A
in,out	*A*	an m x n matrix
	lda	leading dimension of A
	P	row permutation
	Q	column permutation
	LuTag	set the base case to a Tile (FfpackGaussJordanTile) or Slab (FfpackGaussJordanSlab) recursive RedEchelon

| I | A11 | A12 | | |----|-----|-----|----| | |I | * | A22 | | | |0 | 0| A22 | | |----|-----|-----|----| | | 0 | A32 | | |----|-----|-----|----|
where the transformation matrix is stored at the pivot column position

15.22.1.3 KellerGehrig()

```
std::list<Polynomial>& FFPACK::Protected::KellerGehrig (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda )
```

15.22.1.4 KGFast()

```
int FFPACK::Protected::KGFast (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * kg_mc,
            size_t * kg_mb,
            size_t * kg_j )
```

15.22.1.5 KGFast_generalized()

```
std::list<Polynomial>& FFPACK::Protected::KGFast_generalized (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

15.22.1.6 fgemv_kgf()

```
void FFPACK::Protected::fgemv_kgf (
            const Field & F,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr X,
            const size_t incX,
            typename Field::Element_ptr Y,
            const size_t incY,
            const size_t kg_mc,
            const size_t kg_mb,
            const size_t kg_j )
```

15.22.1.7 LUKrylov()

```
std::list<Polynomial>& FFPACK::Protected::LUKrylov (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
```

```
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr U,
            const size_t ldu,
            RandIter & G )
```

15.22.1.8 Danilevski()

```
std::list<Polynomial>& FFPACK::Protected::Danilevski (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda )
```

15.22.1.9 RandomKrylovPrecond()

```
void RandomKrylovPrecond (
            const PolRing & PR,
            std::list< typename PolRing::Element > & completedFactors,
            const size_t N,
            typename PolRing::Domain_t::Element_ptr A,
            const size_t lda,
            size_t & Nb,
            typename PolRing::Domain_t::Element_ptr & B,
            size_t & ldb,
            typename PolRing::Domain_t::RandIter & g,
            const size_t degree = __FFLASFFPACK_ARITHPROG_THRESHOLD )  [inline]
```

Todo swap to save space ??

Todo don't assing K2 c∗noc x N but only mas (c,noc) x N and store each one after the other

Todo swap to save space ??

Todo don't assing K2 c∗noc x N but only mas (c,noc) x N and store each one after the other

15.22.1.10 ArithProg()

```
std::list< typename PolRing::Element > & ArithProg (
            const PolRing & PR,
            std::list< typename PolRing::Element > & frobeniusForm,
            const size_t N,
            typename PolRing::Domain_t::Element_ptr A,
            const size_t lda,
            const size_t degree )  [inline]
```

15.22.1.11 LUKrylov_KGFast()

```
std::list<Polynomial>& FFPACK::Protected::LUKrylov_KGFast (
            const Field & F,
            std::list< Polynomial > & charp,
            const size_t N,
```

```
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx )
```

15.22.1.12 MatVecMinPoly()

```
Polynomial& FFPACK::Protected::MatVecMinPoly (
            const Field & F,
            Polynomial & minP,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr v,
            const size_t incv,
            typename Field::Element_ptr K,
            const size_t ldk,
            size_t * P )
```

15.22.1.13 Hybrid_KGF_LUK_MinPoly()

```
Polynomial& FFPACK::Protected::Hybrid_KGF_LUK_MinPoly (
            const Field & F,
            Polynomial & minP,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            size_t * P,
            const FFPACK_MINPOLY_TAG MinTag = FFPACK::FfpackDense,
            const size_t kg_mc = 0,
            const size_t kg_mb = 0,
            const size_t kg_j = 0 )
```

15.22.1.14 updateD()

```
size_t FFPACK::Protected::updateD (
            const Field & F,
            size_t * d,
            size_t k,
            std::vector< std::vector< typename Field::Element > > & minpt )
```

15.22.1.15 newD()

```
size_t FFPACK::Protected::newD (
            const Field & F,
            size_t * d,
            bool & KeepOn,
            const size_t l,
            const size_t N,
            typename Field::Element_ptr X,
            const size_t * Q,
            std::vector< std::vector< typename Field::Element > > & minpt )
```

15.22.1.16 CompressRows()

```
void FFPACK::Protected::CompressRows (
            Field & F,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t nb_blocs )  [inline]
```

15.22.1.17 CompressRowsQK()

```
void FFPACK::Protected::CompressRowsQK (
            Field & F,
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t deg,
            const size_t nb_blocs )  [inline]
```

15.22.1.18 DeCompressRows()

```
void FFPACK::Protected::DeCompressRows (
            Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t nb_blocs )  [inline]
```

15.22.1.19 DeCompressRowsQK()

```
void FFPACK::Protected::DeCompressRowsQK (
            Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t deg,
            const size_t nb_blocs )  [inline]
```

15.22.1.20 CompressRowsQA()

```
void FFPACK::Protected::CompressRowsQA (
            Field & F,
```

```
            const size_t M,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t nb_blocs )  [inline]
```

15.22.1.21 DeCompressRowsQA()

```
void FFPACK::Protected::DeCompressRowsQA (
            Field & F,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            typename Field::Element_ptr tmp,
            const size_t ldtmp,
            const size_t * d,
            const size_t nb_blocs )  [inline]
```

15.22.1.22 LUdivine_construct() [2/2]

```
size_t FFPACK::Protected::LUdivine_construct (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::Element_ptr X,
            const size_t ldx,
            typename Field::Element_ptr u,
            const size_t incu,
            size_t * P,
            bool computeX,
            const FFPACK::FFPACK_MINPOLY_TAG MinTag,
            const size_t kg_mc,
            const size_t kg_mb,
            const size_t kg_j )
```

15.23 Givaro Namespace Reference

Data Structures

- class ModularBalanced
- class Montgomery

15.24 MKL_CONFIG Namespace Reference

15.25 RecInt Namespace Reference

Data Structures

- class rint

- class ruint

Chapter 16

Data Structure Documentation

16.1 AlgoChooser< ModeT, ParSeq > Struct Template Reference

Public Types

- typedef MMHelperAlgo::Winograd value

16.1.1 Member Typedef Documentation

16.1.1.1 value

`typedef MMHelperAlgo::Winograd value`

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.2 AlgoChooser< ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > Struct Template Reference

Public Types

- typedef MMHelperAlgo::Classic value

16.2.1 Member Typedef Documentation

16.2.1.1 value

`typedef MMHelperAlgo::Classic value`

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.3 ALL< v > Struct Template Reference

The documentation for this struct was generated from the following file:

- test-simd.C

16.4 ALL< false, v... > Struct Template Reference

Static Public Attributes

- static constexpr bool value = false

16.4.1 Field Documentation

16.4.1.1 value

`constexpr bool value = false [static], [constexpr]`

The documentation for this struct was generated from the following file:

- test-simd.C

16.5 ALL< true, v... > Struct Template Reference

Static Public Attributes

- static constexpr bool value = ALL<v...>::value

16.5.1 Field Documentation

16.5.1.1 value

`constexpr bool value = ALL<v...>::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- test-simd.C

16.6 ALL<> Struct Reference

Static Public Attributes

- static constexpr bool value = true

16.6.1 Field Documentation

16.6.1.1 value

`constexpr bool value = true [static], [constexpr]`

The documentation for this struct was generated from the following file:

- test-simd.C

16.7 ArbitraryPrecIntTag Struct Reference

Arbitrary precision integers: GMP.

`#include <field-traits.h>`

16.7.1 Detailed Description

Arbitrary precision integers: GMP.
The documentation for this struct was generated from the following file:

- field-traits.h

16.8 AreEqual< X, Y > Class Template Reference

```
#include <fflas_enum.h>
```

Static Public Attributes

- static const bool value = false

16.8.1 Field Documentation

16.8.1.1 value

```
const bool value = false  [static]
```

The documentation for this class was generated from the following file:

- fflas_enum.h

16.9 AreEqual< X, X > Class Template Reference

```
#include <fflas_enum.h>
```

Static Public Attributes

- static const bool value = true

16.9.1 Field Documentation

16.9.1.1 value

```
const bool value = true  [static]
```

The documentation for this class was generated from the following file:

- fflas_enum.h

16.10 Argument Struct Reference

```
#include <args-parser.h>
```

Data Fields

- char c
- const char ∗ example
- const char ∗ helpString
- ArgumentType type
- void ∗ data

16.10.1 Field Documentation

16.10.1.1 c

`char c`

16.10.1.2 example

`const char* example`

16.10.1.3 helpString

`const char* helpString`

16.10.1.4 type

`ArgumentType type`

16.10.1.5 data

`void* data`

The documentation for this struct was generated from the following file:

- args-parser.h

16.11 associatedDelayedField< Field > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef Field field
- typedef Field & type

16.11.1 Member Typedef Documentation

16.11.1.1 field

`typedef Field field`

16.11.1.2 type

`typedef Field& type`

The documentation for this struct was generated from the following file:

- field-traits.h

16.12 associatedDelayedField< const FFPACK::RNSIntegerMod< RNS > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FFPACK::RNSInteger< RNS > field
- typedef FFPACK::RNSInteger< RNS > type

16.12.1 Member Typedef Documentation

16.12.1.1 field

```
typedef FFPACK::RNSInteger<RNS> field
```

16.12.1.2 type

```
typedef FFPACK::RNSInteger<RNS> type
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.13 associatedDelayedField< const Givaro::Modular< T, X > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef Givaro::ZRing< T > field
- typedef Givaro::ZRing< T > type

16.13.1 Member Typedef Documentation

16.13.1.1 field

```
typedef Givaro::ZRing<T> field
```

16.13.1.2 type

```
typedef Givaro::ZRing<T> type
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.14 associatedDelayedField< const Givaro::ModularBalanced< T > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef Givaro::ZRing< T > field
- typedef Givaro::ZRing< T > type

16.14.1 Member Typedef Documentation

16.14.1.1 field

```
typedef Givaro::ZRing<T> field
```

16.14.1.2 type

```
typedef Givaro::ZRing<T> type
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.15 associatedDelayedField< const Givaro::ZRing< T > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef Givaro::ZRing< T > field
- typedef Givaro::ZRing< T > type

16.15.1 Member Typedef Documentation

16.15.1.1 field

```
typedef Givaro::ZRing<T> field
```

16.15.1.2 type

```
typedef Givaro::ZRing<T> type
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.16 Auto Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.17 Bench< Elt > Class Template Reference

Public Types

- using Field = Modular< Elt >
- using Elt_ptr = typename Field::Element_ptr
- using Residu = typename Field::Residu_t
- template< bool B, class T = void>
  using enable_if_t = typename std::enable_if< B, T >::type

- template<typename Simd >
  using is_same_element = typename Simd::template is_same_element< Field >
- template<typename E >
  using enable_if_no_simd_t = enable_if_t< Simd< E >::vect_size==1 >
- template<typename E >
  using enable_if_simd128_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==16 >
- template<typename E >
  using enable_if_simd256_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==32 >
- template<typename E >
  using enable_if_simd512_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==64 >

Public Member Functions

- Bench (size_t m, size_t n, size_t iters, bool inplace)
- template<typename Simd = NoSimd<Elt>, enable_if_t< is_same_element< Simd >::value > * = nullptr>
  void doBenchs ()
- template<typename _E = Elt, enable_if_t< is_same< _E, Elt >::value > * = nullptr, enable_if_no_simd_t< _E > * = nullptr>
  void run (bool allsimd)

Static Public Member Functions

- template<typename _E = Elt, enable_if_t<!is_same< _E, Givaro::Integer >::value > * = nullptr>
  static Residu cardinality ()
- template<typename _E = Elt, enable_if_t< is_same< _E, Givaro::Integer >::value > * = nullptr>
  static Residu cardinality ()

Protected Attributes

- Field F
- const size_t m
- const size_t n
- const size_t iters
- const bool inplace

16.17.1 Member Typedef Documentation

16.17.1.1 Field

```
using Field = Modular<Elt>
```

16.17.1.2 Elt_ptr

```
using Elt_ptr = typename Field::Element_ptr
```

16.17.1.3 Residu

```
using Residu = typename Field::Residu_t
```

16.17.1.4 enable_if_t

```
using enable_if_t = typename std::enable_if<B, T>::type
```

16.17.1.5 is_same_element

```
using is_same_element = typename Simd::template is_same_element<Field>
```

16.17.1.6 enable_if_no_simd_t

```
using enable_if_no_simd_t = enable_if_t<Simd<E>::vect_size == 1>
```

16.17.1.7 enable_if_simd128_t

```
using enable_if_simd128_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 16>
```

16.17.1.8 enable_if_simd256_t

```
using enable_if_simd256_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 32>
```

16.17.1.9 enable_if_simd512_t

```
using enable_if_simd512_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 64>
```

16.17.2 Constructor & Destructor Documentation

16.17.2.1 Bench()

```
Bench (
            size_t m,
            size_t n,
            size_t iters,
            bool inplace )  [inline]
```

16.17.3 Member Function Documentation

16.17.3.1 cardinality() [1/2]

```
static Residu cardinality ( )  [inline], [static]
```

16.17.3.2 cardinality() [2/2]

```
static Residu cardinality ( )  [inline], [static]
```

16.17.3.3 doBenchs()

```
void doBenchs ( )  [inline]
```

16.17.3.4 run()

```
void run (
            bool allsimd )  [inline]
```

16.17.4 Field Documentation

16.17.4.1 F

`Field F [protected]`

16.17.4.2 m

`const size_t m [protected]`

16.17.4.3 n

`const size_t n [protected]`

16.17.4.4 iters

`const size_t iters [protected]`

16.17.4.5 inplace

`const bool inplace [protected]`

The documentation for this class was generated from the following file:

- benchmark-storage-transpose.C

16.18 Bini Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.19 Block Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.20 BlockTransposeSIMD< Field, Simd, > Struct Template Reference

`#include <fflas_transpose.h>`

Public Member Functions

- template<size_t _s = Simd::vect_size, IsSimdSize< _s, 1 > * = nullptr>
  void transpose (const Field &F, ConstElement_ptr A, size_t lda, Element_ptr B, size_t ldb) const
- template<size_t _s = Simd::vect_size, IsSimdSize< _s, 2 > * = nullptr>
  void transpose (const Field &F, ConstElement_ptr A, size_t lda, Element_ptr B, size_t ldb) const
- template<size_t _s = Simd::vect_size, IsSimdSize< _s, 4 > * = nullptr>
  void transpose (const Field &F, ConstElement_ptr A, size_t lda, Element_ptr B, size_t ldb) const
- template<size_t _s = Simd::vect_size, IsSimdSize< _s, 8 > * = nullptr>
  void transpose (const Field &F, ConstElement_ptr A, size_t lda, Element_ptr B, size_t ldb) const
- template<size_t _s = Simd::vect_size, IsSimdSize< _s, 16 > * = nullptr>
  void transpose (const Field &F, ConstElement_ptr A, size_t lda, Element_ptr B, size_t ldb) const

Static Public Member Functions

- static constexpr size_t size ()
- static const std::string info ()

16.20.1 Member Function Documentation

16.20.1.1 size()

```
static constexpr size_t size ( )  [inline], [static], [constexpr]
```

16.20.1.2 info()

```
static const std::string info ( )  [inline], [static]
```

16.20.1.3 transpose() [1/5]

```
void transpose (
            const Field & F,
            ConstElement_ptr A,
            size_t lda,
            Element_ptr B,
            size_t ldb ) const  [inline]
```

16.20.1.4 transpose() [2/5]

```
void transpose (
            const Field & F,
            ConstElement_ptr A,
            size_t lda,
            Element_ptr B,
            size_t ldb ) const  [inline]
```

16.20.1.5 transpose() [3/5]

```
void transpose (
            const Field & F,
            ConstElement_ptr A,
            size_t lda,
            Element_ptr B,
            size_t ldb ) const  [inline]
```

16.20.1.6 transpose() [4/5]

```
void transpose (
            const Field & F,
            ConstElement_ptr A,
            size_t lda,
            Element_ptr B,
            size_t ldb ) const  [inline]
```

16.20.1.7 transpose() [5/5]

```
void transpose (
            const Field & F,
            ConstElement_ptr A,
            size_t lda,
            Element_ptr B,
            size_t ldb ) const  [inline]
```

The documentation for this struct was generated from the following file:

- fflas_transpose.h

16.21 callLUdivine_small< Element > Class Template Reference

Public Member Functions

- template<class Field >
  size_t operator() (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_↩
  t ∗Q, const FFPACK::FFPACK_LU_TAG LuTag)

16.21.1 Member Function Documentation

16.21.1.1 operator()()

```
size_t operator() (
            const Field & F,
            const FFLAS::FFLAS_DIAG Diag,
            const FFLAS::FFLAS_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            typename Field::Element_ptr A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const FFPACK::FFPACK_LU_TAG LuTag )  [inline]
```

The documentation for this class was generated from the following file:

- ffpack_ludivine.inl

16.22 callLUdivine_small< double > Class Reference

Public Member Functions

- template<class Field >
  size_t operator() (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_↩
  t ∗Q, const FFPACK::FFPACK_LU_TAG LuTag)

16.22.1 Member Function Documentation

16.22.1.1 operator()()

```
size_t operator() (
            const Field & F,
```

```
const FFLAS::FFLAS_DIAG Diag,
const FFLAS::FFLAS_TRANSPOSE trans,
const size_t M,
const size_t N,
typename Field::Element_ptr A,
const size_t lda,
size_t * P,
size_t * Q,
const FFPACK::FFPACK_LU_TAG LuTag )  [inline]
```

The documentation for this class was generated from the following file:

- ffpack_ludivine.inl

16.23 callLUdivine_small< float > Class Reference

Public Member Functions

- template<class Field >
  size_t operator() (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)

16.23.1 Member Function Documentation

16.23.1.1 operator()()

```
size_t operator() (
    const Field & F,
    const FFLAS::FFLAS_DIAG Diag,
    const FFLAS::FFLAS_TRANSPOSE trans,
    const size_t M,
    const size_t N,
    typename Field::Element_ptr A,
    const size_t lda,
    size_t * P,
    size_t * Q,
    const FFPACK::FFPACK_LU_TAG LuTag )  [inline]
```

The documentation for this class was generated from the following file:

- ffpack_ludivine.inl

16.24 CharpolyFailed Class Reference

```
#include <ffpack.h>
```

The documentation for this class was generated from the following file:

- ffpack.h

16.25 Checker_Empty< Field > Struct Template Reference

```
#include <checker_empty.h>
```

Public Member Functions

- template<typename... Params>
  Checker_Empty (Params... parameters)

- template<typename... Params>
  bool check (Params... parameters)

16.25.1 Constructor & Destructor Documentation

16.25.1.1 Checker_Empty()

```
Checker_Empty (
            Params... parameters )  [inline]
```

16.25.2 Member Function Documentation

16.25.2.1 check()

```
bool check (
            Params... parameters )  [inline]
```

The documentation for this struct was generated from the following file:

- checker_empty.h

16.26 CheckerImplem_charpoly< Field, Polynomial > Class Template Reference

Public Member Functions

- CheckerImplem_charpoly (const Field &F_, const size_t n_, typename Field::ConstElement_ptr A, size_↩
  t lda_)
- CheckerImplem_charpoly (typename Field::RandIter &G, const size_t n_, typename Field::ConstElement_ptr A, size_t lda_)
- ∼CheckerImplem_charpoly ()
- bool check (Polynomial &g)

16.26.1 Constructor & Destructor Documentation

16.26.1.1 CheckerImplem_charpoly() [1/2]

```
CheckerImplem_charpoly (
            const Field & F_,
            const size_t n_,
            typename Field::ConstElement_ptr A,
            size_t lda_ )  [inline]
```

16.26.1.2 CheckerImplem_charpoly() [2/2]

```
CheckerImplem_charpoly (
            typename Field::RandIter & G,
            const size_t n_,
            typename Field::ConstElement_ptr A,
            size_t lda_ )  [inline]
```

16.26.1.3 ∼CheckerImplem_charpoly()

```
~CheckerImplem_charpoly ( ) [inline]
```

16.26.2 Member Function Documentation

16.26.2.1 check()

```
bool check (
            Polynomial & g ) [inline]
```

The documentation for this class was generated from the following file:

- checker_charpoly.inl

16.27 CheckerImplem_charpoly< Givaro::ZRing< Givaro::Integer >, Polynomial > Class Template Reference

Public Types

- typedef Givaro::ZRing< Givaro::Integer > Ring

Public Member Functions

- CheckerImplem_charpoly (const Ring &F_, const size_t n_, typename Ring::ConstElement_ptr A, size_t lda_)
- CheckerImplem_charpoly (typename Ring::RandIter &G, const size_t n_, typename Ring::ConstElement_ptr A, size_t lda_)
- ∼CheckerImplem_charpoly ()
- bool check (Polynomial &g)

16.27.1 Member Typedef Documentation

16.27.1.1 Ring

```
typedef Givaro::ZRing<Givaro::Integer> Ring
```

16.27.2 Constructor & Destructor Documentation

16.27.2.1 CheckerImplem_charpoly() [1/2]

```
CheckerImplem_charpoly (
            const Ring & F_,
            const size_t n_,
            typename Ring::ConstElement_ptr A,
            size_t lda_ ) [inline]
```

16.27.2.2 CheckerImplem_charpoly() [2/2]

```
CheckerImplem_charpoly (
            typename Ring::RandIter & G,
            const size_t n_,
            typename Ring::ConstElement_ptr A,
            size_t lda_ )  [inline]
```

16.27.2.3 ∼CheckerImplem_charpoly()

```
~CheckerImplem_charpoly ( )  [inline]
```

16.27.3 Member Function Documentation

16.27.3.1 check()

```
bool check (
            Polynomial & g )  [inline]
```

The documentation for this class was generated from the following file:

- checker_charpoly.inl

16.28 CheckerImplem_Det< Field > Class Template Reference

Public Member Functions

- CheckerImplem_Det (const Field &F_, size_t n_, typename Field::ConstElement_ptr A, size_t lda)
- CheckerImplem_Det (typename Field::RandIter &G, size_t n_, typename Field::ConstElement_ptr A, size_t lda)
- ∼CheckerImplem_Det ()
- bool check (const typename Field::Element &det, typename Field::ConstElement_ptr LU, size_t lda, size_t *P, size_t *Q) const

  check if the Det factorization is correct.

16.28.1 Constructor & Destructor Documentation

16.28.1.1 CheckerImplem_Det() [1/2]

```
CheckerImplem_Det (
            const Field & F_,
            size_t n_,
            typename Field::ConstElement_ptr A,
            size_t lda )  [inline]
```

16.28.1.2 CheckerImplem_Det() [2/2]

```
CheckerImplem_Det (
            typename Field::RandIter & G,
            size_t n_,
            typename Field::ConstElement_ptr A,
            size_t lda )  [inline]
```

16.28.1.3 ∼CheckerImplem_Det()

```
∼CheckerImplem_Det ( ) [inline]
```

16.28.2 Member Function Documentation

16.28.2.1 check()

```
bool check (
            const typename Field::Element & det,
            typename Field::ConstElement_ptr LU,
            size_t lda,
            size_t * P,
            size_t * Q ) const [inline]
```

check if the Det factorization is correct.
Needs matrix in LU form

Parameters

LU,storage	for L and U
det	
P	
Q	

The documentation for this class was generated from the following file:

- checker_det.inl

16.29 CheckerImplem_fgemm< Field > Class Template Reference

Public Member Functions

- CheckerImplem_fgemm (const Field &F_, const size_t m_, const size_t n_, const size_t k_, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc_)
- CheckerImplem_fgemm (typename Field::RandIter &G, const size_t m_, const size_t n_, const size_t k_, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc_)
- ∼CheckerImplem_fgemm ()
- bool check (const FFLAS::FFLAS_TRANSPOSE ta, const FFLAS::FFLAS_TRANSPOSE tb, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::ConstElement_ptr C)

16.29.1 Constructor & Destructor Documentation

16.29.1.1 CheckerImplem_fgemm() [1/2]

```
CheckerImplem_fgemm (
            const Field & F_,
            const size_t m_,
            const size_t n_,
            const size_t k_,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc_ ) [inline]
```

16.29.1.2 CheckerImplem_fgemm() [2/2]

```
CheckerImplem_fgemm (
            typename Field::RandIter & G,
            const size_t m_,
            const size_t n_,
            const size_t k_,
            const typename Field::Element beta,
            typename Field::Element_ptr C,
            const size_t ldc_ )  [inline]
```

16.29.1.3 ~CheckerImplem_fgemm()

```
~CheckerImplem_fgemm ( )  [inline]
```

16.29.2 Member Function Documentation

16.29.2.1 check()

```
bool check (
            const FFLAS::FFLAS_TRANSPOSE ta,
            const FFLAS::FFLAS_TRANSPOSE tb,
            const typename Field::Element alpha,
            typename Field::ConstElement_ptr A,
            const size_t lda,
            typename Field::ConstElement_ptr B,
            const size_t ldb,
            typename Field::ConstElement_ptr C )  [inline]
```

The documentation for this class was generated from the following file:

- checker_fgemm.inl

16.30 CheckerImplem_ftrsm< Field > Class Template Reference

Public Member Functions

- CheckerImplem_ftrsm (const Field &F_, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr B, const size_t ldb)
- CheckerImplem_ftrsm (typename Field::RandIter &G, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr B, const size_t ldb)
- ~CheckerImplem_ftrsm ()
- bool check (const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_UPLO uplo, const FFLAS::FFLAS_TRANSPOSE trans, const FFLAS::FFLAS_DIAG diag, const size_t m, const size_t n, typename Field::Element_ptr A, size_t lda, const typename Field::ConstElement_ptr X, size_t ldx)

16.30.1 Constructor & Destructor Documentation

16.30.1.1 CheckerImplem_ftrsm() [1/2]

```
CheckerImplem_ftrsm (
            const Field & F_,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
```

```
const typename Field::ConstElement_ptr B,
const size_t ldb ) [inline]
```

16.30.1.2 CheckerImplem_ftrsm() [2/2]

```
CheckerImplem_ftrsm (
    typename Field::RandIter & G,
    const size_t m,
    const size_t n,
    const typename Field::Element alpha,
    const typename Field::ConstElement_ptr B,
    const size_t ldb ) [inline]
```

16.30.1.3 ∼CheckerImplem_ftrsm()

```
~CheckerImplem_ftrsm ( ) [inline]
```

16.30.2 Member Function Documentation

16.30.2.1 check()

```
bool check (
    const FFLAS::FFLAS_SIDE side,
    const FFLAS::FFLAS_UPLO uplo,
    const FFLAS::FFLAS_TRANSPOSE trans,
    const FFLAS::FFLAS_DIAG diag,
    const size_t m,
    const size_t n,
    typename Field::Element_ptr A,
    size_t lda,
    const typename Field::ConstElement_ptr X,
    size_t ldx ) [inline]
```

The documentation for this class was generated from the following file:

- checker_ftrsm.inl

16.31 CheckerImplem_invert< Field > Class Template Reference

Public Member Functions

- CheckerImplem_invert (const Field &F_, const size_t m_, typename Field::ConstElement_ptr A, const size_t lda_)
- CheckerImplem_invert (typename Field::RandIter &G, const size_t m_, typename Field::ConstElement_ptr A, const size_t lda_)
- ∼CheckerImplem_invert ()
- bool check (typename Field::ConstElement_ptr A, int nullity)

16.31.1 Constructor & Destructor Documentation

16.31.1.1 CheckerImplem_invert() [1/2]

```
CheckerImplem_invert (
            const Field & F_,
            const size_t m_,
            typename Field::ConstElement_ptr A,
            const size_t lda_ ) [inline]
```

16.31.1.2 CheckerImplem_invert() [2/2]

```
CheckerImplem_invert (
            typename Field::RandIter & G,
            const size_t m_,
            typename Field::ConstElement_ptr A,
            const size_t lda_ ) [inline]
```

16.31.1.3 ∼CheckerImplem_invert()

```
~CheckerImplem_invert ( ) [inline]
```

16.31.2 Member Function Documentation

16.31.2.1 check()

```
bool check (
            typename Field::ConstElement_ptr A,
            int nullity ) [inline]
```

The documentation for this class was generated from the following file:

- checker_invert.inl

16.32 CheckerImplem_PLUQ< Field > Class Template Reference

Public Member Functions

- CheckerImplem_PLUQ (const Field &F_, size_t m_, size_t n_, typename Field::ConstElement_ptr A, size_t lda)
- CheckerImplem_PLUQ (typename Field::RandIter &G, size_t m_, size_t n_, typename Field::ConstElement_ptr A, size_t lda)
- ∼CheckerImplem_PLUQ ()
- bool check (typename Field::ConstElement_ptr A, size_t lda, const FFLAS::FFLAS_DIAG Diag, size_t r, size_t ∗P, size_t ∗Q) const

  check if the PLUQ factorization is correct.

16.32.1 Constructor & Destructor Documentation

16.32.1.1 CheckerImplem_PLUQ() [1/2]

```
CheckerImplem_PLUQ (
            const Field & F_,
            size_t m_,
            size_t n_,
```

```
typename Field::ConstElement_ptr A,
size_t lda ) [inline]
```

16.32.1.2 CheckerImplem_PLUQ() [2/2]

```
CheckerImplem_PLUQ (
    typename Field::RandIter & G,
    size_t m_,
    size_t n_,
    typename Field::ConstElement_ptr A,
    size_t lda ) [inline]
```

16.32.1.3 ∼CheckerImplem_PLUQ()

```
~CheckerImplem_PLUQ ( ) [inline]
```

16.32.2 Member Function Documentation

16.32.2.1 check()

```
bool check (
    typename Field::ConstElement_ptr A,
    size_t lda,
    const FFLAS::FFLAS_DIAG Diag,
    size_t r,
    size_t * P,
    size_t * Q ) const [inline]
```

check if the PLUQ factorization is correct.

Returns true if w - P(L(U(Q.v))) == 0

Parameters

A	
r	
P	
Q	

The documentation for this class was generated from the following file:

- checker_pluq.inl

16.33 Classic Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.34 Column Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.35 CompactElement< Element > Struct Template Reference

Public Types

- typedef Element type

16.35.1 Member Typedef Documentation

16.35.1.1 type

```
typedef Element type
```

The documentation for this struct was generated from the following file:

- test-io.C

16.36 CompactElement< double > Struct Reference

Public Types

- typedef int32_t type

16.36.1 Member Typedef Documentation

16.36.1.1 type

```
typedef int32_t type
```

The documentation for this struct was generated from the following file:

- test-io.C

16.37 CompactElement< float > Struct Reference

Public Types

- typedef int16_t type

16.37.1 Member Typedef Documentation

16.37.1.1 type

```
typedef int16_t type
```

The documentation for this struct was generated from the following file:

- test-io.C

16.38 CompactElement< int16_t > Struct Reference

Public Types

- typedef int8_t type

16.38.1 Member Typedef Documentation

16.38.1.1 type

`typedef int8_t type`

The documentation for this struct was generated from the following file:

- test-io.C

16.39 CompactElement< int32_t > Struct Reference

Public Types

- typedef int16_t type

16.39.1 Member Typedef Documentation

16.39.1.1 type

`typedef int16_t type`

The documentation for this struct was generated from the following file:

- test-io.C

16.40 CompactElement< int64_t > Struct Reference

Public Types

- typedef int32_t type

16.40.1 Member Typedef Documentation

16.40.1.1 type

`typedef int32_t type`

The documentation for this struct was generated from the following file:

- test-io.C

16.41 compatible_data_type< Field > Struct Template Reference

Static Public Attributes

- static constexpr bool value = true

16.41.1 Field Documentation

16.41.1.1 value

`constexpr bool value = true [static], [constexpr]`

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.42 compatible_data_type< Givaro::ZRing< double > > Struct Reference

Static Public Attributes

- static constexpr bool value = false

16.42.1 Field Documentation

16.42.1.1 value

```
constexpr bool value = false  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.43 compatible_data_type< Givaro::ZRing< float > > Struct Reference

Static Public Attributes

- static constexpr bool value = false

16.43.1 Field Documentation

16.43.1.1 value

```
constexpr bool value = false  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.44 Compose< H1, H2 > Struct Template Reference

Public Member Functions

- Compose ()
- Compose (const Compose &other)
- Compose (const Sequential &S)
- Compose (size_t th1, size_t th2)
- Compose (const H1 &o1, const H2 &o2)
- H1 first_component () const
- H2 second_component () const

Friends

- std::ostream & operator<< (std::ostream &o, const Compose &c)

16.44.1 Constructor & Destructor Documentation

16.44.1.1 Compose() [1/5]

```
Compose ( )  [inline]
```

16.44.1.2 Compose() [2/5]

```
Compose (
            const Compose< H1, H2 > & other )  [inline]
```

16.44.1.3 Compose() [3/5]

```
Compose (
            const Sequential & S )  [inline]
```

16.44.1.4 Compose() [4/5]

```
Compose (
            size_t th1,
            size_t th2 )  [inline]
```

16.44.1.5 Compose() [5/5]

```
Compose (
            const H1 & o1,
            const H2 & o2 )  [inline]
```

16.44.2 Member Function Documentation

16.44.2.1 first_component()

```
H1 first_component ( ) const  [inline]
```

16.44.2.2 second_component()

```
H2 second_component ( ) const  [inline]
```

16.44.3 Friends And Related Function Documentation

16.44.3.1 operator<<

```
std::ostream& operator<< (
            std::ostream & o,
            const Compose< H1, H2 > & c )  [friend]
```

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.45 Simd128_impl< true, true, false, 2 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.45.1 Field Documentation

16.45.1.1 v

```
vect_t v
```

16.45.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int16.inl

16.46 Simd128_impl< true, true, false, 4 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.46.1 Field Documentation

16.46.1.1 v

```
vect_t v
```

16.46.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int32.inl

16.47 Simd128_impl< true, true, false, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.47.1 Field Documentation

16.47.1.1 v

```
vect_t v
```

16.47.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int64.inl

16.48 Simd128_impl< true, true, true, 2 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.48.1 Field Documentation

16.48.1.1 v

```
vect_t v
```

16.48.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int16.inl

16.49 Simd128_impl< true, true, true, 4 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.49.1 Field Documentation

16.49.1.1 v

```
vect_t v
```

16.49.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int32.inl

16.50 Simd128_impl< true, true, true, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.50.1 Field Documentation

16.50.1.1 v

```
vect_t v
```

16.50.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd128_int64.inl

16.51 Simd256_impl< true, false, true, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.51.1 Field Documentation

16.51.1.1 v

```
vect_t v
```

16.51.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd256_double.inl

16.52 Simd256_impl< true, true, false, 2 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.52.1 Field Documentation

16.52.1.1 v

```
vect_t v
```

16.52.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd256_int16.inl

16.53 Simd256_impl< true, true, false, 4 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.53.1 Field Documentation

16.53.1.1 v

```
vect_t v
```

16.53.1.2 t

```
scalar_t t
```

The documentation for this union was generated from the following files:

- simd256_int32.inl
- simd512_int32.inl

16.54 Simd256_impl< true, true, false, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.54.1 Field Documentation

16.54.1.1 v

```
vect_t v
```

16.54.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd256_int64.inl

16.55 Simd256_impl< true, true, true, 2 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.55.1 Field Documentation

16.55.1.1 v

```
vect_t v
```

16.55.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd256_int16.inl

16.56 Simd256_impl< true, true, true, 4 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.56.1 Field Documentation

16.56.1.1 v

```
vect_t v
```

16.56.1.2 t

```
scalar_t t
```

The documentation for this union was generated from the following files:

- simd256_int32.inl
- simd512_int32.inl

16.57 Simd256_impl< true, true, true, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.57.1 Field Documentation

16.57.1.1 v

```
vect_t v
```

16.57.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd256_int64.inl

16.58 Simd512_impl< true, true, false, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.58.1 Field Documentation

16.58.1.1 v

```
vect_t v
```

16.58.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd512_int64.inl

16.59 Simd512_impl< true, true, true, 8 >::Converter Union Reference

Data Fields

- vect_t v
- scalar_t t [vect_size]

16.59.1 Field Documentation

16.59.1.1 v

```
vect_t v
```

16.59.1.2 t

```
scalar_t t[vect_size]
```

The documentation for this union was generated from the following file:

- simd512_int64.inl

16.60 ConvertTo< T > Struct Template Reference

Force conversion to appropriate element type of ElementCategory T.

#include <field-traits.h>

16.60.1 Detailed Description

template<class T>
struct FFLAS::ModeCategories::ConvertTo< T >

Force conversion to appropriate element type of ElementCategory T.

e.g.

- ConvertTo<ElementCategories::MachineFloatTag> tries conversion of Modular<int> to Modular<double>
- ConvertTo<ElementCategories::FixedPrecIntTag> tries conversion of Modular<Integer> to Modular<Rec↩ Int<K> >
- ConvertTo<ElementCategories::ArbitraryPrecIntTag> tries conversion of Modular<Integer> to RNSInteger

The documentation for this struct was generated from the following file:

- field-traits.h

16.61 Coo< ValT, IdxT > Struct Template Reference

Public Types

- using Self = Coo< ValT, IdxT >

Public Member Functions

- Coo (ValT v, IdxT r, IdxT c)
- Coo ()=default
- Coo (const Self &)=default
- Coo (Self &&)=default
- Self & operator= (const Self &)=default
- Self & operator= (Self &&)=default

Data Fields

- ValT val = 0
- IdxT row = 0
- IdxT col = 0

16.61.1 Member Typedef Documentation

16.61.1.1 Self

```
using Self = Coo<ValT, IdxT>
```

16.61.2 Constructor & Destructor Documentation

16.61.2.1 Coo() [1/4]

```
Coo (
            ValT v,
            IdxT r,
            IdxT c )  [inline]
```

16.61.2.2 Coo() [2/4]

```
Coo ( )  [default]
```

16.61.2.3 Coo() [3/4]

```
Coo (
            const Self & )  [default]
```

16.61.2.4 Coo() [4/4]

```
Coo (
            Self && )  [default]
```

16.61.3 Member Function Documentation

16.61.3.1 operator=() [1/2]

```
Self& operator= (
            const Self & )  [default]
```

16.61.3.2 operator=() [2/2]

```
Self& operator= (
            Self && )  [default]
```

16.61.4 Field Documentation

16.61.4.1 val

```
ValT val = 0
```

16.61.4.2 row

```
IdxT row = 0
```

16.61.4.3 col

```
IdxT col = 0
```

The documentation for this struct was generated from the following file:

- csr_hyb_utils.inl

16.62 Coo< Field > Struct Template Reference

`#include <read_sparse.h>`

Public Member Functions

- Coo ()=default
- Coo (typename Field::Element v, index_t r, index_t c)
- Coo (const Self &)=default
- Coo (Self &&)=default
- Self & operator= (const Self &)=default
- Self & operator= (Self &&)=default

Data Fields

- Field::Element val = 0
- index_t col = 0
- index_t row = 0
- bool deleted = false

16.62.1 Constructor & Destructor Documentation

16.62.1.1 Coo() [1/4]

```
Coo ( )  [default]
```

16.62.1.2 Coo() [2/4]

```
Coo (
            typename Field::Element v,
            index_t r,
            index_t c )  [inline]
```

16.62.1.3 Coo() [3/4]

```
Coo (
            const Self & )  [default]
```

16.62.1.4 Coo() [4/4]

```
Coo (
            Self && )  [default]
```

16.62.2 Member Function Documentation

16.62.2.1 operator=() [1/2]

```
Self& operator= (
            const Self & )  [default]
```

16.62.2.2 operator=() [2/2]

```
Self& operator= (
            Self &&  )  [default]
```

16.62.3 Field Documentation

16.62.3.1 val

```
Field::Element val = 0
```

16.62.3.2 col

```
index_t col = 0
```

16.62.3.3 row

```
index_t row = 0
```

16.62.3.4 deleted

```
bool deleted = false
```

The documentation for this struct was generated from the following file:

- read_sparse.h

16.63 Coo< ValT, IdxT > Struct Template Reference

Public Types

- using Self = Coo< ValT, IdxT >

Public Member Functions

- Coo (ValT v, IdxT r, IdxT c)
- Coo ()=default
- Coo (const Self &)=default
- Coo (Self &&)=default
- Self & operator= (const Self &)=default
- Self & operator= (Self &&)=default

Data Fields

- ValT val = 0
- IdxT row = 0
- IdxT col = 0

16.63.1 Member Typedef Documentation

16.63.1.1 Self

```
using Self = Coo<ValT, IdxT>
```

16.63.2 Constructor & Destructor Documentation

16.63.2.1 Coo() [1/4]

```
Coo (
            ValT v,
            IdxT r,
            IdxT c )  [inline]
```

16.63.2.2 Coo() [2/4]

```
Coo ( )  [default]
```

16.63.2.3 Coo() [3/4]

```
Coo (
            const Self & )  [default]
```

16.63.2.4 Coo() [4/4]

```
Coo (
            Self && )  [default]
```

16.63.3 Member Function Documentation

16.63.3.1 operator=() [1/2]

```
Self& operator= (
            const Self & )  [default]
```

16.63.3.2 operator=() [2/2]

```
Self& operator= (
            Self && )  [default]
```

16.63.4 Field Documentation

16.63.4.1 val

```
ValT val = 0
```

16.63.4.2 row

```
IdxT row = 0
```

16.63.4.3 col

`IdxT col = 0`

The documentation for this struct was generated from the following file:

- sell_utils.inl

16.64 CooMat< Field > Struct Template Reference

`#include <fflas_sparse.h>`

Data Fields

- FFLAS::Sparse< Field, SparseMatrix_t::COO, int16_t > * _coo16 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::COO, int32_t > * _coo32 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::COO, int64_t > * _coo64 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::COO_ZO, int16_t > * _coo16_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::COO_ZO, int32_t > * _coo32_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::COO_ZO, int64_t > * _coo64_zo = nullptr

16.64.1 Field Documentation

16.64.1.1 _coo16

`FFLAS::Sparse<Field,SparseMatrix_t::COO,int16_t>* _coo16 = nullptr`

16.64.1.2 _coo32

`FFLAS::Sparse<Field,SparseMatrix_t::COO,int32_t>* _coo32 = nullptr`

16.64.1.3 _coo64

`FFLAS::Sparse<Field,SparseMatrix_t::COO,int64_t>* _coo64 = nullptr`

16.64.1.4 _coo16_zo

`FFLAS::Sparse<Field,SparseMatrix_t::COO_ZO,int16_t>* _coo16_zo = nullptr`

16.64.1.5 _coo32_zo

`FFLAS::Sparse<Field,SparseMatrix_t::COO_ZO,int32_t>* _coo32_zo = nullptr`

16.64.1.6 _coo64_zo

`FFLAS::Sparse<Field,SparseMatrix_t::COO_ZO,int64_t>* _coo64_zo = nullptr`

The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.65 count_nonconst_lvalue_reference< T > Struct Template Reference

The documentation for this struct was generated from the following file:

- test-simd.C

16.66 count_nonconst_lvalue_reference< const T &, O... > Struct Template Reference

Static Public Attributes

- static constexpr size_t n = count_nonconst_lvalue_reference<O...>::n

16.66.1 Field Documentation

16.66.1.1 n

```
constexpr size_t n = count_nonconst_lvalue_reference<O...>::n  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.67 count_nonconst_lvalue_reference< T &, O... > Struct Template Reference

Static Public Attributes

- static constexpr size_t n

16.67.1 Field Documentation

16.67.1.1 n

```
constexpr size_t n  [static], [constexpr]
```

Initial value:

```
= std::integral_constant<size_t, 1>::value
                                    + count_nonconst_lvalue_reference<O...>::n
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.68 count_nonconst_lvalue_reference< T, O... > Struct Template Reference

Static Public Attributes

- static constexpr size_t n = count_nonconst_lvalue_reference<O...>::n

16.68.1 Field Documentation

16.68.1.1 n

`constexpr size_t n = count_nonconst_lvalue_reference<0...>::n [static], [constexpr]`

The documentation for this struct was generated from the following file:

- test-simd.C

16.69 count_nonconst_lvalue_reference<> Struct Reference

Static Public Attributes

- static constexpr size_t n = std::integral_constant<size_t, 0>::value

16.69.1 Field Documentation

16.69.1.1 n

`constexpr size_t n = std::integral_constant<size_t, 0>::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- test-simd.C

16.70 CsrMat< Field > Struct Template Reference

`#include <fflas_sparse.h>`

Data Fields

- FFLAS::Sparse< Field, SparseMatrix_t::CSR, int16_t > ∗ _csr16 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::CSR, int32_t > ∗ _csr32 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::CSR, int64_t > ∗ _csr64 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::CSR_ZO, int16_t > ∗ _csr16_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::CSR_ZO, int32_t > ∗ _csr32_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::CSR_ZO, int64_t > ∗ _csr64_zo = nullptr

16.70.1 Field Documentation

16.70.1.1 _csr16

`FFLAS::Sparse<Field,SparseMatrix_t::CSR,int16_t>* _csr16 = nullptr`

16.70.1.2 _csr32

`FFLAS::Sparse<Field,SparseMatrix_t::CSR,int32_t>* _csr32 = nullptr`

16.70.1.3 _csr64

`FFLAS::Sparse<Field,SparseMatrix_t::CSR,int64_t>* _csr64 = nullptr`

16.70.1.4 _csr16_zo

```
FFLAS::Sparse<Field,SparseMatrix_t::CSR_ZO,int16_t>* _csr16_zo = nullptr
```

16.70.1.5 _csr32_zo

```
FFLAS::Sparse<Field,SparseMatrix_t::CSR_ZO,int32_t>* _csr32_zo = nullptr
```

16.70.1.6 _csr64_zo

```
FFLAS::Sparse<Field,SparseMatrix_t::CSR_ZO,int64_t>* _csr64_zo = nullptr
```

The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.71 DefaultBoundedTag Struct Reference

Use standard field operations, but keeps track of bounds on input and output.

```
#include <field-traits.h>
```

16.71.1 Detailed Description

Use standard field operations, but keeps track of bounds on input and output.
The documentation for this struct was generated from the following file:

- field-traits.h

16.72 DefaultTag Struct Reference

No specific mode of action: use standard field operations.

```
#include <field-traits.h>
```

16.72.1 Detailed Description

No specific mode of action: use standard field operations.
The documentation for this struct was generated from the following file:

- field-traits.h

16.73 DelayedTag Struct Reference

Performs field operations with delayed mod reductions. Ensures result is reduced.

```
#include <field-traits.h>
```

16.73.1 Detailed Description

Performs field operations with delayed mod reductions. Ensures result is reduced.
The documentation for this struct was generated from the following file:

- field-traits.h

16.74 DivideAndConquer Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.75 ElementTraits< Element > Struct Template Reference

ElementTraits.

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::GenericTag value

16.75.1 Detailed Description

template<class Element>
struct FFLAS::ElementTraits< Element >

ElementTraits.

16.75.2 Member Typedef Documentation

16.75.2.1 value

`typedef ElementCategories::GenericTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.76 ElementTraits< double > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::MachineFloatTag value

16.76.1 Member Typedef Documentation

16.76.1.1 value

`typedef ElementCategories::MachineFloatTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.77 ElementTraits< FFPACK::rns_double_elt > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::RNSElementTag value

16.77.1 Member Typedef Documentation

16.77.1.1 value

```
typedef ElementCategories::RNSElementTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.78 ElementTraits< float > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineFloatTag value

16.78.1 Member Typedef Documentation

16.78.1.1 value

```
typedef ElementCategories::MachineFloatTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.79 ElementTraits< Givaro::Integer > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::ArbitraryPrecIntTag value

16.79.1 Member Typedef Documentation

16.79.1.1 value

```
typedef ElementCategories::ArbitraryPrecIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.80 ElementTraits< int16_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.80.1 Member Typedef Documentation

16.80.1.1 value

```
typedef ElementCategories::MachineIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.81 ElementTraits< int32_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.81.1 Member Typedef Documentation

16.81.1.1 value

```
typedef ElementCategories::MachineIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.82 ElementTraits< int64_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.82.1 Member Typedef Documentation

16.82.1.1 value

```
typedef ElementCategories::MachineIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.83 ElementTraits< int8_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.83.1 Member Typedef Documentation

16.83.1.1 value

`typedef ElementCategories::MachineIntTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.84 ElementTraits< RecInt::rint< K > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::FixedPrecIntTag value

16.84.1 Member Typedef Documentation

16.84.1.1 value

`typedef ElementCategories::FixedPrecIntTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.85 ElementTraits< RecInt::rmint< K, MG > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::FixedPrecIntTag value

16.85.1 Member Typedef Documentation

16.85.1.1 value

`typedef ElementCategories::FixedPrecIntTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.86 ElementTraits< RecInt::ruint< K > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::FixedPrecIntTag value

16.86.1 Member Typedef Documentation

16.86.1.1 value

```
typedef ElementCategories::FixedPrecIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.87 ElementTraits< uint16_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.87.1 Member Typedef Documentation

16.87.1.1 value

```
typedef ElementCategories::MachineIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.88 ElementTraits< uint32_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.88.1 Member Typedef Documentation

16.88.1.1 value

```
typedef ElementCategories::MachineIntTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.89 ElementTraits< uint64_t > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ElementCategories::MachineIntTag value

16.89.1 Member Typedef Documentation

16.89.1.1 value

`typedef ElementCategories::MachineIntTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.90 ElementTraits< uint8_t > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef ElementCategories::MachineIntTag value

16.90.1 Member Typedef Documentation

16.90.1.1 value

`typedef ElementCategories::MachineIntTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.91 EllMat< Field > Struct Template Reference

`#include <fflas_sparse.h>`

Data Fields

- FFLAS::Sparse< Field, SparseMatrix_t::ELL, int16_t > * _ell16 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::ELL, int32_t > * _ell32 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::ELL, int64_t > * _ell64 = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::ELL_ZO, int16_t > * _ell16_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::ELL_ZO, int32_t > * _ell32_zo = nullptr
- FFLAS::Sparse< Field, SparseMatrix_t::ELL_ZO, int64_t > * _ell64_zo = nullptr

16.91.1 Field Documentation

16.91.1.1 _ell16

`FFLAS::Sparse<Field,SparseMatrix_t::ELL,int16_t>* _ell16 = nullptr`

16.91.1.2 _ell32

`FFLAS::Sparse<Field,SparseMatrix_t::ELL,int32_t>* _ell32 = nullptr`

16.91.1.3 _ell64

`FFLAS::Sparse<Field,SparseMatrix_t::ELL,int64_t>* _ell64 = nullptr`

16.91.1.4 _ell16_zo

`FFLAS::Sparse<Field,SparseMatrix_t::ELL_ZO,int16_t>* _ell16_zo = nullptr`

16.91.1.5 _ell32_zo

`FFLAS::Sparse<Field,SparseMatrix_t::ELL_ZO,int32_t>* _ell32_zo = nullptr`

16.91.1.6 _ell64_zo

`FFLAS::Sparse<Field,SparseMatrix_t::ELL_ZO,int64_t>* _ell64_zo = nullptr`

The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.92 Failure Class Reference

A precondtion failed.

`#include <debug.h>`

Public Member Functions

- Failure ()
- void operator() (const char ∗function, int line, const char ∗check)
- void operator() (const char ∗function, const char ∗file, int line, const char ∗check)
- void setErrorStream (std::ostream &stream)
- std::ostream & print (std::ostream &o) const

Protected Attributes

- std::ostream ∗ _errorStream

16.92.1 Detailed Description

A precondtion failed.

The `throw` mechanism is usually used here as in

```
if (!check)
failure()(__func__,__LINE__,"this check just failed");
```

The parameters of the constructor help debugging.

16.92.2 Constructor & Destructor Documentation

16.92.2.1 Failure()

`Failure ( ) [inline]`

16.92.3 Member Function Documentation

16.92.3.1 operator()() [1/2]

```
void operator() (
            const char * function,
            int line,
            const char * check ) [inline]
```

A precondtion failed.

Parameters

function	usually **func**, the function that threw the error
line	usually **LINE**, the line where it happened
check	a string telling what failed.

16.92.3.2 operator()() [2/2]

```
void operator() (
            const char * function,
            const char * file,
            int line,
            const char * check ) [inline]
```

A precondtion failed. The parameter help debugging. This is not much different from the previous except we can digg faster in the file where the exception was triggered.

Parameters

function	usually **func**, the function that threw the error
file	usually **FILE**, the file where this function is
line	usually **LINE**, the line where it happened
check	a string telling what failed.

16.92.3.3 setErrorStream()

```
void setErrorStream (
            std::ostream & stream )
```

16.92.3.4 print()

```
std::ostream& print (
            std::ostream & o ) const [inline]
```

overload the virtual print of LinboxError.

Parameters

o	output stream

16.92.4 Field Documentation

16.92.4.1 _errorStream

`std::ostream* _errorStream [protected]`

The documentation for this class was generated from the following file:

- debug.h

16.93 FailureCharpolyCheck Class Reference

`#include <checkers_ffpack.h>`

The documentation for this class was generated from the following file:

- checkers_ffpack.h

16.94 FailureDetCheck Class Reference

`#include <checkers_ffpack.h>`

The documentation for this class was generated from the following file:

- checkers_ffpack.h

16.95 FailureFgemmCheck Class Reference

`#include <checkers_fflas.h>`

The documentation for this class was generated from the following file:

- checkers_fflas.h

16.96 FailureInvertCheck Class Reference

`#include <checkers_ffpack.h>`

The documentation for this class was generated from the following file:

- checkers_ffpack.h

16.97 FailurePLUQCheck Class Reference

`#include <checkers_ffpack.h>`

The documentation for this class was generated from the following file:

- checkers_ffpack.h

16.98 FailureTrsmCheck Class Reference

`#include <checkers_fflas.h>`

The documentation for this class was generated from the following file:

- checkers_fflas.h

16.99 FieldSimd< _Field > Class Template Reference

Public Types

- using Field = _Field
- using Element = typename Field::Element
- using simd = Simd< typename _Field::Element >
- using vect_t = typename simd::vect_t
- using scalar_t = typename simd::scalar_t

Public Member Functions

- FieldSimd (const Field &f)
- FieldSimd (const Self &)=default
- FieldSimd (Self &&)=default
- Self & operator= (const Self &)=default
- Self & operator= (Self &&)=default
- INLINE vect_t init (vect_t &x, const vect_t a) const
- INLINE vect_t init (const vect_t a) const
- INLINE vect_t add (vect_t &c, const vect_t a, const vect_t b)
- INLINE vect_t add (const vect_t a, const vect_t b)
- INLINE vect_t addin (vect_t &a, const vect_t b) const
- INLINE vect_t add_r (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t add_r (const vect_t a, const vect_t b) const
- INLINE vect_t addin_r (vect_t &a, const vect_t b) const
- INLINE vect_t sub (vect_t &c, const vect_t a, const vect_t b)
- INLINE vect_t sub (const vect_t a, const vect_t b)
- INLINE vect_t subin (vect_t &a, const vect_t b) const
- INLINE vect_t sub_r (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t sub_r (const vect_t a, const vect_t b) const
- INLINE vect_t subin_r (vect_t &a, const vect_t b) const
- INLINE vect_t zero (vect_t &x) const
- INLINE vect_t zero () const
- INLINE vect_t mod (vect_t &c) const
- INLINE vect_t mul (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t mul (const vect_t a, const vect_t b) const
- INLINE vect_t mulin (vect_t &a, const vect_t b) const
- INLINE vect_t mul_r (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t mul_r (const vect_t a, const vect_t b) const
- INLINE vect_t axpy (vect_t &r, const vect_t a, const vect_t b, const vect_t c) const
- INLINE vect_t axpy (const vect_t c, const vect_t a, const vect_t b) const
- INLINE vect_t axpyin (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t axpy_r (vect_t &r, const vect_t a, const vect_t b, const vect_t c) const
- INLINE vect_t axpy_r (const vect_t c, const vect_t a, const vect_t b) const
- INLINE vect_t axpyin_r (vect_t &c, const vect_t a, const vect_t b) const
- INLINE vect_t maxpy (vect_t &r, const vect_t a, const vect_t b, const vect_t c) const
- INLINE vect_t maxpy (const vect_t c, const vect_t a, const vect_t b) const
- INLINE vect_t maxpyin (vect_t &c, const vect_t a, const vect_t b) const

Static Public Attributes

- static constexpr const size_t vect_size = simd::vect_size
- static constexpr const size_t alignment = simd::alignment

16.99.1 Member Typedef Documentation

16.99.1.1 Field

```
using Field = _Field
```

16.99.1.2 Element

```
using Element = typename Field::Element
```

16.99.1.3 simd

```
using simd = Simd<typename _Field::Element>
```

16.99.1.4 vect_t

```
using vect_t = typename simd::vect_t
```

16.99.1.5 scalar_t

```
using scalar_t = typename simd::scalar_t
```

16.99.2 Constructor & Destructor Documentation

16.99.2.1 FieldSimd() [1/3]

```
FieldSimd (
            const Field & f )  [inline]
```

16.99.2.2 FieldSimd() [2/3]

```
FieldSimd (
            const Self & )  [default]
```

16.99.2.3 FieldSimd() [3/3]

```
FieldSimd (
            Self && )  [default]
```

16.99.3 Member Function Documentation

16.99.3.1 operator=() [1/2]

```
Self& operator= (
            const Self & )  [default]
```

16.99.3.2 operator=() [2/2]

```
Self& operator= (
            Self && )  [default]
```

16.99.3.3 init() [1/2]

```
INLINE vect_t init (
            vect_t & x,
            const vect_t a ) const  [inline]
```

16.99.3.4 init() [2/2]

```
INLINE vect_t init (
            const vect_t a ) const [inline]
```

16.99.3.5 add() [1/2]

```
INLINE vect_t add (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline]
```

16.99.3.6 add() [2/2]

```
INLINE vect_t add (
            const vect_t a,
            const vect_t b ) [inline]
```

16.99.3.7 addin()

```
INLINE vect_t addin (
            vect_t & a,
            const vect_t b ) const [inline]
```

16.99.3.8 add_r() [1/2]

```
INLINE vect_t add_r (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const [inline]
```

16.99.3.9 add_r() [2/2]

```
INLINE vect_t add_r (
            const vect_t a,
            const vect_t b ) const [inline]
```

16.99.3.10 addin_r()

```
INLINE vect_t addin_r (
            vect_t & a,
            const vect_t b ) const [inline]
```

16.99.3.11 sub() [1/2]

```
INLINE vect_t sub (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline]
```

16.99.3.12 sub() [2/2]

```
INLINE vect_t sub (
            const vect_t a,
            const vect_t b )  [inline]
```

16.99.3.13 subin()

```
INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) const  [inline]
```

16.99.3.14 sub_r() [1/2]

```
INLINE vect_t sub_r (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.15 sub_r() [2/2]

```
INLINE vect_t sub_r (
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.16 subin_r()

```
INLINE vect_t subin_r (
            vect_t & a,
            const vect_t b ) const  [inline]
```

16.99.3.17 zero() [1/2]

```
INLINE vect_t zero (
            vect_t & x ) const  [inline]
```

16.99.3.18 zero() [2/2]

```
INLINE vect_t zero ( ) const  [inline]
```

16.99.3.19 mod()

```
INLINE vect_t mod (
            vect_t & c ) const  [inline]
```

16.99.3.20 mul() [1/2]

```
INLINE vect_t mul (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.21 mul() [2/2]

```
INLINE vect_t mul (
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.22 mulin()

```
INLINE vect_t mulin (
            vect_t & a,
            const vect_t b ) const  [inline]
```

16.99.3.23 mul_r() [1/2]

```
INLINE vect_t mul_r (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.24 mul_r() [2/2]

```
INLINE vect_t mul_r (
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.25 axpy() [1/2]

```
INLINE vect_t axpy (
            vect_t & r,
            const vect_t a,
            const vect_t b,
            const vect_t c ) const  [inline]
```

16.99.3.26 axpy() [2/2]

```
INLINE vect_t axpy (
            const vect_t c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.27 axpyin()

```
INLINE vect_t axpyin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.28 axpy_r() [1/2]

```
INLINE vect_t axpy_r (
            vect_t & r,
            const vect_t a,
```

```
            const vect_t b,
            const vect_t c ) const  [inline]
```

16.99.3.29 axpy_r() [2/2]

```
INLINE vect_t axpy_r (
            const vect_t c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.30 axpyin_r()

```
INLINE vect_t axpyin_r (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.31 maxpy() [1/2]

```
INLINE vect_t maxpy (
            vect_t & r,
            const vect_t a,
            const vect_t b,
            const vect_t c ) const  [inline]
```

16.99.3.32 maxpy() [2/2]

```
INLINE vect_t maxpy (
            const vect_t c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.3.33 maxpyin()

```
INLINE vect_t maxpyin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) const  [inline]
```

16.99.4 Field Documentation

16.99.4.1 vect_size

```
constexpr const size_t vect_size = simd::vect_size  [static], [constexpr]
```

16.99.4.2 alignment

```
constexpr const size_t alignment = simd::alignment  [static], [constexpr]
```

The documentation for this class was generated from the following file:

- simd_modular.inl

16.100 FieldTraits< Field > Struct Template Reference

FieldTrait.

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::GenericTag category

Static Public Attributes

- static const bool balanced = false

16.100.1 Detailed Description

template<class Field>
struct FFLAS::FieldTraits< Field >

FieldTrait.

16.100.2 Member Typedef Documentation

16.100.2.1 category

`typedef FieldCategories::GenericTag category`

16.100.3 Field Documentation

16.100.3.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.101 FieldTraits< FFPACK::RNSInteger< T > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.101.1 Member Typedef Documentation

16.101.1.1 category

`typedef FieldCategories::UnparametricTag category`

16.101.2 Field Documentation

16.101.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.102 FieldTraits< FFPACK::RNSIntegerMod< T > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::ModularTag category

Static Public Attributes

- static const bool balanced = false

16.102.1 Member Typedef Documentation

16.102.1.1 category

`typedef FieldCategories::ModularTag category`

16.102.2 Field Documentation

16.102.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.103 FieldTraits< Givaro::Modular< Element > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::ModularTag category

Static Public Attributes

- static const bool balanced = false

16.103.1 Member Typedef Documentation

16.103.1.1 category

`typedef FieldCategories::ModularTag category`

16.103.2 Field Documentation

16.103.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.104 FieldTraits< Givaro::ModularBalanced< Element > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::ModularTag category

Static Public Attributes

- static const bool balanced = true

16.104.1 Member Typedef Documentation

16.104.1.1 category

`typedef FieldCategories::ModularTag category`

16.104.2 Field Documentation

16.104.2.1 balanced

`const bool balanced = true [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.105 FieldTraits< Givaro::ZRing< double > > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.105.1 Member Typedef Documentation

16.105.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.105.2 Field Documentation

16.105.2.1 balanced

```
const bool balanced = false  [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.106 FieldTraits< Givaro::ZRing< float > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.106.1 Member Typedef Documentation

16.106.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.106.2 Field Documentation

16.106.2.1 balanced

```
const bool balanced = false  [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.107 FieldTraits< Givaro::ZRing< Givaro::Integer > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.107.1 Member Typedef Documentation

16.107.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.107.2 Field Documentation

16.107.2.1 balanced

```
const bool balanced = false  [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.108 FieldTraits< Givaro::ZRing< int16_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.108.1 Member Typedef Documentation

16.108.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.108.2 Field Documentation

16.108.2.1 balanced

```
const bool balanced = false  [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.109 FieldTraits< Givaro::ZRing< int32_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.109.1 Member Typedef Documentation

16.109.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.109.2 Field Documentation

16.109.2.1 balanced

```
const bool balanced = false [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.110 FieldTraits< Givaro::ZRing< int64_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.110.1 Member Typedef Documentation

16.110.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.110.2 Field Documentation

16.110.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.111 FieldTraits< Givaro::ZRing< RecInt::ruint< K > > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.111.1 Member Typedef Documentation

16.111.1.1 category

`typedef FieldCategories::UnparametricTag category`

16.111.2 Field Documentation

16.111.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.112 FieldTraits< Givaro::ZRing< uint16_t > > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.112.1 Member Typedef Documentation

16.112.1.1 category

`typedef FieldCategories::UnparametricTag category`

16.112.2 Field Documentation

16.112.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.113 FieldTraits< Givaro::ZRing< uint32_t > > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.113.1 Member Typedef Documentation

16.113.1.1 category

`typedef FieldCategories::UnparametricTag category`

16.113.2 Field Documentation

16.113.2.1 balanced

`const bool balanced = false [static]`

The documentation for this struct was generated from the following file:

- field-traits.h

16.114 FieldTraits< Givaro::ZRing< uint64_t > > Struct Reference

`#include <field-traits.h>`

Public Types

- typedef FieldCategories::UnparametricTag category

Static Public Attributes

- static const bool balanced = false

16.114.1 Member Typedef Documentation

16.114.1.1 category

```
typedef FieldCategories::UnparametricTag category
```

16.114.2 Field Documentation

16.114.2.1 balanced

```
const bool balanced = false  [static]
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.115 Fixed Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.116 FixedPrecIntTag Struct Reference

Fixed precision integers above machine precision: Givaro::recInt.

```
#include <field-traits.h>
```

16.116.1 Detailed Description

Fixed precision integers above machine precision: Givaro::recInt.
The documentation for this struct was generated from the following file:

- field-traits.h

16.117 ScalFunctionsBase< Element, typename enable_if< is_floating_point< Element >::value >::type >::FloatingPointTestDistribution Class Reference

Public Types

- using IntType = typename make_unsigned_int< Element >::type

Public Member Functions

- FloatingPointTestDistribution ()
- template<class Generator >
  Element operator() (Generator &g)

16.117.1 Member Typedef Documentation

16.117.1.1 IntType

```
using IntType = typename make_unsigned_int<Element>::type
```

16.117.2 Constructor & Destructor Documentation

16.117.2.1 FloatingPointTestDistribution()

```
FloatingPointTestDistribution ( ) [inline]
```

16.117.3 Member Function Documentation

16.117.3.1 operator()()

```
Element operator() (
            Generator & g ) [inline]
```

The documentation for this class was generated from the following file:

- test-simd.C

16.118 ForStrategy1D< blocksize_t, Cut, Param > Struct Template Reference

Public Member Functions

- ForStrategy1D (const blocksize_t n, const ParSeqHelper::Parallel< Cut, Param > H)
- ForStrategy1D (const blocksize_t b, const blocksize_t e, const ParSeqHelper::Parallel< Cut, Param > H)
- void build (const blocksize_t n, const ParSeqHelper::Parallel< Cut, Param > H)
- blocksize_t initialize ()
- bool isTerminated () const
- blocksize_t begin () const
- blocksize_t end () const
- blocksize_t numblocks () const
- blocksize_t blockindex () const
- blocksize_t operator++ ()

Protected Attributes

- blocksize_t ibeg
- blocksize_t iend
- blocksize_t current
- blocksize_t firstBlockSize
- blocksize_t lastBlockSize
- blocksize_t changeBS
- blocksize_t numBlock

16.118.1 Constructor & Destructor Documentation

16.118.1.1 ForStrategy1D() [1/2]

```
ForStrategy1D (
            const blocksize_t n,
            const ParSeqHelper::Parallel< Cut, Param > H ) [inline]
```

16.118.1.2 ForStrategy1D() [2/2]

```
ForStrategy1D (
            const blocksize_t b,
            const blocksize_t e,
            const ParSeqHelper::Parallel< Cut, Param > H ) [inline]
```

16.118.2 Member Function Documentation

16.118.2.1 build()

```
void build (
            const blocksize_t n,
            const ParSeqHelper::Parallel< Cut, Param > H )  [inline]
```

16.118.2.2 initialize()

```
blocksize_t initialize ( )  [inline]
```

16.118.2.3 isTerminated()

```
bool isTerminated ( ) const  [inline]
```

16.118.2.4 begin()

```
blocksize_t begin ( ) const  [inline]
```

16.118.2.5 end()

```
blocksize_t end ( ) const  [inline]
```

16.118.2.6 numblocks()

```
blocksize_t numblocks ( ) const  [inline]
```

16.118.2.7 blockindex()

```
blocksize_t blockindex ( ) const  [inline]
```

16.118.2.8 operator++()

```
blocksize_t operator++ ( )  [inline]
```

16.118.3 Field Documentation

16.118.3.1 ibeg

```
blocksize_t ibeg  [protected]
```

16.118.3.2 iend

```
blocksize_t iend  [protected]
```

16.118.3.3 current

```
blocksize_t current [protected]
```

16.118.3.4 firstBlockSize

```
blocksize_t firstBlockSize [protected]
```

16.118.3.5 lastBlockSize

```
blocksize_t lastBlockSize [protected]
```

16.118.3.6 changeBS

```
blocksize_t changeBS [protected]
```

16.118.3.7 numBlock

```
blocksize_t numBlock [protected]
```

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.119 ForStrategy2D< blocksize_t, Cut, Param > Struct Template Reference

Public Member Functions

- ForStrategy2D (const blocksize_t m, const blocksize_t n, const ParSeqHelper::Parallel< Cut, Param > H)
- blocksize_t initialize ()
- bool isTerminated () const
- blocksize_t ibegin () const
- blocksize_t jbegin () const
- blocksize_t iend () const
- blocksize_t jend () const
- blocksize_t operator++ ()
- blocksize_t rownumblocks () const
- blocksize_t colnumblocks () const
- blocksize_t blockindex () const
- blocksize_t rowblockindex () const
- blocksize_t colblockindex () const

Protected Attributes

- blocksize_t _ibeg
- blocksize_t _iend
- blocksize_t _jbeg
- blocksize_t _jend
- blocksize_t rowBlockSize
- blocksize_t colBlockSize
- blocksize_t current
- blocksize_t lastRBS
- blocksize_t lastCBS

- blocksize_t changeRBS
- blocksize_t changeCBS
- blocksize_t numRowBlock
- blocksize_t numColBlock
- blocksize_t BLOCKS

Friends

- std::ostream & operator<< (std::ostream &out, const ForStrategy2D &FS2D)

16.119.1 Constructor & Destructor Documentation

16.119.1.1 ForStrategy2D()

```
ForStrategy2D (
            const blocksize_t m,
            const blocksize_t n,
            const ParSeqHelper::Parallel< Cut, Param > H )  [inline]
```

16.119.2 Member Function Documentation

16.119.2.1 initialize()

```
blocksize_t initialize ( )  [inline]
```

16.119.2.2 isTerminated()

```
bool isTerminated ( ) const  [inline]
```

16.119.2.3 ibegin()

```
blocksize_t ibegin ( ) const  [inline]
```

16.119.2.4 jbegin()

```
blocksize_t jbegin ( ) const  [inline]
```

16.119.2.5 iend()

```
blocksize_t iend ( ) const  [inline]
```

16.119.2.6 jend()

```
blocksize_t jend ( ) const  [inline]
```

16.119.2.7 operator++()

```
blocksize_t operator++ ( )  [inline]
```

16.119.2.8 rownumblocks()

```
blocksize_t rownumblocks ( ) const [inline]
```

16.119.2.9 colnumblocks()

```
blocksize_t colnumblocks ( ) const [inline]
```

16.119.2.10 blockindex()

```
blocksize_t blockindex ( ) const [inline]
```

16.119.2.11 rowblockindex()

```
blocksize_t rowblockindex ( ) const [inline]
```

16.119.2.12 colblockindex()

```
blocksize_t colblockindex ( ) const [inline]
```

16.119.3 Friends And Related Function Documentation

16.119.3.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const ForStrategy2D< blocksize_t, Cut, Param > & FS2D ) [friend]
```

16.119.4 Field Documentation

16.119.4.1 _ibeg

```
blocksize_t _ibeg [protected]
```

16.119.4.2 _iend

```
blocksize_t _iend [protected]
```

16.119.4.3 _jbeg

```
blocksize_t _jbeg [protected]
```

16.119.4.4 _jend

```
blocksize_t _jend [protected]
```

16.119.4.5 rowBlockSize

`blocksize_t rowBlockSize [protected]`

16.119.4.6 colBlockSize

`blocksize_t colBlockSize [protected]`

16.119.4.7 current

`blocksize_t current [protected]`

16.119.4.8 lastRBS

`blocksize_t lastRBS [protected]`

16.119.4.9 lastCBS

`blocksize_t lastCBS [protected]`

16.119.4.10 changeRBS

`blocksize_t changeRBS [protected]`

16.119.4.11 changeCBS

`blocksize_t changeCBS [protected]`

16.119.4.12 numRowBlock

`blocksize_t numRowBlock [protected]`

16.119.4.13 numColBlock

`blocksize_t numColBlock [protected]`

16.119.4.14 BLOCKS

`blocksize_t BLOCKS [protected]`

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.120 ftrmmLeftLowerNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.121 ftrmmLeftLowerNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.122 ftrmmLeftLowerTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.123 ftrmmLeftLowerTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.124 ftrmmLeftUpperNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.125 ftrmmLeftUpperNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.126 ftrmmLeftUpperTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.127 ftrmmLeftUpperTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.128 ftrmmRightLowerNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.129 ftrmmRightLowerNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.130 ftrmmRightLowerTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.131 ftrmmRightLowerTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.132 ftrmmRightUpperNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.133 ftrmmRightUpperNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.134 ftrmmRightUpperTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.135 ftrmmRightUpperTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.136 ftrsmLeftLowerNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.137 ftrsmLeftLowerNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.138 ftrsmLeftLowerTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.139 ftrsmLeftLowerTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.140 ftrsmLeftUpperNoTransNonUnit< Element > Class Template Reference

Computes the maximal size for delaying the modular reduction in a triangular system resolution.

16.140.1 Detailed Description

template<class Element>
class FFLAS::Protected::ftrsmLeftUpperNoTransNonUnit< Element >

Computes the maximal size for delaying the modular reduction in a triangular system resolution.
Compute the maximal dimension k, such that a unit diagonal triangular system of dimension k can be solved over Z without overflow of the underlying floating point representation.

Bibliography
- Dumas, Giorgi, Pernet 06, arXiv:cs/0601133.

Parameters

F	Finite Field/Ring of the computation

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.141 ftrsmLeftUpperNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.142 ftrsmLeftUpperTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.143 ftrsmLeftUpperTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.144 ftrsmRightLowerNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.145 ftrsmRightLowerNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.146 ftrsmRightLowerTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.147 ftrsmRightLowerTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.148 ftrsmRightUpperNoTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.149 ftrsmRightUpperNoTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.150 ftrsmRightUpperTransNonUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.151 ftrsmRightUpperTransUnit< Element > Class Template Reference

The documentation for this class was generated from the following file:

- fflas_level3.inl

16.152 GenericTag Struct Reference

default is generic

`#include <field-traits.h>`

16.152.1 Detailed Description

default is generic

The documentation for this struct was generated from the following file:

- field-traits.h

16.153 GenericTag Struct Reference

generic ring.

`#include <field-traits.h>`

16.153.1 Detailed Description

generic ring.

The documentation for this struct was generated from the following file:

- field-traits.h

16.154 Grain Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.155 has_minus_eq_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.155.1 Field Documentation

16.155.1.1 value

`constexpr bool value = type::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.156 has_minus_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.156.1 Field Documentation

16.156.1.1 value

`constexpr bool value = type::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.157 has_mul_eq_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.157.1 Field Documentation

16.157.1.1 value

`constexpr bool value = type::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.158 has_mul_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.158.1 Field Documentation

16.158.1.1 value

`constexpr bool value = type::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.159 has_operation< T > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value

16.159.1 Field Documentation

16.159.1.1 value

`constexpr bool value [static], [constexpr]`

Initial value:

```
= (has_plus<T>::value && has_minus<T>::value && has_equal<T>::value &&
                                        has_plus_eq<T>::value && has_minus_eq<T>::value && has_mul<T>::value
      && has_mul_eq<T>::value)
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.160 has_plus_eq_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.160.1 Field Documentation

16.160.1.1 value

`constexpr bool value = type::value [static], [constexpr]`

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.161 has_plus_impl< C > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Static Public Attributes

- static constexpr bool value = type::value

16.161.1 Field Documentation

16.161.1.1 value

```
constexpr bool value = type::value [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.162 HelperFlag Struct Reference

```
#include <fflas_sparse.h>
```

Static Public Attributes

- static constexpr uint64_t none = 0_ui64
- static constexpr uint64_t coo = 1_ui64
- static constexpr uint64_t csr = 1_ui64 << 1
- static constexpr uint64_t ell = 1_ui64 << 2
- static constexpr uint64_t aut = 1_ui64 << 32
- static constexpr uint64_t pm1 = 1_ui64 << 33

16.162.1 Field Documentation

16.162.1.1 none

```
constexpr uint64_t none = 0_ui64 [static], [constexpr]
```

16.162.1.2 coo

```
constexpr uint64_t coo = 1_ui64 [static], [constexpr]
```

16.162.1.3 csr

```
constexpr uint64_t csr = 1_ui64 << 1 [static], [constexpr]
```

16.162.1.4 ell

```
constexpr uint64_t ell = 1_ui64 << 2 [static], [constexpr]
```

16.162.1.5 aut

```
constexpr uint64_t aut = 1_ui64 << 32 [static], [constexpr]
```

16.162.1.6 pm1

```
constexpr uint64_t pm1 = 1_ui64 << 33 [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.163 HelperMod< Field, ElementTraits > Struct Template Reference

The documentation for this struct was generated from the following file:

- fflas_freduce.inl

16.164 HelperMod< Field, ElementCategories::MachineIntTag > Struct Template Reference

Public Member Functions

- HelperMod ()
- HelperMod (const Field &F)

Data Fields

- Field::Element p
- double invp
- double min
- double max
- int64_t pow50rem

16.164.1 Constructor & Destructor Documentation

16.164.1.1 HelperMod() [1/2]

`HelperMod ( ) [inline]`

16.164.1.2 HelperMod() [2/2]

```
HelperMod (
            const Field & F ) [inline]
```

16.164.2 Field Documentation

16.164.2.1 p

`Field::Element p`

16.164.2.2 invp

`double invp`

16.164.2.3 min

`double min`

16.164.2.4 max

`double max`

16.164.2.5 pow50rem

`int64_t pow50rem`

The documentation for this struct was generated from the following file:

- fflas_freduce.inl

16.165 HelperMod< Field, FFLAS::ElementCategories::ArbitraryPrecIntTag > Struct Template Reference

Public Member Functions

- HelperMod ()
- HelperMod (const Field &F)

Data Fields

- Field::Element p

16.165.1 Constructor & Destructor Documentation

16.165.1.1 HelperMod() [1/2]

`HelperMod ( ) [inline]`

16.165.1.2 HelperMod() [2/2]

```
HelperMod (
            const Field & F ) [inline]
```

16.165.2 Field Documentation

16.165.2.1 p

`Field::Element p`

The documentation for this struct was generated from the following file:

- fflas_freduce.inl

16.166 HelperMod< Field, FFLAS::ElementCategories::FixedPrecIntTag > Struct Template Reference

Public Member Functions

- HelperMod ()
- HelperMod (const Field &F)

Data Fields

- Field::Element p

16.166.1 Constructor & Destructor Documentation

16.166.1.1 HelperMod() [1/2]

HelperMod ( ) [inline]

16.166.1.2 HelperMod() [2/2]

HelperMod (
const Field & F) [inline]

16.166.2 Field Documentation

16.166.2.1 p

Field::Element p

The documentation for this struct was generated from the following file:

- fflas_freduce.inl

16.167 HelperMod< Field, FFLAS::ElementCategories::MachineFloatTag > Struct Template Reference

Public Member Functions

- HelperMod ()
- HelperMod (const Field &F)

Data Fields

- Field::Element p
- Field::Element invp
- Field::Element min
- Field::Element max

16.167.1 Constructor & Destructor Documentation

16.167.1.1 HelperMod() [1/2]

HelperMod ( ) [inline]

16.167.1.2 HelperMod() [2/2]

HelperMod (
const Field & F) [inline]

16.167.2 Field Documentation

16.167.2.1 p

```
Field::Element p
```

16.167.2.2 invp

```
Field::Element invp
```

16.167.2.3 min

```
Field::Element min
```

16.167.2.4 max

```
Field::Element max
```

The documentation for this struct was generated from the following file:

- fflas_freduce.inl

16.168 Hybrid Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.169 Info Struct Reference

Public Member Functions

- Info (uint64_t it, uint64_t s, uint64_t p)
- Info ()=default
- Info (const Info &)=default
- Info (Info &&)=default
- Info & operator= (const Info &)=default
- Info & operator= (Info &&)=default

Data Fields

- uint64_t size = 0
- uint64_t perm = 0
- uint64_t begin = 0

16.169.1 Constructor & Destructor Documentation

16.169.1.1 Info() [1/4]

```
Info (
            uint64_t it,
            uint64_t s,
            uint64_t p )  [inline]
```

16.169.1.2 Info() [2/4]

```
Info ( ) [default]
```

16.169.1.3 Info() [3/4]

```
Info (
            const Info & ) [default]
```

16.169.1.4 Info() [4/4]

```
Info (
            Info && ) [default]
```

16.169.2 Member Function Documentation

16.169.2.1 operator=() [1/2]

```
Info& operator= (
            const Info & ) [default]
```

16.169.2.2 operator=() [2/2]

```
Info& operator= (
            Info && ) [default]
```

16.169.3 Field Documentation

16.169.3.1 size

```
uint64_t size = 0
```

16.169.3.2 perm

```
uint64_t perm = 0
```

16.169.3.3 begin

```
uint64_t begin = 0
```

The documentation for this struct was generated from the following file:

- csr_hyb_utils.inl

16.170 Info Struct Reference

Public Member Functions

- Info (uint64_t it, uint64_t s, uint64_t p)
- Info ()=default
- Info (const Info &)=default

- Info (Info &&)=default
- Info & operator= (const Info &)=default
- Info & operator= (Info &&)=default

Data Fields

- uint64_t size = 0
- uint64_t perm = 0
- uint64_t begin = 0

16.170.1 Constructor & Destructor Documentation

16.170.1.1 Info() [1/4]

```
Info (
            uint64_t it,
            uint64_t s,
            uint64_t p )  [inline]
```

16.170.1.2 Info() [2/4]

```
Info ( )  [default]
```

16.170.1.3 Info() [3/4]

```
Info (
            const Info & )  [default]
```

16.170.1.4 Info() [4/4]

```
Info (
            Info && )  [default]
```

16.170.2 Member Function Documentation

16.170.2.1 operator=() [1/2]

```
Info& operator= (
            const Info & )  [default]
```

16.170.2.2 operator=() [2/2]

```
Info& operator= (
            Info && )  [default]
```

16.170.3 Field Documentation

16.170.3.1 size

```
uint64_t size = 0
```

16.170.3.2 perm

```
uint64_t perm = 0
```

16.170.3.3 begin

```
uint64_t begin = 0
```

The documentation for this struct was generated from the following file:

- sell_utils.inl

16.171 is_all_same< Args > Struct Template Reference

The documentation for this struct was generated from the following file:

- test-simd.C

16.172 is_all_same< T, Args... > Struct Template Reference

Static Public Attributes

- static constexpr bool value = ALL<std::is_same<typename decay<T>::type, typename decay<Args>↩ ::type>::value...>::value

16.172.1 Field Documentation

16.172.1.1 value

```
constexpr bool value = ALL<std::is_same<typename decay<T>::type, typename decay<Args>↩
::type>::value...>::value  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.173 is_all_same<> Struct Reference

Static Public Attributes

- static constexpr bool value = true

16.173.1 Field Documentation

16.173.1.1 value

```
constexpr bool value = true  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.174 is_simd< T > Struct Template Reference

```
#include <fflas_simd.h>
```

Public Types

- using type = std::integral_constant< bool, false >

Static Public Attributes

- static constexpr const bool value = false

16.174.1 Member Typedef Documentation

16.174.1.1 type

```
using type = std::integral_constant<bool, false>
```

16.174.2 Field Documentation

16.174.2.1 value

```
constexpr const bool value = false  [static], [constexpr]
```

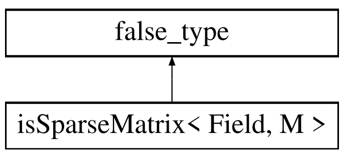
The documentation for this struct was generated from the following file:

- fflas_simd.h

16.175 isSparseMatrix< Field, M > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isSparseMatrix< Field, M >:



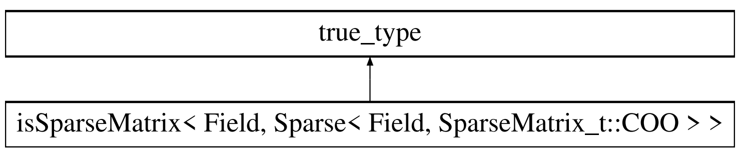
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.176 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO > >:



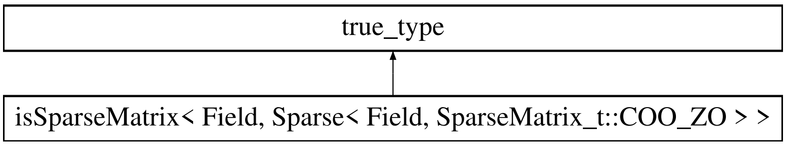
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.177 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >:



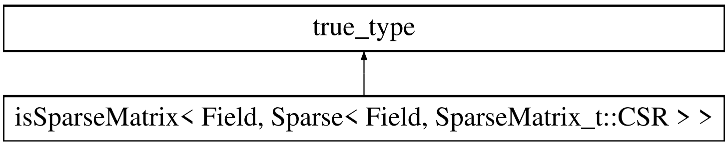
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.178 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR > > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR > >:



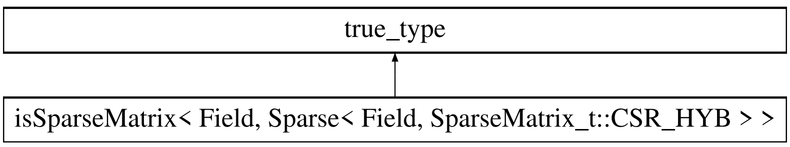
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.179 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_HYB > > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_HYB > >:



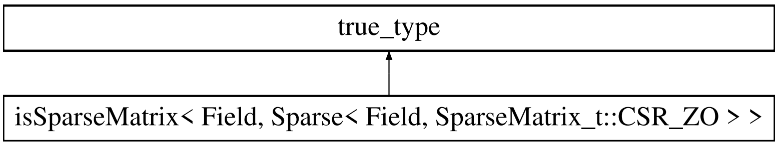
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.180 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > > Struct Template Reference

#include <sparse_matrix_traits.h>

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >:



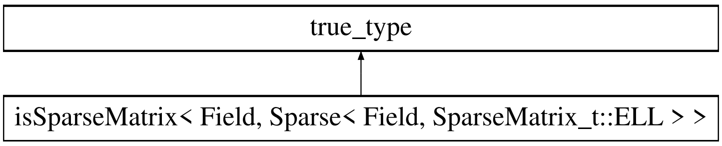
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.181 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL > > Struct Template Reference

#include <sparse_matrix_traits.h>

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL > >:



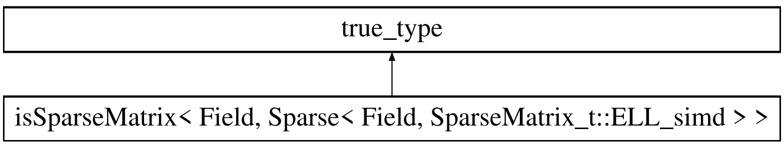
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.182 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd > > Struct Template Reference

#include <sparse_matrix_traits.h>

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd > >:



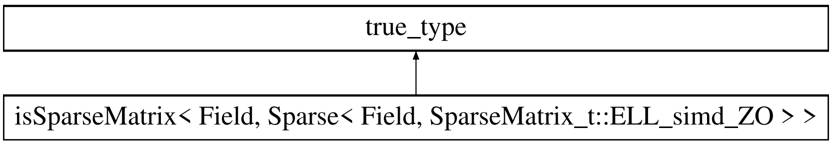
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.183 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > > Struct Template Reference

#include <sparse_matrix_traits.h>

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >:



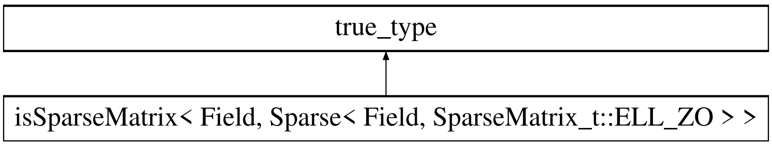
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.184 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >:



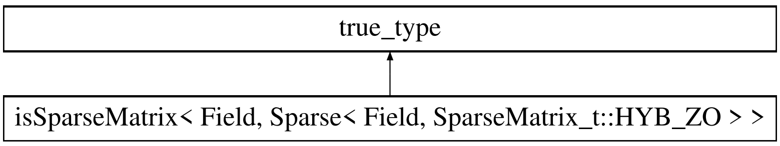
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.185 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::HYB_ZO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::HYB_ZO > >:



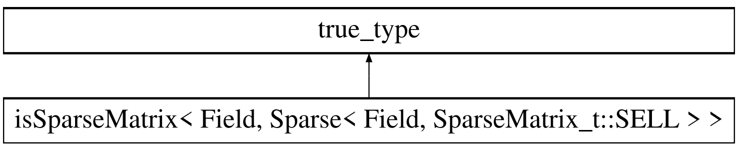
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.186 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL > >:

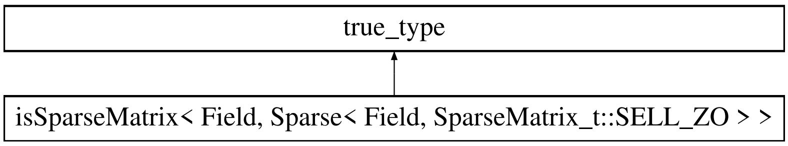


The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.187 isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > > Struct Template Reference

#include <sparse_matrix_traits.h>
Inheritance diagram for isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >:

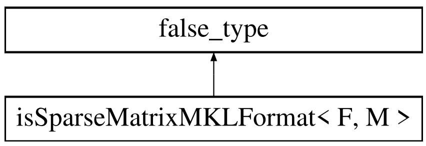


The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.188 isSparseMatrixMKLFormat< F, M > Struct Template Reference

#include <sparse_matrix_traits.h>
Inheritance diagram for isSparseMatrixMKLFormat< F, M >:

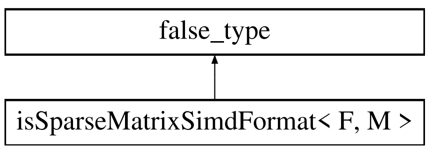


The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.189 isSparseMatrixSimdFormat< F, M > Struct Template Reference

#include <sparse_matrix_traits.h>
Inheritance diagram for isSparseMatrixSimdFormat< F, M >:

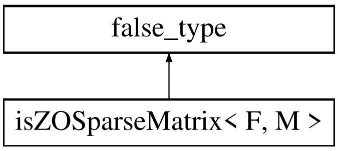


The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.190 isZOSparseMatrix< F, M > Struct Template Reference

#include <sparse_matrix_traits.h>
Inheritance diagram for isZOSparseMatrix< F, M >:



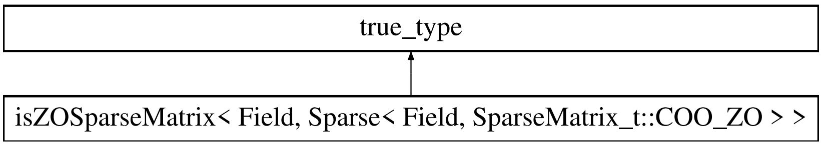
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.191 isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >:



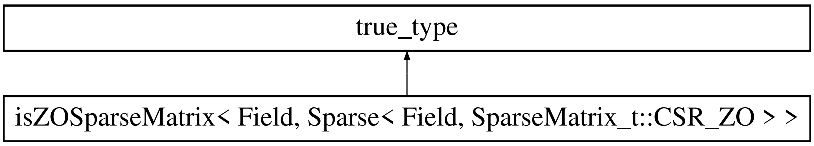
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.192 isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >:



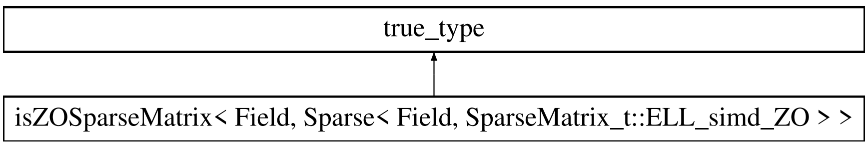
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.193 isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > > Struct Template Reference

```
#include <sparse_matrix_traits.h>
```

Inheritance diagram for isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >:



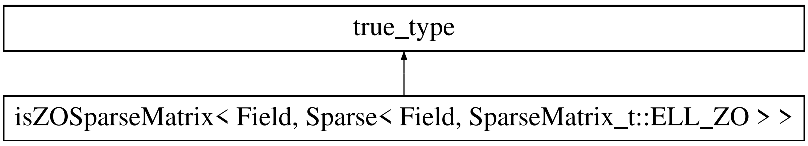
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.194 isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Inheritance diagram for isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >:



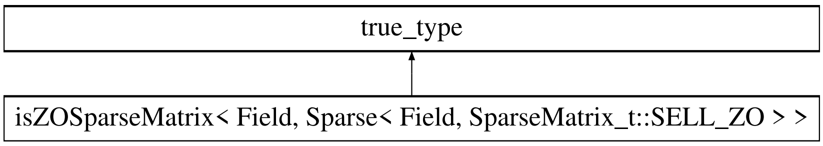
The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.195 isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > > Struct Template Reference

`#include <sparse_matrix_traits.h>`

Inheritance diagram for isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >:



The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.196 Iterative Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.197 LazyTag Struct Reference

Performs field operations with delayed mod only when necessary. Result may not be reduced.
`#include <field-traits.h>`

16.197.1 Detailed Description

Performs field operations with delayed mod only when necessary. Result may not be reduced.
The documentation for this struct was generated from the following file:

- field-traits.h

16.198 limits< T > Struct Template Reference

The documentation for this struct was generated from the following file:

- flimits.h

16.199 limits< char > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef char T

Static Public Member Functions

- constexpr static char max () noexcept
- constexpr static char min () noexcept
- constexpr static int32_t digits () noexcept

16.199.1 Member Typedef Documentation

16.199.1.1 T

```
typedef char T
```

16.199.2 Member Function Documentation

16.199.2.1 max()

```
constexpr static char max ( ) [inline], [static], [constexpr], [noexcept]
```

16.199.2.2 min()

```
constexpr static char min ( ) [inline], [static], [constexpr], [noexcept]
```

16.199.2.3 digits()

```
constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.200 limits< double > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef double T

Static Public Member Functions

- constexpr static int64_t max () noexcept
- constexpr static int64_t min () noexcept
- constexpr static int32_t digits () noexcept

16.200.1 Member Typedef Documentation

16.200.1.1 T

`typedef double T`

16.200.2 Member Function Documentation

16.200.2.1 max()

`constexpr static int64_t max ( ) [inline], [static], [constexpr], [noexcept]`

16.200.2.2 min()

`constexpr static int64_t min ( ) [inline], [static], [constexpr], [noexcept]`

16.200.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.201 limits< float > Struct Reference

`#include <flimits.h>`

Public Types

- typedef float T

Static Public Member Functions

- constexpr static int32_t max () noexcept
- constexpr static int32_t min () noexcept
- constexpr static int32_t digits () noexcept

16.201.1 Member Typedef Documentation

16.201.1.1 T

`typedef float T`

16.201.2 Member Function Documentation

16.201.2.1 max()

```
constexpr static int32_t max ( ) [inline], [static], [constexpr], [noexcept]
```

16.201.2.2 min()

```
constexpr static int32_t min ( ) [inline], [static], [constexpr], [noexcept]
```

16.201.2.3 digits()

```
constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.202 limits< Givaro::Integer > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef Givaro::Integer T

Static Public Member Functions

- constexpr static int max () noexcept
- constexpr static int min () noexcept

16.202.1 Member Typedef Documentation

16.202.1.1 T

```
typedef Givaro::Integer T
```

16.202.2 Member Function Documentation

16.202.2.1 max()

```
constexpr static int max ( ) [inline], [static], [constexpr], [noexcept]
```

16.202.2.2 min()

```
constexpr static int min ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.203 limits< int > Struct Reference

`#include <flimits.h>`

Public Types

- typedef int T

Static Public Member Functions

- constexpr static int max () noexcept
- constexpr static int min () noexcept
- constexpr static int32_t digits () noexcept

16.203.1 Member Typedef Documentation

16.203.1.1 T

`typedef int T`

16.203.2 Member Function Documentation

16.203.2.1 max()

`constexpr static int max ( ) [inline], [static], [constexpr], [noexcept]`

16.203.2.2 min()

`constexpr static int min ( ) [inline], [static], [constexpr], [noexcept]`

16.203.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.204 limits< long > Struct Reference

`#include <flimits.h>`

Public Types

- typedef long T

Static Public Member Functions

- constexpr static long max () noexcept
- constexpr static long min () noexcept
- constexpr static int32_t digits () noexcept

16.204.1 Member Typedef Documentation

16.204.1.1 T

```
typedef long T
```

16.204.2 Member Function Documentation

16.204.2.1 max()

```
constexpr static long max ( ) [inline], [static], [constexpr], [noexcept]
```

16.204.2.2 min()

```
constexpr static long min ( ) [inline], [static], [constexpr], [noexcept]
```

16.204.2.3 digits()

```
constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.205 limits< long long > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef long long T

Static Public Member Functions

- constexpr static long long max () noexcept
- constexpr static long long min () noexcept
- constexpr static int32_t digits () noexcept

16.205.1 Member Typedef Documentation

16.205.1.1 T

```
typedef long long T
```

16.205.2 Member Function Documentation

16.205.2.1 max()

```
constexpr static long long max ( ) [inline], [static], [constexpr], [noexcept]
```

16.205.2.2 min()

```
constexpr static long long min ( ) [inline], [static], [constexpr], [noexcept]
```

16.205.2.3 digits()

```
constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.206 limits< RecInt::rint< K > > Struct Template Reference

```
#include <flimits.h>
```

Public Types

- typedef RecInt::ruint< K > T

Static Public Member Functions

- constexpr static RecInt::rint< K > max () noexcept
- constexpr static RecInt::rint< K > min () noexcept

16.206.1 Member Typedef Documentation

16.206.1.1 T

```
typedef RecInt::ruint<K> T
```

16.206.2 Member Function Documentation

16.206.2.1 max()

```
constexpr static RecInt::rint<K> max ( ) [inline], [static], [constexpr], [noexcept]
```

16.206.2.2 min()

```
constexpr static RecInt::rint<K> min ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.207 limits< RecInt::ruint< K > > Struct Template Reference

```
#include <flimits.h>
```

Public Types

- typedef RecInt::ruint< K > T

Static Public Member Functions

- constexpr static RecInt::ruint< K > max () noexcept
- constexpr static RecInt::ruint< K > min () noexcept

16.207.1 Member Typedef Documentation

16.207.1.1 T

```
typedef RecInt::ruint<K> T
```

16.207.2 Member Function Documentation

16.207.2.1 max()

```
constexpr static RecInt::ruint<K> max ( ) [inline], [static], [constexpr], [noexcept]
```

16.207.2.2 min()

```
constexpr static RecInt::ruint<K> min ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.208 limits< short int > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef short int T

Static Public Member Functions

- constexpr static short int max () noexcept
- constexpr static short int min () noexcept
- constexpr static int32_t digits () noexcept

16.208.1 Member Typedef Documentation

16.208.1.1 T

```
typedef short int T
```

16.208.2 Member Function Documentation

16.208.2.1 max()

```
constexpr static short int max ( ) [inline], [static], [constexpr], [noexcept]
```

16.208.2.2 min()

`constexpr static short int min ( ) [inline], [static], [constexpr], [noexcept]`

16.208.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.209 limits< signed char > Struct Reference

`#include <flimits.h>`

Public Types

- typedef signed char T

Static Public Member Functions

- constexpr static signed char max () noexcept
- constexpr static signed char min () noexcept
- constexpr static int32_t digits () noexcept

16.209.1 Member Typedef Documentation

16.209.1.1 T

`typedef signed char T`

16.209.2 Member Function Documentation

16.209.2.1 max()

`constexpr static signed char max ( ) [inline], [static], [constexpr], [noexcept]`

16.209.2.2 min()

`constexpr static signed char min ( ) [inline], [static], [constexpr], [noexcept]`

16.209.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.210 limits< unsigned char > Struct Reference

`#include <flimits.h>`

Public Types

- typedef unsigned char T

Static Public Member Functions

- constexpr static unsigned char max () noexcept
- constexpr static unsigned char min () noexcept
- constexpr static int32_t digits () noexcept

16.210.1 Member Typedef Documentation

16.210.1.1 T

`typedef unsigned char T`

16.210.2 Member Function Documentation

16.210.2.1 max()

`constexpr static unsigned char max ( ) [inline], [static], [constexpr], [noexcept]`

16.210.2.2 min()

`constexpr static unsigned char min ( ) [inline], [static], [constexpr], [noexcept]`

16.210.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.211 limits< unsigned int > Struct Reference

`#include <flimits.h>`

Public Types

- typedef unsigned int T

Static Public Member Functions

- constexpr static unsigned int max () noexcept
- constexpr static unsigned int min () noexcept
- constexpr static int32_t digits () noexcept

16.211.1 Member Typedef Documentation

16.211.1.1 T

```
typedef unsigned int T
```

16.211.2 Member Function Documentation

16.211.2.1 max()

```
constexpr static unsigned int max ( ) [inline], [static], [constexpr], [noexcept]
```

16.211.2.2 min()

```
constexpr static unsigned int min ( ) [inline], [static], [constexpr], [noexcept]
```

16.211.2.3 digits()

```
constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.212 limits< unsigned long > Struct Reference

```
#include <flimits.h>
```

Public Types

- typedef unsigned long T

Static Public Member Functions

- constexpr static unsigned long max () noexcept
- constexpr static unsigned long min () noexcept
- constexpr static int32_t digits () noexcept

16.212.1 Member Typedef Documentation

16.212.1.1 T

```
typedef unsigned long T
```

16.212.2 Member Function Documentation

16.212.2.1 max()

```
constexpr static unsigned long max ( ) [inline], [static], [constexpr], [noexcept]
```

16.212.2.2 min()

```
constexpr static unsigned long min ( ) [inline], [static], [constexpr], [noexcept]
```

16.212.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.213 limits< unsigned long long > Struct Reference

`#include <flimits.h>`

Public Types

- typedef unsigned long long T

Static Public Member Functions

- constexpr static unsigned long long max () noexcept
- constexpr static unsigned long long min () noexcept
- constexpr static int32_t digits () noexcept

16.213.1 Member Typedef Documentation

16.213.1.1 T

`typedef unsigned long long T`

16.213.2 Member Function Documentation

16.213.2.1 max()

`constexpr static unsigned long long max ( ) [inline], [static], [constexpr], [noexcept]`

16.213.2.2 min()

`constexpr static unsigned long long min ( ) [inline], [static], [constexpr], [noexcept]`

16.213.2.3 digits()

`constexpr static int32_t digits ( ) [inline], [static], [constexpr], [noexcept]`

The documentation for this struct was generated from the following file:

- flimits.h

16.214 limits< unsigned short int > Struct Reference

`#include <flimits.h>`

Public Types

- typedef unsigned short int T

Static Public Member Functions

- constexpr static unsigned short int max () noexcept
- constexpr static unsigned short int min () noexcept
- constexpr static int32_t digits () noexcept

16.214.1 Member Typedef Documentation

16.214.1.1 T

```
typedef unsigned short int T
```

16.214.2 Member Function Documentation

16.214.2.1 max()

```
constexpr static unsigned short int max ( )  [inline], [static], [constexpr], [noexcept]
```

16.214.2.2 min()

```
constexpr static unsigned short int min ( )  [inline], [static], [constexpr], [noexcept]
```

16.214.2.3 digits()

```
constexpr static int32_t digits ( )  [inline], [static], [constexpr], [noexcept]
```

The documentation for this struct was generated from the following file:

- flimits.h

16.215 MachineFloatTag Struct Reference

float or double

```
#include <field-traits.h>
```

16.215.1 Detailed Description

float or double

The documentation for this struct was generated from the following file:

- field-traits.h

16.216 MachineIntTag Struct Reference

short, int, long, long long, and unsigned variants

```
#include <field-traits.h>
```

16.216.1 Detailed Description

short, int, long, long long, and unsigned variants

The documentation for this struct was generated from the following file:

- field-traits.h

16.217 MMHelper< Field, AlgoTrait, ModeTrait, ParSeqTrait > Struct Template Reference

Public Types

- typedef MMHelper< Field, AlgoTrait, ModeTrait, ParSeqTrait > Self_t
- typedef associatedDelayedField< const Field >::type DelayedField_t
- typedef associatedDelayedField< const Field >::field DelayedField
- typedef DelayedField::Element DFElt

Public Member Functions

- void initC ()
- void initA ()
- void initB ()
- void initOut ()
- size_t MaxDelayedDim (DFElt beta)
- bool Aunfit ()
- bool Bunfit ()
- void setOutBounds (const size_t k, const DFElt alpha, const DFElt beta)
- bool checkA (const Field &F, const FFLAS::FFLAS_TRANSPOSE ta, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)
- bool checkB (const Field &F, const FFLAS::FFLAS_TRANSPOSE tb, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb)
- bool checkOut (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)
- bool checkOut (const Field &F, FFLAS_UPLO uplo, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)
- MMHelper ()
- MMHelper (const Field &F, size_t m, size_t k, size_t n, ParSeqTrait _PS)
- MMHelper (const Field &F, int w, ParSeqTrait _PS=ParSeqTrait())
- template<class F2 , typename AlgoT2 , typename FT2 , typename PS2 >
  MMHelper (MMHelper< F2, AlgoT2, FT2, PS2 > &WH)
- MMHelper (const Field &F, int w, DFElt _Amin, DFElt _Amax, DFElt _Bmin, DFElt _Bmax, DFElt _Cmin, DFElt _Cmax, ParSeqTrait _PS=ParSeqTrait())

Data Fields

- int recLevel
- DFElt FieldMin
- DFElt FieldMax
- DFElt Amin
- DFElt Amax
- DFElt Bmin
- DFElt Bmax
- DFElt Cmin
- DFElt Cmax
- DFElt Outmin
- DFElt Outmax
- DFElt MaxStorableValue
- const DelayedField_t delayedField
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.217.1 Member Typedef Documentation

16.217.1.1 Self_t

```
typedef MMHelper<Field,AlgoTrait,ModeTrait,ParSeqTrait> Self_t
```

16.217.1.2 DelayedField_t

```
typedef associatedDelayedField<const Field>::type DelayedField_t
```

16.217.1.3 DelayedField

```
typedef associatedDelayedField<const Field>::field DelayedField
```

16.217.1.4 DFElt

```
typedef DelayedField::Element DFElt
```

16.217.2 Constructor & Destructor Documentation

16.217.2.1 MMHelper() [1/5]

```
MMHelper ( ) [inline]
```

16.217.2.2 MMHelper() [2/5]

```
MMHelper (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            ParSeqTrait _PS ) [inline]
```

16.217.2.3 MMHelper() [3/5]

```
MMHelper (
            const Field & F,
            int w,
            ParSeqTrait _PS = ParSeqTrait() ) [inline]
```

16.217.2.4 MMHelper() [4/5]

```
MMHelper (
            MMHelper< F2, AlgoT2, FT2, PS2 > & WH ) [inline]
```

16.217.2.5 MMHelper() [5/5]

```
MMHelper (
            const Field & F,
            int w,
            DFElt _Amin,
            DFElt _Amax,
            DFElt _Bmin,
            DFElt _Bmax,
            DFElt _Cmin,
            DFElt _Cmax,
            ParSeqTrait _PS = ParSeqTrait() )  [inline]
```

16.217.3 Member Function Documentation

16.217.3.1 initC()

```
void initC ( )  [inline]
```

16.217.3.2 initA()

```
void initA ( )  [inline]
```

16.217.3.3 initB()

```
void initB ( )  [inline]
```

16.217.3.4 initOut()

```
void initOut ( )  [inline]
```

16.217.3.5 MaxDelayedDim()

```
size_t MaxDelayedDim (
            DFElt beta )  [inline]
```

16.217.3.6 Aunfit()

```
bool Aunfit ( )  [inline]
```

16.217.3.7 Bunfit()

```
bool Bunfit ( )  [inline]
```

16.217.3.8 setOutBounds()

```
void setOutBounds (
            const size_t k,
            const DFElt alpha,
            const DFElt beta )  [inline]
```

16.217.3.9 checkA()

```
bool checkA (
            const Field & F,
            const FFLAS::FFLAS_TRANSPOSE ta,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda )  [inline]
```

16.217.3.10 checkB()

```
bool checkB (
            const Field & F,
            const FFLAS::FFLAS_TRANSPOSE tb,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr B,
            const size_t ldb )  [inline]
```

16.217.3.11 checkOut() [1/2]

```
bool checkOut (
            const Field & F,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda )  [inline]
```

16.217.3.12 checkOut() [2/2]

```
bool checkOut (
            const Field & F,
            FFLAS_UPLO uplo,
            const size_t M,
            const size_t N,
            typename Field::ConstElement_ptr A,
            const size_t lda )  [inline]
```

16.217.4 Friends And Related Function Documentation

16.217.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M )  [friend]
```

16.217.5 Field Documentation

16.217.5.1 recLevel

```
int recLevel
```

16.217.5.2 FieldMin

`DFElt FieldMin`

16.217.5.3 FieldMax

`DFElt FieldMax`

16.217.5.4 Amin

`DFElt Amin`

16.217.5.5 Amax

`DFElt Amax`

16.217.5.6 Bmin

`DFElt Bmin`

16.217.5.7 Bmax

`DFElt Bmax`

16.217.5.8 Cmin

`DFElt Cmin`

16.217.5.9 Cmax

`DFElt Cmax`

16.217.5.10 Outmin

`DFElt Outmin`

16.217.5.11 Outmax

`DFElt Outmax`

16.217.5.12 MaxStorableValue

`DFElt MaxStorableValue`

16.217.5.13 delayedField

`const DelayedField_t delayedField`

16.217.5.14 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.218 MMHelper< FFPACK::RNSInteger< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Struct Template Reference

Public Types

- typedef MMHelper< FFPACK::RNSInteger< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Self_t

Public Member Functions

- MMHelper ()
- MMHelper (Givaro::Integer Amax, Givaro::Integer Bmax)
- MMHelper (const FFPACK::RNSInteger< E > &F, size_t m, size_t n, size_t k, ParSeqTrait PS=ParSeqTrait())
- MMHelper (const FFPACK::RNSInteger< E > &F, int wino, ParSeqTrait PS=ParSeqTrait())
- template<class F2 , class A2 , class M2 , class PS2 >
  MMHelper (MMHelper< F2, A2, M2, PS2 > H2)
- void setNorm (Givaro::Integer p)

Data Fields

- Givaro::Integer normA
- Givaro::Integer normB
- int recLevel
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.218.1 Member Typedef Documentation

16.218.1.1 Self_t

```
typedef MMHelper<FFPACK::RNSInteger<E>, AlgoTrait,ModeCategories::DefaultTag, ParSeqTrait>
Self_t
```

16.218.2 Constructor & Destructor Documentation

16.218.2.1 MMHelper() [1/5]

```
MMHelper ( ) [inline]
```

16.218.2.2 MMHelper() [2/5]

```
MMHelper (
            Givaro::Integer Amax,
            Givaro::Integer Bmax )  [inline]
```

16.218.2.3 MMHelper() [3/5]

```
MMHelper (
            const FFPACK::RNSInteger< E > & F,
            size_t m,
            size_t n,
            size_t k,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.218.2.4 MMHelper() [4/5]

```
MMHelper (
            const FFPACK::RNSInteger< E > & F,
            int wino,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.218.2.5 MMHelper() [5/5]

```
MMHelper (
            MMHelper< F2, A2, M2, PS2 > H2 )  [inline]
```

16.218.3 Member Function Documentation

16.218.3.1 setNorm()

```
void setNorm (
            Givaro::Integer p )  [inline]
```

16.218.4 Friends And Related Function Documentation

16.218.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M )  [friend]
```

16.218.5 Field Documentation

16.218.5.1 normA

```
Givaro::Integer normA
```

16.218.5.2 normB

```
Givaro::Integer normB
```

16.218.5.3 recLevel

```
int recLevel
```

16.218.5.4 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fgemm_classical_mp.inl

16.219 MMHelper< FFPACK::RNSIntegerMod< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Struct Template Reference

Public Types

- typedef MMHelper< FFPACK::RNSIntegerMod< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Self_t

Public Member Functions

- MMHelper ()
- MMHelper (Givaro::Integer Amax, Givaro::Integer Bmax)
- MMHelper (const FFPACK::RNSIntegerMod< E > &F, size_t m, size_t n, size_t k, ParSeqTrait PS=ParSeq↩ Trait())
- MMHelper (const FFPACK::RNSIntegerMod< E > &F, int wino, ParSeqTrait PS=ParSeqTrait())
- template<class F2 , typename AlgoT2 , typename FT2 , typename PS2 >
  MMHelper (MMHelper< F2, AlgoT2, FT2, PS2 > &WH)
- void setNorm (Givaro::Integer p)

Data Fields

- Givaro::Integer normA
- Givaro::Integer normB
- int recLevel
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.219.1 Member Typedef Documentation

16.219.1.1 Self_t

```
typedef MMHelper<FFPACK::RNSIntegerMod<E>, AlgoTrait,ModeCategories::DefaultTag, ParSeqTrait>
Self_t
```

16.219.2 Constructor & Destructor Documentation

16.219.2.1 MMHelper() [1/5]

```
MMHelper ( )  [inline]
```

16.219.2.2 MMHelper() [2/5]

```
MMHelper (
            Givaro::Integer Amax,
            Givaro::Integer Bmax )  [inline]
```

16.219.2.3 MMHelper() [3/5]

```
MMHelper (
            const FFPACK::RNSIntegerMod< E > & F,
            size_t m,
            size_t n,
            size_t k,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.219.2.4 MMHelper() [4/5]

```
MMHelper (
            const FFPACK::RNSIntegerMod< E > & F,
            int wino,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.219.2.5 MMHelper() [5/5]

```
MMHelper (
            MMHelper< F2, AlgoT2, FT2, PS2 > & WH )  [inline]
```

16.219.3 Member Function Documentation

16.219.3.1 setNorm()

```
void setNorm (
            Givaro::Integer p )  [inline]
```

16.219.4 Friends And Related Function Documentation

16.219.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M )  [friend]
```

16.219.5 Field Documentation

16.219.5.1 normA

```
Givaro::Integer normA
```

16.219.5.2 normB

```
Givaro::Integer normB
```

16.219.5.3 recLevel

```
int recLevel
```

16.219.5.4 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fgemm_classical_mp.inl

16.220 MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< Dest >, ParSeqTrait > Struct Template Reference

Public Types

- typedef MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< Dest >, ParSeqTrait > Self_t

Public Member Functions

- MMHelper ()
- MMHelper (const Field &F, size_t m, size_t k, size_t n, ParSeqTrait _PS)
- MMHelper (const Field &F, int w, ParSeqTrait _PS=ParSeqTrait())
- template<class F2 , typename AlgoT2 , typename FT2 , typename PS2 >
  MMHelper (MMHelper< F2, AlgoT2, FT2, PS2 > &WH)

Data Fields

- int recLevel
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.220.1 Member Typedef Documentation

16.220.1.1 Self_t

```
typedef MMHelper<Field,AlgoTrait, ModeCategories::ConvertTo<Dest>,ParSeqTrait> Self_t
```

16.220.2 Constructor & Destructor Documentation

16.220.2.1 MMHelper() [1/4]

```
MMHelper ( ) [inline]
```

16.220.2.2 MMHelper() [2/4]

```
MMHelper (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            ParSeqTrait _PS ) [inline]
```

16.220.2.3 MMHelper() [3/4]

```
MMHelper (
            const Field & F,
            int w,
            ParSeqTrait _PS = ParSeqTrait() ) [inline]
```

16.220.2.4 MMHelper() [4/4]

```
MMHelper (
            MMHelper< F2, AlgoT2, FT2, PS2 > & WH ) [inline]
```

16.220.3 Friends And Related Function Documentation

16.220.3.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M ) [friend]
```

16.220.4 Field Documentation

16.220.4.1 recLevel

```
int recLevel
```

16.220.4.2 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.221 MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeqTrait > Struct Template Reference

Public Types

- typedef MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeqTrait > Self_t

Public Member Functions

- MMHelper ()
- template<class F2 , class A2 , class M2 , class PS2 >
  MMHelper (MMHelper< F2, A2, M2, PS2 > H2)
- MMHelper (Givaro::Integer Amax, Givaro::Integer Bmax)
- MMHelper (const Field &F, size_t m, size_t n, size_t k, ParSeqTrait PS=ParSeqTrait())
- MMHelper (const Field &F, int wino, ParSeqTrait PS=ParSeqTrait())
- void setNorm (Givaro::Integer p)

Data Fields

- Givaro::Integer normA
- Givaro::Integer normB
- int recLevel
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.221.1 Member Typedef Documentation

16.221.1.1 Self_t

```
typedef MMHelper<Field, AlgoTrait,ModeCategories::ConvertTo<ElementCategories::RNSElementTag>,
ParSeqTrait> Self_t
```

16.221.2 Constructor & Destructor Documentation

16.221.2.1 MMHelper() [1/5]

```
MMHelper ( )  [inline]
```

16.221.2.2 MMHelper() [2/5]

```
MMHelper (
            MMHelper< F2, A2, M2, PS2 > H2 )  [inline]
```

16.221.2.3 MMHelper() [3/5]

```
MMHelper (
            Givaro::Integer Amax,
            Givaro::Integer Bmax )  [inline]
```

16.221.2.4 MMHelper() [4/5]

```
MMHelper (
            const Field & F,
            size_t m,
            size_t n,
            size_t k,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.221.2.5 MMHelper() [5/5]

```
MMHelper (
            const Field & F,
            int wino,
            ParSeqTrait PS = ParSeqTrait() )  [inline]
```

16.221.3 Member Function Documentation

16.221.3.1 setNorm()

```
void setNorm (
            Givaro::Integer p )  [inline]
```

16.221.4 Friends And Related Function Documentation

16.221.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M )  [friend]
```

16.221.5 Field Documentation

16.221.5.1 normA

```
Givaro::Integer normA
```

16.221.5.2 normB

```
Givaro::Integer normB
```

16.221.5.3 recLevel

`int recLevel`

16.221.5.4 parseq

`ParSeqTrait parseq`

The documentation for this struct was generated from the following file:

- fgemm_classical_mp.inl

16.222 MMHelper< Field, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Struct Template Reference

FGEMM Helper for Default and ConvertTo modes of operation.

Public Types

- typedef MMHelper< Field, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait > Self_t

Public Member Functions

- MMHelper ()
- MMHelper (const Field &F, size_t m, size_t k, size_t n, ParSeqTrait _PS)
- MMHelper (const Field &F, int w, ParSeqTrait _PS=ParSeqTrait())
- template<class F2 , typename AlgoT2 , typename FT2 , typename PS2 >
  MMHelper (MMHelper< F2, AlgoT2, FT2, PS2 > &WH)

Data Fields

- int recLevel
- ParSeqTrait parseq

Friends

- std::ostream & operator<< (std::ostream &out, const Self_t &M)

16.222.1 Detailed Description

template<class Field, typename AlgoTrait, typename ParSeqTrait>
struct FFLAS::MMHelper< Field, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >

FGEMM Helper for Default and ConvertTo modes of operation.

16.222.2 Member Typedef Documentation

16.222.2.1 Self_t

`typedef MMHelper<Field,AlgoTrait, ModeCategories::DefaultTag,ParSeqTrait> Self_t`

16.222.3 Constructor & Destructor Documentation

16.222.3.1 MMHelper() [1/4]

```
MMHelper ( ) [inline]
```

16.222.3.2 MMHelper() [2/4]

```
MMHelper (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            ParSeqTrait _PS ) [inline]
```

16.222.3.3 MMHelper() [3/4]

```
MMHelper (
            const Field & F,
            int w,
            ParSeqTrait _PS = ParSeqTrait() ) [inline]
```

16.222.3.4 MMHelper() [4/4]

```
MMHelper (
            MMHelper< F2, AlgoT2, FT2, PS2 > & WH ) [inline]
```

16.222.4 Friends And Related Function Documentation

16.222.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Self_t & M ) [friend]
```

16.222.5 Field Documentation

16.222.5.1 recLevel

```
int recLevel
```

16.222.5.2 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.223 ModeTraits< Field > Struct Template Reference

ModeTraits.

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DefaultTag value

16.223.1 Detailed Description

template<class Field>
struct FFLAS::ModeTraits< Field >

ModeTraits.

16.223.2 Member Typedef Documentation

16.223.2.1 value

`typedef ModeCategories::DefaultTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.224 ModeTraits< Givaro::Modular< Element, Compute > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ModeCategories::DelayedTag value

16.224.1 Member Typedef Documentation

16.224.1.1 value

`typedef ModeCategories::DelayedTag value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.225 ModeTraits< Givaro::Modular< Givaro::Integer, Compute > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::RNSElementTag > value

16.225.1 Member Typedef Documentation

16.225.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::RNSElementTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.226 ModeTraits< Givaro::Modular< int16_t, Compute > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.226.1 Member Typedef Documentation

16.226.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.227 ModeTraits< Givaro::Modular< int32_t, Compute > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.227.1 Member Typedef Documentation

16.227.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.228 ModeTraits< Givaro::Modular< int64_t, uint64_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DefaultTag value

16.228.1 Member Typedef Documentation

16.228.1.1 value

```
typedef ModeCategories::DefaultTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.229 ModeTraits< Givaro::Modular< int8_t, Compute > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.229.1 Member Typedef Documentation

16.229.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.230 ModeTraits< Givaro::Modular< RecInt::ruint< K >, Compute > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::RNSElementTag > value

16.230.1 Member Typedef Documentation

16.230.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::RNSElementTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.231 ModeTraits< Givaro::Modular< uint16_t, Compute > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.231.1 Member Typedef Documentation

16.231.1.1 value

`typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.232 ModeTraits< Givaro::Modular< uint32_t, Compute > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.232.1 Member Typedef Documentation

16.232.1.1 value

`typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.233 ModeTraits< Givaro::Modular< uint8_t, Compute > > Struct Template Reference

`#include <field-traits.h>`

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.233.1 Member Typedef Documentation

16.233.1.1 value

`typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.234 ModeTraits< Givaro::ModularBalanced< Element > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DelayedTag value

16.234.1 Member Typedef Documentation

16.234.1.1 value

```
typedef ModeCategories::DelayedTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.235 ModeTraits< Givaro::ModularBalanced< Givaro::Integer > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::RNSElementTag > value

16.235.1 Member Typedef Documentation

16.235.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::RNSElementTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.236 ModeTraits< Givaro::ModularBalanced< int16_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.236.1 Member Typedef Documentation

16.236.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.237 ModeTraits< Givaro::ModularBalanced< int32_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.237.1 Member Typedef Documentation

16.237.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.238 ModeTraits< Givaro::ModularBalanced< int8_t > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > value

16.238.1 Member Typedef Documentation

16.238.1.1 value

```
typedef ModeCategories::ConvertTo<ElementCategories::MachineFloatTag> value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.239 ModeTraits< Givaro::Montgomery< T > > Struct Template Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DefaultBoundedTag value

16.239.1 Member Typedef Documentation

16.239.1.1 value

```
typedef ModeCategories::DefaultBoundedTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.240 ModeTraits< Givaro::ZRing< double > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DefaultBoundedTag value

16.240.1 Member Typedef Documentation

16.240.1.1 value

```
typedef ModeCategories::DefaultBoundedTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.241 ModeTraits< Givaro::ZRing< float > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::DefaultBoundedTag value

16.241.1 Member Typedef Documentation

16.241.1.1 value

```
typedef ModeCategories::DefaultBoundedTag value
```

The documentation for this struct was generated from the following file:

- field-traits.h

16.242 ModeTraits< Givaro::ZRing< Givaro::Integer > > Struct Reference

```
#include <field-traits.h>
```

Public Types

- typedef ModeCategories::ConvertTo< ElementCategories::RNSElementTag > value

16.242.1 Member Typedef Documentation

16.242.1.1 value

`typedef ModeCategories::ConvertTo<ElementCategories::RNSElementTag> value`

The documentation for this struct was generated from the following file:

- field-traits.h

16.243 ModularBalanced< T > Class Template Reference

The documentation for this class was generated from the following file:

- field-traits.h

16.244 ModularTag Struct Reference

This is a modular field like e.g. `Modular<T>` or `ModularBalanced<T>`

`#include <field-traits.h>`

16.244.1 Detailed Description

This is a modular field like e.g. `Modular<T>` or `ModularBalanced<T>`

The documentation for this struct was generated from the following file:

- field-traits.h

16.245 Montgomery< T > Class Template Reference

The documentation for this class was generated from the following file:

- field-traits.h

16.246 need_field_characteristic< Field > Struct Template Reference

Static Public Attributes

- static constexpr bool value = false

16.246.1 Field Documentation

16.246.1.1 value

`constexpr bool value = false [static], [constexpr]`

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.247 need_field_characteristic< Givaro::Modular< Field > > Struct Template Reference

Static Public Attributes

- static constexpr bool value = true

16.247.1 Field Documentation

16.247.1.1 value

`constexpr bool value = true [static], [constexpr]`

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.248 need_field_characteristic< Givaro::ModularBalanced< Field > > Struct Template Reference

Static Public Attributes

- static constexpr bool value = true

16.248.1 Field Documentation

16.248.1.1 value

`constexpr bool value = true [static], [constexpr]`

The documentation for this struct was generated from the following file:

- benchmark-fgemv.C

16.249 NoSimd< T > Struct Template Reference

`#include <fflas_simd.h>`

Public Types

- using vect_t = T ∗
- using scalar_t = T
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, T >

Static Public Member Functions

- static const std::string type_string ()
- template<class TT >
  static constexpr bool valid (TT p)
- template<class TT >
  static constexpr bool compliant (TT n)

Static Public Attributes

- static constexpr const size_t vect_size = 1
- static constexpr const size_t alignment = static_cast<size_t>(Alignment::Normal)

16.249.1 Member Typedef Documentation

16.249.1.1 vect_t

```
using vect_t = T*
```

16.249.1.2 scalar_t

```
using scalar_t = T
```

16.249.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.249.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.249.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, T>
```

16.249.2 Member Function Documentation

16.249.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.249.2.2 valid()

```
static constexpr bool valid (
             TT p )  [inline], [static], [constexpr]
```

16.249.2.3 compliant()

```
static constexpr bool compliant (
             TT n )  [inline], [static], [constexpr]
```

16.249.3 Field Documentation

16.249.3.1 vect_size

```
constexpr const size_t vect_size = 1  [static], [constexpr]
```

16.249.3.2 alignment

```
constexpr const size_t alignment = static_cast<size_t>(Alignment::Normal)  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.250 Parallel< C, P > Struct Template Reference

Public Types

- typedef C Cut
- typedef P Param

Public Member Functions

- Parallel (size_t n=NUM_THREADS)
- size_t numthreads () const
- size_t & set_numthreads (size_t n)

Friends

- std::ostream & operator<< (std::ostream &out, const Parallel &p)

16.250.1 Member Typedef Documentation

16.250.1.1 Cut

```
typedef C Cut
```

16.250.1.2 Param

```
typedef P Param
```

16.250.2 Constructor & Destructor Documentation

16.250.2.1 Parallel()

```
Parallel (
            size_t n = NUM_THREADS )   [inline]
```

16.250.3 Member Function Documentation

16.250.3.1 numthreads()

```
size_t numthreads ( ) const  [inline]
```

16.250.3.2 set_numthreads()

```
size_t& set_numthreads (
            size_t n )   [inline]
```

16.250.4 Friends And Related Function Documentation

16.250.4.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Parallel< C, P > & p ) [friend]
```

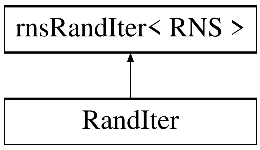
The documentation for this struct was generated from the following file:

- blockcuts.inl

16.251 RNSInteger< RNS >::RandIter Class Reference

```
#include <rns-integer.h>
```

Inheritance diagram for RNSInteger< RNS >::RandIter:



Public Member Functions

- RandIter (const RNSInteger< RNS > &F, uint64_t seed=0)
- RNS::Element & random (typename RNS::Element &elt) const

  RNS ring Element random assignement.
- RNS::Element random () const
- RNS::Element & operator() (typename RNS::Element &elt) const
- RNS::Element operator() () const
- const RNS & ring () const

16.251.1 Constructor & Destructor Documentation

16.251.1.1 RandIter()

```
RandIter (
            const RNSInteger< RNS > & F,
            uint64_t seed = 0 ) [inline]
```

16.251.2 Member Function Documentation

16.251.2.1 random() [1/2]

```
RNS::Element& random (
            typename RNS::Element & elt ) const [inline], [inherited]
```

RNS ring Element random assignement.
Element is supposed to be initialized

Returns

random ring Element

16.251.2.2 random() [2/2]

```
RNS::Element random ( ) const  [inline], [inherited]
```

16.251.2.3 operator()() [1/2]

```
RNS::Element& operator() (
            typename RNS::Element & elt ) const  [inline], [inherited]
```

16.251.2.4 operator()() [2/2]

```
RNS::Element operator() ( ) const  [inline], [inherited]
```

16.251.2.5 ring()

```
const RNS& ring ( ) const  [inline], [inherited]
```

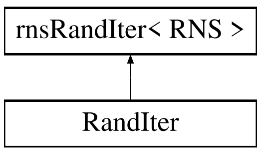
The documentation for this class was generated from the following file:

- rns-integer.h

16.252 RNSIntegerMod< RNS >::RandIter Class Reference

```
#include <rns-integer-mod.h>
```

Inheritance diagram for RNSIntegerMod< RNS >::RandIter:



Public Member Functions

- RandIter (const RNSIntegerMod< RNS > &F, uint64_t seed=0)
- RNS::Element & random (typename RNS::Element &elt) const
- RNS::Element random () const
- RNS::Element & operator() (typename RNS::Element &elt) const
- RNS::Element operator() () const
- const RNS & ring () const

16.252.1 Constructor & Destructor Documentation

16.252.1.1 RandIter()

```
RandIter (
            const RNSIntegerMod< RNS > & F,
            uint64_t seed = 0 )  [inline]
```

16.252.2 Member Function Documentation

16.252.2.1 random() [1/2]

```
RNS::Element& random (
            typename RNS::Element & elt ) const  [inline]
```

16.252.2.2 random() [2/2]

```
RNS::Element random ( ) const  [inline], [inherited]
```

16.252.2.3 operator()() [1/2]

```
RNS::Element& operator() (
            typename RNS::Element & elt ) const  [inline], [inherited]
```

16.252.2.4 operator()() [2/2]

```
RNS::Element operator() ( ) const  [inline], [inherited]
```

16.252.2.5 ring()

```
const RNS& ring ( ) const  [inline], [inherited]
```

The documentation for this class was generated from the following file:

- rns-integer-mod.h

16.253 readMyMachineType< Field, T > Struct Template Reference

```
#include <read_sparse.h>
```

Public Types

- typedef Field::Element Element
- typedef Field::Element_ptr Element_ptr

Public Member Functions

- void operator() (const Field &F, Element &modulo, Element_ptr val, std::ifstream &file, const uint64_t dims, const mask_t data_type, const mask_t field_desc)

16.253.1 Member Typedef Documentation

16.253.1.1 Element

```
typedef Field::Element Element
```

16.253.1.2 Element_ptr

```
typedef Field::Element_ptr Element_ptr
```

16.253.2 Member Function Documentation

16.253.2.1 operator()()

```
void operator() (
            const Field & F,
            Element & modulo,
            Element_ptr val,
            std::ifstream & file,
            const uint64_t dims,
            const mask_t data_type,
            const mask_t field_desc )
```

The documentation for this struct was generated from the following file:

- read_sparse.h

16.254 readMyMachineType< Field, mpz_t > Struct Template Reference

```
#include <read_sparse.h>
```

Public Types

- typedef Field::Element Element
- typedef Field::Element_ptr Element_ptr

Public Member Functions

- void operator() (const Field &F, Element &modulo, Element_ptr val, std::ifstream &file, const uint64_t dims, const mask_t data_type, const mask_t field_desc)

16.254.1 Member Typedef Documentation

16.254.1.1 Element

```
typedef Field::Element Element
```

16.254.1.2 Element_ptr

```
typedef Field::Element_ptr Element_ptr
```

16.254.2 Member Function Documentation

16.254.2.1 operator()()

```
void operator() (
            const Field & F,
            typename Field::Element & modulo,
            typename Field::Element_ptr val,
            std::ifstream & file,
            const uint64_t dims,
            const mask_t data_type,
            const mask_t field_desc )
```

The documentation for this struct was generated from the following file:

- read_sparse.h

16.255 Recursive Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.256 Recursive Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.257 rint< K > Class Template Reference

The documentation for this class was generated from the following file:

- field-traits.h

16.258 rns_double Struct Reference

```
#include <rns-double.h>
```

Public Types

- typedef Givaro::Integer integer
- typedef Givaro::Modular< double > ModField
- typedef double BasisElement
- typedef rns_double_elt Element
- typedef rns_double_elt_ptr Element_ptr
- typedef rns_double_elt_cstptr ConstElement_ptr

Public Member Functions

- rns_double (const integer &bound, size_t pbits, bool rnsmod=false, long seed=time(NULL))
- rns_double (size_t pbits, size_t size, long seed=time(NULL))
- template<typename Vect >
  rns_double (const Vect &basis, bool rnsmod=false, long seed=time(NULL))
- rns_double (const RNSIntegerMod< rns_double > &basis, bool rnsmod=false, long seed=time(NULL))
- void precompute_cst (size_t K=0)
- template<typename T >
  void init (size_t m, size_t n, double *Arns, size_t rda, const T *A, size_t lda, const integer &maxA, bool RNS_MAJOR=false) const
- void init (size_t m, size_t n, double *Arns, size_t rda, const integer *A, size_t lda, size_t k, bool RNS_↩ MAJOR=false) const
- void init_transpose (size_t m, size_t n, double *Arns, size_t rda, const integer *A, size_t lda, size_t k, bool RNS_MAJOR=false) const
- void convert (size_t m, size_t n, integer gamma, integer *A, size_t lda, const double *Arns, size_t rda, bool RNS_MAJOR=false) const
- void convert_transpose (size_t m, size_t n, integer gamma, integer *A, size_t lda, const double *Arns, size_t rda, bool RNS_MAJOR=false) const
- void reduce (size_t n, double *Arns, size_t rda, bool RNS_MAJOR=false) const
- template<size_t K>
  void init (size_t m, size_t n, double *Arns, size_t rda, const RecInt::ruint< K > *A, size_t lda, size_t k, bool RNS_MAJOR=false) const
- template<size_t K>
  void convert (size_t m, size_t n, integer gamma, RecInt::ruint< K > *A, size_t lda, const double *Arns, size_t rda, integer p=0, bool RNS_MAJOR=false) const

Data Fields

- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _basis
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _basisMax
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _negbasis
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _invbasis
- std::vector< ModField > _field_rns
- integer _M
- std::vector< integer > _Mi
- std::vector< double > _MMi
- std::vector< double > _crt_in
- std::vector< double > _crt_out
- size_t _size
- size_t _pbits
- size_t _ldm
- integer _mi_sum

16.258.1 Member Typedef Documentation

16.258.1.1 integer

```
typedef Givaro::Integer integer
```

16.258.1.2 ModField

```
typedef Givaro::Modular<double> ModField
```

16.258.1.3 BasisElement

```
typedef double BasisElement
```

16.258.1.4 Element

```
typedef rns_double_elt Element
```

16.258.1.5 Element_ptr

```
typedef rns_double_elt_ptr Element_ptr
```

16.258.1.6 ConstElement_ptr

```
typedef rns_double_elt_cstptr ConstElement_ptr
```

16.258.2 Constructor & Destructor Documentation

16.258.2.1 rns_double() [1/4]

```
rns_double (
            const integer & bound,
            size_t pbits,
            bool rnsmod = false,
            long seed = time(NULL) )  [inline]
```

16.258.2.2 rns_double() [2/4]

```
rns_double (
            size_t pbits,
            size_t size,
            long seed = time(NULL) )  [inline]
```

16.258.2.3 rns_double() [3/4]

```
rns_double (
            const Vect & basis,
            bool rnsmod = false,
            long seed = time(NULL) )  [inline]
```

16.258.2.4 rns_double() [4/4]

```
rns_double (
            const RNSIntegerMod< rns_double > & basis,
            bool rnsmod = false,
            long seed = time(NULL) )  [inline]
```

16.258.3 Member Function Documentation

16.258.3.1 precompute_cst()

```
void precompute_cst (
            size_t K = 0 )  [inline]
```

16.258.3.2 init() [1/3]

```
void init (
            size_t m,
            size_t n,
            double * Arns,
            size_t rda,
            const T * A,
            size_t lda,
            const integer & maxA,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.3 init() [2/3]

```
void init (
            size_t m,
            size_t n,
```

```
            double * Arns,
            size_t rda,
            const integer * A,
            size_t lda,
            size_t k,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.4 init_transpose()

```
void init_transpose (
            size_t m,
            size_t n,
            double * Arns,
            size_t rda,
            const integer * A,
            size_t lda,
            size_t k,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.5 convert() [1/2]

```
void convert (
            size_t m,
            size_t n,
            integer gamma,
            integer * A,
            size_t lda,
            const double * Arns,
            size_t rda,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.6 convert_transpose()

```
void convert_transpose (
            size_t m,
            size_t n,
            integer gamma,
            integer * A,
            size_t lda,
            const double * Arns,
            size_t rda,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.7 reduce()

```
void reduce (
            size_t n,
            double * Arns,
            size_t rda,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.8 init() [3/3]

```
void init (
```

```
            size_t m,
            size_t n,
            double * Arns,
            size_t rda,
            const RecInt::ruint< K > * A,
            size_t lda,
            size_t k,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.3.9 convert() [2/2]

```
void convert (
            size_t m,
            size_t n,
            integer gamma,
            RecInt::ruint< K > * A,
            size_t lda,
            const double * Arns,
            size_t rda,
            integer p = 0,
            bool RNS_MAJOR = false ) const  [inline]
```

16.258.4 Field Documentation

16.258.4.1 _basis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _basis
```

16.258.4.2 _basisMax

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _basisMax
```

16.258.4.3 _negbasis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _negbasis
```

16.258.4.4 _invbasis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _invbasis
```

16.258.4.5 _field_rns

```
std::vector<ModField> _field_rns
```

16.258.4.6 _M

```
integer _M
```

16.258.4.7 _Mi

```
std::vector<integer> _Mi
```

16.258.4.8 _MMi

```
std::vector<double> _MMi
```

16.258.4.9 _crt_in

```
std::vector<double> _crt_in
```

16.258.4.10 _crt_out

```
std::vector<double> _crt_out
```

16.258.4.11 _size

```
size_t _size
```

16.258.4.12 _pbits

```
size_t _pbits
```

16.258.4.13 _ldm

```
size_t _ldm
```

16.258.4.14 _mi_sum

```
integer _mi_sum
```

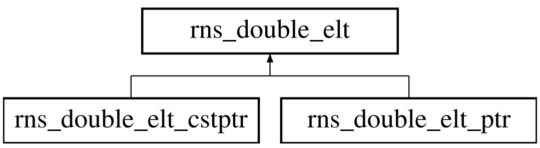
The documentation for this struct was generated from the following files:

- rns-double.h
- rns-double-recint.inl
- rns-double.inl

16.259 rns_double_elt Struct Reference

```
#include <rns-double-elt.h>
```

Inheritance diagram for rns_double_elt:



Public Member Functions

- rns_double_elt ()
- ∼rns_double_elt ()
- rns_double_elt (double ∗p, size_t r, size_t a=false)
- rns_double_elt_ptr operator& ()
- rns_double_elt_cstptr operator& () const
- rns_double_elt (const rns_double_elt &x)

Data Fields

- double ∗ _ptr
- size_t _stride
- bool _alloc

16.259.1 Constructor & Destructor Documentation

16.259.1.1 rns_double_elt() [1/3]

```
rns_double_elt ( )  [inline]
```

16.259.1.2 ∼rns_double_elt()

```
~rns_double_elt ( )  [inline]
```

16.259.1.3 rns_double_elt() [2/3]

```
rns_double_elt (
            double * p,
            size_t r,
            size_t a = false )  [inline]
```

16.259.1.4 rns_double_elt() [3/3]

```
rns_double_elt (
            const rns_double_elt & x )  [inline]
```

16.259.2 Member Function Documentation

16.259.2.1 operator&() [1/2]

```
rns_double_elt_ptr operator& ( )  [inline]
```

16.259.2.2 operator&() [2/2]

```
rns_double_elt_cstptr operator& ( ) const  [inline]
```

16.259.3 Field Documentation

16.259.3.1 _ptr

`double* _ptr`

16.259.3.2 _stride

`size_t _stride`

16.259.3.3 _alloc

`bool _alloc`

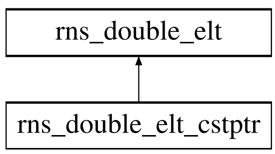
The documentation for this struct was generated from the following file:

- rns-double-elt.h

16.260 rns_double_elt_cstptr Struct Reference

`#include <rns-double-elt.h>`

Inheritance diagram for rns_double_elt_cstptr:



Public Member Functions

- rns_double_elt_cstptr ()
- rns_double_elt_cstptr (double ∗p, size_t r)
- rns_double_elt_cstptr (const rns_double_elt_ptr &x)
- rns_double_elt_cstptr (const rns_double_elt_cstptr &x)
- rns_double_elt_cstptr (rns_double_elt_cstptr &&)=default
- rns_double_elt_cstptr ∗ operator& ()
- rns_double_elt & operator∗ () const
- rns_double_elt operator[ ] (size_t i) const
- rns_double_elt & operator[ ] (size_t i)
- rns_double_elt_cstptr operator++ ()
- rns_double_elt_cstptr operator-- ()
- rns_double_elt_cstptr operator+ (size_t inc) const
- rns_double_elt_cstptr operator- (size_t inc) const
- rns_double_elt_cstptr & operator+= (size_t inc)
- rns_double_elt_cstptr & operator-= (size_t inc)
- rns_double_elt_cstptr & operator= (const rns_double_elt_cstptr &x)
- bool operator< (const rns_double_elt_cstptr &x)
- bool operator!= (const rns_double_elt_cstptr &x)
- rns_double_elt_cstptr operator& () const

Data Fields

- rns_double_elt other
- double ∗ _ptr
- size_t _stride
- bool _alloc

16.260.1 Constructor & Destructor Documentation

16.260.1.1 rns_double_elt_cstptr() [1/5]

```
rns_double_elt_cstptr ( ) [inline]
```

16.260.1.2 rns_double_elt_cstptr() [2/5]

```
rns_double_elt_cstptr (
            double * p,
            size_t r ) [inline]
```

16.260.1.3 rns_double_elt_cstptr() [3/5]

```
rns_double_elt_cstptr (
            const rns_double_elt_ptr & x ) [inline]
```

16.260.1.4 rns_double_elt_cstptr() [4/5]

```
rns_double_elt_cstptr (
            const rns_double_elt_cstptr & x ) [inline]
```

16.260.1.5 rns_double_elt_cstptr() [5/5]

```
rns_double_elt_cstptr (
            rns_double_elt_cstptr && ) [default]
```

16.260.2 Member Function Documentation

16.260.2.1 operator&() [1/2]

```
rns_double_elt_cstptr* operator& ( ) [inline]
```

16.260.2.2 operator*()

```
rns_double_elt& operator* ( ) const [inline]
```

16.260.2.3 operator[]() [1/2]

```
rns_double_elt operator[] (
            size_t i ) const [inline]
```

16.260.2.4 operator[]() [2/2]

```
rns_double_elt& operator[] (
            size_t i ) [inline]
```

16.260.2.5 operator++()

rns_double_elt_cstptr operator++ ( ) [inline]

16.260.2.6 operator--()

rns_double_elt_cstptr operator-- ( ) [inline]

16.260.2.7 operator+()

rns_double_elt_cstptr operator+ (
size_t *inc*) const [inline]

16.260.2.8 operator-()

rns_double_elt_cstptr operator- (
size_t *inc*) const [inline]

16.260.2.9 operator+=()

rns_double_elt_cstptr& operator+= (
size_t *inc*) [inline]

16.260.2.10 operator-=()

rns_double_elt_cstptr& operator-= (
size_t *inc*) [inline]

16.260.2.11 operator=()

rns_double_elt_cstptr & operator= (
const rns_double_elt_cstptr & *x*) [inline]

16.260.2.12 operator<()

bool operator< (
const rns_double_elt_cstptr & *x*) [inline]

16.260.2.13 operator"!=()

bool operator!= (
const rns_double_elt_cstptr & *x*) [inline]

16.260.2.14 operator&() [2/2]

rns_double_elt_cstptr operator& ( ) const [inline], [inherited]

16.260.3 Field Documentation

16.260.3.1 other

```
rns_double_elt other
```

16.260.3.2 _ptr

```
double* _ptr [inherited]
```

16.260.3.3 _stride

```
size_t _stride [inherited]
```

16.260.3.4 _alloc

```
bool _alloc [inherited]
```

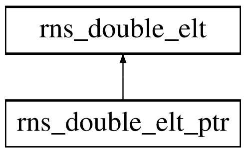
The documentation for this struct was generated from the following file:

- rns-double-elt.h

16.261 rns_double_elt_ptr Struct Reference

```
#include <rns-double-elt.h>
```

Inheritance diagram for rns_double_elt_ptr:



Public Member Functions

- rns_double_elt_ptr ()
- rns_double_elt_ptr (double *p, size_t r)
- rns_double_elt_ptr (const rns_double_elt_ptr &x)
- rns_double_elt_ptr (const rns_double_elt_cstptr &x)
- rns_double_elt_ptr (rns_double_elt_ptr &&)=default
- rns_double_elt_ptr * operator& ()
- rns_double_elt & operator* ()
- rns_double_elt operator[ ] (size_t i) const
- rns_double_elt & operator[ ] (size_t i)
- rns_double_elt_ptr operator++ ()
- rns_double_elt_ptr operator-- ()
- rns_double_elt_ptr operator+ (size_t inc)
- rns_double_elt_ptr operator- (size_t inc)
- rns_double_elt_ptr & operator+= (size_t inc)
- rns_double_elt_ptr & operator-= (size_t inc)
- rns_double_elt_ptr & operator= (const rns_double_elt_ptr &x)
- bool operator< (const rns_double_elt_ptr &x)
- bool operator!= (const rns_double_elt_ptr &x)
- rns_double_elt_cstptr operator& () const

Data Fields

- rns_double_elt other
- double * _ptr
- size_t _stride
- bool _alloc

16.261.1 Constructor & Destructor Documentation

16.261.1.1 rns_double_elt_ptr() [1/5]

```
rns_double_elt_ptr ( ) [inline]
```

16.261.1.2 rns_double_elt_ptr() [2/5]

```
rns_double_elt_ptr (
            double * p,
            size_t r ) [inline]
```

16.261.1.3 rns_double_elt_ptr() [3/5]

```
rns_double_elt_ptr (
            const rns_double_elt_ptr & x ) [inline]
```

16.261.1.4 rns_double_elt_ptr() [4/5]

```
rns_double_elt_ptr (
            const rns_double_elt_cstptr & x ) [inline]
```

16.261.1.5 rns_double_elt_ptr() [5/5]

```
rns_double_elt_ptr (
            rns_double_elt_ptr && ) [default]
```

16.261.2 Member Function Documentation

16.261.2.1 operator&() [1/2]

```
rns_double_elt_ptr* operator& ( ) [inline]
```

16.261.2.2 operator*()

```
rns_double_elt& operator* ( ) [inline]
```

16.261.2.3 operator[]() [1/2]

```
rns_double_elt operator[] (
            size_t i ) const [inline]
```

16.261.2.4 operator[]() [2/2]

```
rns_double_elt& operator[] (
            size_t i ) [inline]
```

16.261.2.5 operator++()

```
rns_double_elt_ptr operator++ ( ) [inline]
```

16.261.2.6 operator--()

```
rns_double_elt_ptr operator-- ( ) [inline]
```

16.261.2.7 operator+()

```
rns_double_elt_ptr operator+ (
            size_t inc ) [inline]
```

16.261.2.8 operator-()

```
rns_double_elt_ptr operator- (
            size_t inc ) [inline]
```

16.261.2.9 operator+=()

```
rns_double_elt_ptr& operator+= (
            size_t inc ) [inline]
```

16.261.2.10 operator-=()

```
rns_double_elt_ptr& operator-= (
            size_t inc ) [inline]
```

16.261.2.11 operator=()

```
rns_double_elt_ptr & operator= (
            const rns_double_elt_ptr & x ) [inline]
```

16.261.2.12 operator<()

```
bool operator< (
            const rns_double_elt_ptr & x ) [inline]
```

16.261.2.13 operator"!=()

```
bool operator!= (
            const rns_double_elt_ptr & x ) [inline]
```

16.261.2.14 operator&() [2/2]

```
rns_double_elt_cstptr operator& ( ) const [inline], [inherited]
```

16.261.3 Field Documentation

16.261.3.1 other

`rns_double_elt other`

16.261.3.2 _ptr

`double* _ptr [inherited]`

16.261.3.3 _stride

`size_t _stride [inherited]`

16.261.3.4 _alloc

`bool _alloc [inherited]`

The documentation for this struct was generated from the following file:

- rns-double-elt.h

16.262 rns_double_extended Struct Reference

`#include <rns-double.h>`

Public Types

- typedef Givaro::Integer integer
- typedef Givaro::ModularExtended< double > ModField
- typedef double BasisElement
- typedef rns_double_elt Element
- typedef rns_double_elt_ptr Element_ptr
- typedef rns_double_elt_cstptr ConstElement_ptr

Public Member Functions

- rns_double_extended (const integer &bound, size_t pbits, bool rnsmod=false, long seed=time(NULL))
- rns_double_extended (size_t pbits, size_t size, long seed=time(NULL))
- template<typename Vect >
  rns_double_extended (const Vect &basis, bool rnsmod=false, long seed=time(NULL))
- void precompute_cst ()
- void init (size_t m, size_t n, double ∗Arns, size_t rda, const integer ∗A, size_t lda, const integer &maxA, bool RNS_MAJOR=false) const
- void init (size_t m, size_t n, double ∗Arns, size_t rda, const integer ∗A, size_t lda, size_t k, bool RNS_↩ MAJOR=false)
- void convert (size_t m, size_t n, integer gamma, integer ∗A, size_t lda, const double ∗Arns, size_t rda, bool RNS_MAJOR=false)
- void init (size_t m, double ∗Arns, const integer ∗A, size_t lda) const
- void convert (size_t m, integer ∗A, const double ∗Arns) const
- void reduce (size_t n, double ∗Arns, size_t rda, bool RNS_MAJOR=false) const

Data Fields

- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _basis
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _basisMax
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _negbasis
- std::vector< double, AlignedAllocator< double, Alignment::CACHE_LINE > > _invbasis
- std::vector< ModField > _field_rns
- integer _M
- std::vector< integer > _Mi
- std::vector< double > _MMi
- std::vector< double > _crt_in
- std::vector< double > _crt_out
- size_t _size
- size_t _pbits
- size_t _ldm

16.262.1 Member Typedef Documentation

16.262.1.1 integer

```
typedef Givaro::Integer integer
```

16.262.1.2 ModField

```
typedef Givaro::ModularExtended<double> ModField
```

16.262.1.3 BasisElement

```
typedef double BasisElement
```

16.262.1.4 Element

```
typedef rns_double_elt Element
```

16.262.1.5 Element_ptr

```
typedef rns_double_elt_ptr Element_ptr
```

16.262.1.6 ConstElement_ptr

```
typedef rns_double_elt_cstptr ConstElement_ptr
```

16.262.2 Constructor & Destructor Documentation

16.262.2.1 rns_double_extended() [1/3]

```
rns_double_extended (
            const integer & bound,
            size_t pbits,
            bool rnsmod = false,
            long seed = time(NULL) )  [inline]
```

16.262.2.2 rns_double_extended() [2/3]

```
rns_double_extended (
            size_t pbits,
            size_t size,
            long seed = time(NULL) )  [inline]
```

16.262.2.3 rns_double_extended() [3/3]

```
rns_double_extended (
            const Vect & basis,
            bool rnsmod = false,
            long seed = time(NULL) )  [inline]
```

16.262.3 Member Function Documentation

16.262.3.1 precompute_cst()

```
void precompute_cst ( )  [inline]
```

16.262.3.2 init() [1/3]

```
void init (
            size_t m,
            size_t n,
            double * Arns,
            size_t rda,
            const integer * A,
            size_t lda,
            const integer & maxA,
            bool RNS_MAJOR = false ) const  [inline]
```

16.262.3.3 init() [2/3]

```
void init (
            size_t m,
            size_t n,
            double * Arns,
            size_t rda,
            const integer * A,
            size_t lda,
            size_t k,
            bool RNS_MAJOR = false )  [inline]
```

16.262.3.4 convert() [1/2]

```
void convert (
            size_t m,
            size_t n,
            integer gamma,
            integer * A,
            size_t lda,
            const double * Arns,
            size_t rda,
            bool RNS_MAJOR = false )  [inline]
```

16.262.3.5 init() [3/3]

```
void init (
            size_t m,
            double * Arns,
            const integer * A,
            size_t lda ) const  [inline]
```

16.262.3.6 convert() [2/2]

```
void convert (
            size_t m,
            integer * A,
            const double * Arns ) const  [inline]
```

16.262.3.7 reduce()

```
void reduce (
            size_t n,
            double * Arns,
            size_t rda,
            bool RNS_MAJOR = false ) const  [inline]
```

16.262.4 Field Documentation

16.262.4.1 _basis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _basis
```

16.262.4.2 _basisMax

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _basisMax
```

16.262.4.3 _negbasis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _negbasis
```

16.262.4.4 _invbasis

```
std::vector<double, AlignedAllocator<double, Alignment::CACHE_LINE> > _invbasis
```

16.262.4.5 _field_rns

```
std::vector<ModField> _field_rns
```

16.262.4.6 _M

```
integer _M
```

16.262.4.7 _Mi

```
std::vector<integer> _Mi
```

16.262.4.8 _MMi

```
std::vector<double> _MMi
```

16.262.4.9 _crt_in

```
std::vector<double> _crt_in
```

16.262.4.10 _crt_out

```
std::vector<double> _crt_out
```

16.262.4.11 _size

```
size_t _size
```

16.262.4.12 _pbits

```
size_t _pbits
```

16.262.4.13 _ldm

```
size_t _ldm
```

The documentation for this struct was generated from the following files:

- rns-double.h
- rns-double.inl

16.263 RNSElementTag Struct Reference

Representation in a Residue Number System.

```
#include <field-traits.h>
```

16.263.1 Detailed Description

Representation in a Residue Number System.
The documentation for this struct was generated from the following file:

- field-traits.h

16.264 RNSInteger< RNS > Class Template Reference

`#include <rns-integer.h>`

Data Structures

- class RandIter

Public Types

- typedef RNS::Element Element
- typedef RNS::Element_ptr Element_ptr
- typedef RNS::ConstElement_ptr ConstElement_ptr

Public Member Functions

- RNSInteger (const RNS &myrns)
- template<typename T >
  RNSInteger (const T &F)
- const RNS & rns () const
- size_t size () const
- bool isOne (const Element &x) const
- bool isMOne (const Element &x) const
- bool isZero (const Element &x) const
- integer characteristic (integer &p) const
- integer cardinality (integer &p) const
- Element & init (Element &x) const
- Element & init (Element &x, const Givaro::Integer &y) const
- Element & reduce (Element &x, const Element &y) const
- Element & reduce (Element &x) const
- Givaro::Integer convert (Givaro::Integer &x, const Element &y) const
- Element & assign (Element &x, const Element &y) const
- std::ostream & write (std::ostream &os, const Element &y) const
- std::ostream & write (std::ostream &os) const

Data Fields

- Element one
- Element mOne
- Element zero

Protected Types

- typedef RNS::BasisElement BasisElement
- typedef Givaro::Integer integer

Protected Attributes

- const RNS * _rns

16.264.1 Member Typedef Documentation

16.264.1.1 BasisElement

```
typedef RNS::BasisElement BasisElement  [protected]
```

16.264.1.2 integer

```
typedef Givaro::Integer integer  [protected]
```

16.264.1.3 Element

```
typedef RNS::Element Element
```

16.264.1.4 Element_ptr

```
typedef RNS::Element_ptr Element_ptr
```

16.264.1.5 ConstElement_ptr

```
typedef RNS::ConstElement_ptr ConstElement_ptr
```

16.264.2 Constructor & Destructor Documentation

16.264.2.1 RNSInteger() [1/2]

```
RNSInteger (
            const RNS & myrns )  [inline]
```

16.264.2.2 RNSInteger() [2/2]

```
RNSInteger (
            const T & F )  [inline]
```

16.264.3 Member Function Documentation

16.264.3.1 rns()

```
const RNS& rns ( ) const  [inline]
```

16.264.3.2 size()

```
size_t size ( ) const  [inline]
```

16.264.3.3 isOne()

```
bool isOne (
            const Element & x ) const  [inline]
```

16.264.3.4 isMOne()

```
bool isMOne (
            const Element & x ) const  [inline]
```

16.264.3.5 isZero()

```
bool isZero (
            const Element & x ) const  [inline]
```

16.264.3.6 characteristic()

```
integer characteristic (
            integer & p ) const  [inline]
```

16.264.3.7 cardinality()

```
integer cardinality (
            integer & p ) const  [inline]
```

16.264.3.8 init() [1/2]

```
Element& init (
            Element & x ) const  [inline]
```

16.264.3.9 init() [2/2]

```
Element& init (
            Element & x,
            const Givaro::Integer & y ) const  [inline]
```

16.264.3.10 reduce() [1/2]

```
Element& reduce (
            Element & x,
            const Element & y ) const  [inline]
```

16.264.3.11 reduce() [2/2]

```
Element& reduce (
            Element & x ) const  [inline]
```

16.264.3.12 convert()

```
Givaro::Integer convert (
            Givaro::Integer & x,
            const Element & y ) const  [inline]
```

16.264.3.13 assign()

```
Element& assign (
            Element & x,
            const Element & y ) const  [inline]
```

16.264.3.14 write() [1/2]

```
std::ostream& write (
            std::ostream & os,
            const Element & y ) const  [inline]
```

16.264.3.15 write() [2/2]

```
std::ostream& write (
            std::ostream & os ) const  [inline]
```

16.264.4 Field Documentation

16.264.4.1 _rns

```
const RNS* _rns  [protected]
```

16.264.4.2 one

```
Element one
```

16.264.4.3 mOne

```
Element mOne
```

16.264.4.4 zero

```
Element zero
```

The documentation for this class was generated from the following files:

- field-traits.h
- rns-integer.h

16.265 RNSIntegerMod< RNS > Class Template Reference

```
#include <rns-integer-mod.h>
```

Data Structures

- class RandIter

Public Types

- typedef RNS::Element Element
- typedef RNS::Element_ptr Element_ptr
- typedef RNS::ConstElement_ptr ConstElement_ptr

Public Member Functions

- RNSIntegerMod (const integer &p, const RNS &myrns)
- const rns_double & rns () const
- const RNSInteger< RNS > & delayed () const
- size_t size () const
- bool isOne (const Element &x) const
- bool isMOne (const Element &x) const
- bool isZero (const Element &x) const
- integer & characteristic (integer &p) const
- integer characteristic () const
- integer & cardinality (integer &p) const
- integer cardinality () const
- integer minElement () const
- integer maxElement () const
- Element & init (Element &x) const
- Element & init (Element &x, const Givaro::Integer &y) const
- Element & reduce (Element &x, const Element &y) const
- Element & reduce (Element &x) const
- Element & init (Element &x, const Element &y) const
- Givaro::Integer convert (Givaro::Integer &x, const Element &y) const
- Element & assign (Element &x, const Element &y) const
- Element & add (Element &x, const Element &y, const Element &z) const
- Element & sub (Element &x, const Element &y, const Element &z) const
- Element & neg (Element &x, const Element &y) const
- Element & mul (Element &x, const Element &y, const Element &z) const
- Element & axpyin (Element &x, const Element &y, const Element &z) const
- Element & inv (Element &x, const Element &y) const
- bool areEqual (const Element &x, const Element &y) const
- std::ostream & write (std::ostream &os, const Element &y) const
- std::ostream & write (std::ostream &os) const
- void reduce_modp (size_t n, Element_ptr B) const
- std::ostream & write_matrix (std::ostream &c, const double ∗E, int n, int m, int lda) const
- std::ostream & write_matrix_long (std::ostream &c, const double ∗E, int n, int m, int lda) const
- void reduce_modp (size_t m, size_t n, Element_ptr B, size_t lda) const
- void reduce_modp_rnsmajor (size_t n, Element_ptr B) const

Data Fields

- Element one
- Element mOne
- Element zero

Protected Types

- typedef RNS::BasisElement BasisElement
- typedef Givaro::Modular< BasisElement > ModField
- typedef Givaro::Integer integer

Protected Attributes

- integer _p
- std::vector< BasisElement, AlignedAllocator< BasisElement, Alignment::CACHE_LINE > > _Mi_modp_rns
- std::vector< BasisElement, AlignedAllocator< BasisElement, Alignment::CACHE_LINE > > _iM_modp_rns
- const RNS * _rns
- Givaro::Modular< Givaro::Integer > _F
- RNSInteger< RNS > _RNSdelayed

16.265.1 Member Typedef Documentation

16.265.1.1 Element

```
typedef RNS::Element Element
```

16.265.1.2 Element_ptr

```
typedef RNS::Element_ptr Element_ptr
```

16.265.1.3 ConstElement_ptr

```
typedef RNS::ConstElement_ptr ConstElement_ptr
```

16.265.1.4 BasisElement

```
typedef RNS::BasisElement BasisElement  [protected]
```

16.265.1.5 ModField

```
typedef Givaro::Modular<BasisElement> ModField  [protected]
```

16.265.1.6 integer

```
typedef Givaro::Integer integer  [protected]
```

16.265.2 Constructor & Destructor Documentation

16.265.2.1 RNSIntegerMod()

```
RNSIntegerMod (
            const integer & p,
            const RNS & myrns )  [inline]
```

16.265.3 Member Function Documentation

16.265.3.1 rns()

```
const rns_double& rns ( ) const  [inline]
```

16.265.3.2 delayed()

```
const RNSInteger<RNS>& delayed ( ) const [inline]
```

16.265.3.3 size()

```
size_t size ( ) const [inline]
```

16.265.3.4 isOne()

```
bool isOne (
            const Element & x ) const [inline]
```

16.265.3.5 isMOne()

```
bool isMOne (
            const Element & x ) const [inline]
```

16.265.3.6 isZero()

```
bool isZero (
            const Element & x ) const [inline]
```

16.265.3.7 characteristic() [1/2]

```
integer& characteristic (
            integer & p ) const [inline]
```

16.265.3.8 characteristic() [2/2]

```
integer characteristic ( ) const [inline]
```

16.265.3.9 cardinality() [1/2]

```
integer& cardinality (
            integer & p ) const [inline]
```

16.265.3.10 cardinality() [2/2]

```
integer cardinality ( ) const [inline]
```

16.265.3.11 minElement()

```
integer minElement ( ) const [inline]
```

16.265.3.12 maxElement()

```
integer maxElement ( ) const [inline]
```

16.265.3.13 init() [1/3]

```
Element& init (
            Element & x ) const  [inline]
```

16.265.3.14 init() [2/3]

```
Element& init (
            Element & x,
            const Givaro::Integer & y ) const  [inline]
```

16.265.3.15 reduce() [1/2]

```
Element& reduce (
            Element & x,
            const Element & y ) const  [inline]
```

16.265.3.16 reduce() [2/2]

```
Element& reduce (
            Element & x ) const  [inline]
```

16.265.3.17 init() [3/3]

```
Element& init (
            Element & x,
            const Element & y ) const  [inline]
```

16.265.3.18 convert()

```
Givaro::Integer convert (
            Givaro::Integer & x,
            const Element & y ) const  [inline]
```

16.265.3.19 assign()

```
Element& assign (
            Element & x,
            const Element & y ) const  [inline]
```

16.265.3.20 add()

```
Element& add (
            Element & x,
            const Element & y,
            const Element & z ) const  [inline]
```

16.265.3.21 sub()

```
Element& sub (
            Element & x,
```

```
            const Element & y,
            const Element & z ) const  [inline]
```

16.265.3.22 neg()

```
Element& neg (
            Element & x,
            const Element & y ) const  [inline]
```

16.265.3.23 mul()

```
Element& mul (
            Element & x,
            const Element & y,
            const Element & z ) const  [inline]
```

16.265.3.24 axpyin()

```
Element& axpyin (
            Element & x,
            const Element & y,
            const Element & z ) const  [inline]
```

16.265.3.25 inv()

```
Element& inv (
            Element & x,
            const Element & y ) const  [inline]
```

16.265.3.26 areEqual()

```
bool areEqual (
            const Element & x,
            const Element & y ) const  [inline]
```

16.265.3.27 write() [1/2]

```
std::ostream& write (
            std::ostream & os,
            const Element & y ) const  [inline]
```

16.265.3.28 write() [2/2]

```
std::ostream& write (
            std::ostream & os ) const  [inline]
```

16.265.3.29 reduce_modp() [1/2]

```
void reduce_modp (
            size_t n,
            Element_ptr B ) const  [inline]
```

16.265.3.30 write_matrix()

```
std::ostream& write_matrix (
            std::ostream & c,
            const double * E,
            int n,
            int m,
            int lda ) const  [inline]
```

16.265.3.31 write_matrix_long()

```
std::ostream& write_matrix_long (
            std::ostream & c,
            const double * E,
            int n,
            int m,
            int lda ) const  [inline]
```

16.265.3.32 reduce_modp() [2/2]

```
void reduce_modp (
            size_t m,
            size_t n,
            Element_ptr B,
            size_t lda ) const  [inline]
```

16.265.3.33 reduce_modp_rnsmajor()

```
void reduce_modp_rnsmajor (
            size_t n,
            Element_ptr B ) const  [inline]
```

16.265.4 Field Documentation

16.265.4.1 _p

```
integer _p  [protected]
```

16.265.4.2 _Mi_modp_rns

```
std::vector<BasisElement, AlignedAllocator<BasisElement, Alignment::CACHE_LINE> > _Mi_modp_↩
rns  [protected]
```

16.265.4.3 _iM_modp_rns

```
std::vector<BasisElement, AlignedAllocator<BasisElement, Alignment::CACHE_LINE> > _iM_modp_↩
rns  [protected]
```

16.265.4.4 _rns

```
const RNS* _rns  [protected]
```

16.265.4.5 _F

`Givaro::Modular<Givaro::Integer> _F [protected]`

16.265.4.6 _RNSdelayed

`RNSInteger<RNS> _RNSdelayed [protected]`

16.265.4.7 one

`Element one`

16.265.4.8 mOne

`Element mOne`

16.265.4.9 zero

`Element zero`

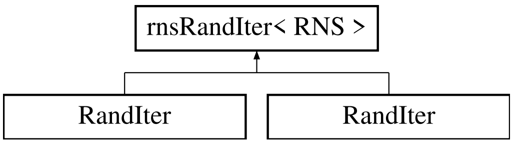
The documentation for this class was generated from the following files:

- field-traits.h
- rns-integer-mod.h

16.266 rnsRandIter< RNS > Class Template Reference

`#include <rns-double.h>`

Inheritance diagram for rnsRandIter< RNS >:



Public Member Functions

- rnsRandIter (const RNS &R, uint64_t seed=0)
- RNS::Element & random (typename RNS::Element &elt) const

  RNS ring Element random assignement.
- RNS::Element & operator() (typename RNS::Element &elt) const
- RNS::Element operator() () const
- RNS::Element random () const
- const RNS & ring () const

16.266.1 Constructor & Destructor Documentation

16.266.1.1 rnsRandIter()

```
rnsRandIter (
            const RNS & R,
            uint64_t seed = 0 ) [inline]
```

16.266.2 Member Function Documentation

16.266.2.1 random() [1/2]

```
RNS::Element& random (
            typename RNS::Element & elt ) const  [inline]
```

RNS ring Element random assignement.
Element is supposed to be initialized

Returns

random ring Element

16.266.2.2 operator()() [1/2]

```
RNS::Element& operator() (
            typename RNS::Element & elt ) const  [inline]
```

16.266.2.3 operator()() [2/2]

```
RNS::Element operator() ( ) const  [inline]
```

16.266.2.4 random() [2/2]

```
RNS::Element random ( ) const  [inline]
```

16.266.2.5 ring()

```
const RNS& ring ( ) const  [inline]
```

The documentation for this class was generated from the following file:

- rns-double.h

16.267 Row Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

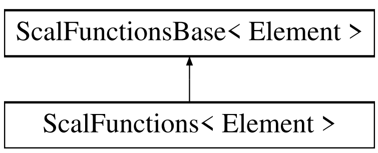
16.268 ruint< K > Class Template Reference

The documentation for this class was generated from the following file:

- field-traits.h

16.269 ScalFunctions< Element > Struct Template Reference

Inheritance diagram for ScalFunctions< Element >:



Public Types

- using vectElt = vector< Element >

Static Public Member Functions

- static void genInputs (vector< vectElt > &inputs)
- static void genInputsWithZero (vector< vectElt > &inputs)
- static Element zero ()
- static Element vand (Element x1, Element x2)
- static Element vor (Element x1, Element x2)
- static Element vxor (Element x1, Element x2)
- static Element vandnot (Element x1, Element x2)
- static Element add (Element x1, Element x2)
- static Element addin (Element &x1, Element x2)
- static Element sub (Element x1, Element x2)
- static Element subin (Element &x1, Element x2)
- static Element mul (Element x1, Element x2)
- static Element mulin (Element &x1, Element x2)
- static Element div (Element x1, Element x2)
- static Element fmadd (Element x1, Element x2, Element x3)
- static Element fmaddin (Element &x1, Element x2, Element x3)
- static Element fmsub (Element x1, Element x2, Element x3)
- static Element fmsubin (Element &x1, Element x2, Element x3)
- static Element fnmadd (Element x1, Element x2, Element x3)
- static Element fnmaddin (Element &x1, Element x2, Element x3)
- static Element lesser (Element x1, Element x2)
- static Element lesser_eq (Element x1, Element x2)
- static Element greater (Element x1, Element x2)
- static Element greater_eq (Element x1, Element x2)
- static Element eq (Element x1, Element x2)
- static vectElt unpacklo (vectElt a, vectElt b)
- static vectElt unpackhi (vectElt a, vectElt b)
- static void unpacklohi (vectElt &lo, vectElt &hi, vectElt a, vectElt b)
- static vectElt pack_even (vectElt a, vectElt b)
- static vectElt pack_odd (vectElt a, vectElt b)
- static void pack (vectElt &even, vectElt &odd, vectElt a, vectElt b)
- template< uint16_t s >
  static vectElt blend (vectElt a, vectElt b)

16.269.1 Member Typedef Documentation

16.269.1.1 vectElt

```
using vectElt = vector<Element>
```

16.269.2 Member Function Documentation

16.269.2.1 genInputs()

```
static void genInputs (
            vector< vectElt > & inputs )  [inline], [static]
```

16.269.2.2 genInputsWithZero()

```
static void genInputsWithZero (
            vector< vectElt > & inputs )  [inline], [static]
```

16.269.2.3 zero()

```
static Element zero ( )  [inline], [static]
```

16.269.2.4 vand()

```
static Element vand (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.5 vor()

```
static Element vor (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.6 vxor()

```
static Element vxor (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.7 vandnot()

```
static Element vandnot (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.8 add()

```
static Element add (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.9 addin()

```
static Element addin (
            Element & x1,
            Element x2 )  [inline], [static]
```

16.269.2.10 sub()

```
static Element sub (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.11 subin()

```
static Element subin (
            Element & x1,
            Element x2 )  [inline], [static]
```

16.269.2.12 mul()

```
static Element mul (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.13 mulin()

```
static Element mulin (
            Element & x1,
            Element x2 )  [inline], [static]
```

16.269.2.14 div()

```
static Element div (
            Element x1,
            Element x2 )  [inline], [static]
```

16.269.2.15 fmadd()

```
static Element fmadd (
            Element x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.269.2.16 fmaddin()

```
static Element fmaddin (
            Element & x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.269.2.17 fmsub()

```
static Element fmsub (
            Element x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.269.2.18 fmsubin()

```
static Element fmsubin (
            Element & x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.269.2.19 fnmadd()

```
static Element fnmadd (
            Element x1,
            Element x2,
            Element x3 ) [inline], [static]
```

16.269.2.20 fnmaddin()

```
static Element fnmaddin (
            Element & x1,
            Element x2,
            Element x3 ) [inline], [static]
```

16.269.2.21 lesser()

```
static Element lesser (
            Element x1,
            Element x2 ) [inline], [static]
```

16.269.2.22 lesser_eq()

```
static Element lesser_eq (
            Element x1,
            Element x2 ) [inline], [static]
```

16.269.2.23 greater()

```
static Element greater (
            Element x1,
            Element x2 ) [inline], [static]
```

16.269.2.24 greater_eq()

```
static Element greater_eq (
            Element x1,
            Element x2 ) [inline], [static]
```

16.269.2.25 eq()

```
static Element eq (
            Element x1,
            Element x2 ) [inline], [static]
```

16.269.2.26 unpacklo()

```
static vectElt unpacklo (
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.27 unpackhi()

```
static vectElt unpackhi (
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.28 unpacklohi()

```
static void unpacklohi (
            vectElt & lo,
            vectElt & hi,
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.29 pack_even()

```
static vectElt pack_even (
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.30 pack_odd()

```
static vectElt pack_odd (
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.31 pack()

```
static void pack (
            vectElt & even,
            vectElt & odd,
            vectElt a,
            vectElt b ) [inline], [static]
```

16.269.2.32 blend()

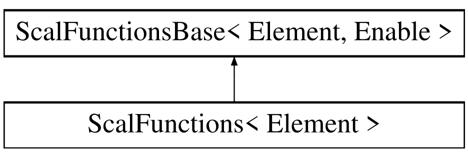
```
static vectElt blend (
            vectElt a,
            vectElt b ) [inline], [static]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.270 ScalFunctionsBase< Element, Enable > Struct Template Reference

Inheritance diagram for ScalFunctionsBase< Element, Enable >:



The documentation for this struct was generated from the following file:

- test-simd.C

16.271 ScalFunctionsBase< Element, typename enable_if< is_floating_point< Element >::value >::type > Struct Template Reference

Data Structures

- class FloatingPointTestDistribution

Static Public Member Functions

- static FloatingPointTestDistribution get_default_random_generator ()
- static Element ceil (Element x)
- static Element floor (Element x)
- static Element round (Element x)
- static Element blendv (Element a, Element b, Element mask)
- static Element fma (Element x, Element y, Element z)

Static Public Attributes

- static constexpr Element _zero = 0.0
- static constexpr Element cmp_true = NAN
- static constexpr Element cmp_false = _zero

16.271.1 Member Function Documentation

16.271.1.1 get_default_random_generator()

```
static FloatingPointTestDistribution get_default_random_generator ( )  [inline], [static]
```

16.271.1.2 ceil()

```
static Element ceil (
            Element x )  [inline], [static]
```

16.271.1.3 floor()

```
static Element floor (
            Element x )  [inline], [static]
```

16.271.1.4 round()

```
static Element round (
            Element x )  [inline], [static]
```

16.271.1.5 blendv()

```
static Element blendv (
            Element a,
            Element b,
            Element mask ) [inline], [static]
```

16.271.1.6 fma()

```
static Element fma (
            Element x,
            Element y,
            Element z ) [inline], [static]
```

16.271.2 Field Documentation

16.271.2.1 _zero

```
constexpr Element _zero = 0.0 [static], [constexpr]
```

16.271.2.2 cmp_true

```
constexpr Element cmp_true = NAN [static], [constexpr]
```

16.271.2.3 cmp_false

```
constexpr Element cmp_false = _zero [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.272 ScalFunctionsBase< Element, typename enable_if< is_integral< Element >::value >::type > Struct Template Reference

Static Public Member Functions

- static uniform_int_distribution< Element > get_default_random_generator ()
- static Element round (Element x)
- static Element fma (Element x, Element y, Element z)
- static Element mullo (Element x1, Element x2)
- static Element mulhi (Element x1, Element x2)
- static Element mulx (Element x1, Element x2)
- static Element fmaddx (Element x1, Element x2, Element x3)
- static Element fmaddxin (Element &x1, Element x2, Element x3)
- static Element fmsubx (Element x1, Element x2, Element x3)
- static Element fmsubxin (Element &x1, Element x2, Element x3)
- static Element fnmaddx (Element x1, Element x2, Element x3)
- static Element fnmaddxin (Element &x1, Element x2, Element x3)
- template<int s>
  static Element sra (Element x1)
- template<int s>
  static Element srl (Element x1)
- template<int s>
  static Element sll (Element x1)

Static Public Attributes

- static constexpr Element _zero = 0
- static constexpr Element cmp_true = -1
- static constexpr Element cmp_false = _zero

16.272.1 Member Function Documentation

16.272.1.1 get_default_random_generator()

```
static uniform_int_distribution<Element> get_default_random_generator ( )  [inline], [static]
```

16.272.1.2 round()

```
static Element round (
             Element x )  [inline], [static]
```

16.272.1.3 fma()

```
static Element fma (
             Element x,
             Element y,
             Element z )  [inline], [static]
```

16.272.1.4 mullo()

```
static Element mullo (
             Element x1,
             Element x2 )  [inline], [static]
```

16.272.1.5 mulhi()

```
static Element mulhi (
             Element x1,
             Element x2 )  [inline], [static]
```

16.272.1.6 mulx()

```
static Element mulx (
             Element x1,
             Element x2 )  [inline], [static]
```

16.272.1.7 fmaddx()

```
static Element fmaddx (
             Element x1,
             Element x2,
             Element x3 )  [inline], [static]
```

16.272.1.8 fmaddxin()

```
static Element fmaddxin (
            Element & x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.272.1.9 fmsubx()

```
static Element fmsubx (
            Element x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.272.1.10 fmsubxin()

```
static Element fmsubxin (
            Element & x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.272.1.11 fnmaddx()

```
static Element fnmaddx (
            Element x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.272.1.12 fnmaddxin()

```
static Element fnmaddxin (
            Element & x1,
            Element x2,
            Element x3 )  [inline], [static]
```

16.272.1.13 sra()

```
static Element sra (
            Element x1 )  [inline], [static]
```

16.272.1.14 srl()

```
static Element srl (
            Element x1 )  [inline], [static]
```

16.272.1.15 sll()

```
static Element sll (
            Element x1 )  [inline], [static]
```

16.272.2 Field Documentation

16.272.2.1 _zero

```
constexpr Element _zero = 0  [static], [constexpr]
```

16.272.2.2 cmp_true

```
constexpr Element cmp_true = -1  [static], [constexpr]
```

16.272.2.3 cmp_false

```
constexpr Element cmp_false = _zero  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.273 Sequential Struct Reference

Public Member Functions

- Sequential ()
- Sequential (size_t nth)
- template<class Cut , class Param >
  Sequential (Parallel< Cut, Param > &)
- size_t numthreads () const

Friends

- std::ostream & operator<< (std::ostream &out, const Sequential &)

16.273.1 Constructor & Destructor Documentation

16.273.1.1 Sequential() [1/3]

```
Sequential ( )  [inline]
```

16.273.1.2 Sequential() [2/3]

```
Sequential (
            size_t nth )  [inline]
```

16.273.1.3 Sequential() [3/3]

```
Sequential (
            Parallel< Cut, Param > & )  [inline]
```

16.273.2 Member Function Documentation

16.273.2.1 numthreads()

```
size_t numthreads ( ) const  [inline]
```

16.273.3 Friends And Related Function Documentation

16.273.3.1 operator<<

```
std::ostream& operator<< (
            std::ostream & out,
            const Sequential & ) [friend]
```

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.274 Simd128_impl< ArithType, Int, Signed, Size > Struct Template Reference

The documentation for this struct was generated from the following file:

- simd128.inl

16.275 Simd128_impl< true, false, true, 4 > Struct Reference

The documentation for this struct was generated from the following file:

- simd128_float.inl

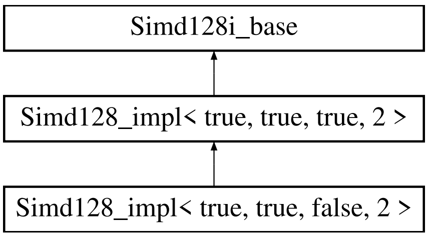
16.276 Simd128_impl< true, false, true, 8 > Struct Reference

The documentation for this struct was generated from the following file:

- simd128_double.inl

16.277 Simd128_impl< true, true, false, 2 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, false, 2 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint16_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using vect_t = __m128i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint32_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)

- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const __m64 &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 16

16.277.1 Member Typedef Documentation

16.277.1.1 scalar_t

```
using scalar_t = uint16_t
```

16.277.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.277.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.277.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.277.1.5 vect_t

```
using vect_t = __m128i  [inherited]
```

16.277.2 Member Function Documentation

16.277.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.277.2.2 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.277.2.3 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.277.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.277.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.277.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.277.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.277.2.8 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.277.2.9 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.277.2.10 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.277.2.11 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.277.2.12 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.277.2.13 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.277.2.14 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.277.2.15 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.277.2.16 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.277.2.17 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.18 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.19 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.20 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.21 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.22 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.277.2.23 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.277.2.24 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr], [inherited]
```

16.277.2.25 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr], [inherited]
```

16.277.2.26 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static], [inherited]
```

16.277.2.27 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static], [inherited]
```

16.277.2.28 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static], [inherited]
```

16.277.2.29 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.30 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.31 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.32 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.33 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.34 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.35 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.36 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.37 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 )  [inline], [static], [inherited]
```

16.277.2.38 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.39 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.40 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.277.2.41 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.42 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.43 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.44 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.45 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.46 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.47 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.48 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.49 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.50 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.51 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.52 round()

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static], [inherited]
```

16.277.2.53 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const __m64 & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T ) [inline], [static], [inherited]
```

16.277.2.54 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static], [inherited]
```

16.277.2.55 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a ) [inline], [static], [inherited]
```

16.277.2.56 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a ) [inline], [static], [inherited]
```

16.277.2.57 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.58 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.59 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.2.60 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.277.3 Field Documentation

16.277.3.1 vect_size

```
constexpr const size_t vect_size = 8 [static], [constexpr], [inherited]
```

16.277.3.2 alignment

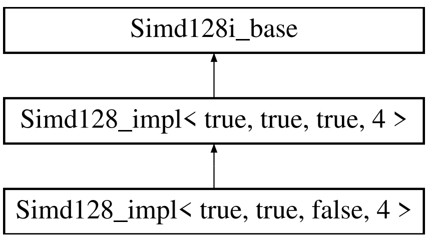
```
constexpr const size_t alignment = 16 [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd128_int16.inl

16.278 Simd128_impl< true, true, false, 4 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, false, 4 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint32_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using vect_t = __m128i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3)

- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 4
- static constexpr const size_t alignment = 16

16.278.1 Member Typedef Documentation

16.278.1.1 scalar_t

```
using scalar_t = uint32_t
```

16.278.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.278.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.278.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.278.1.5 vect_t

```
using vect_t = __m128i [inherited]
```

16.278.2 Member Function Documentation

16.278.2.1 type_string()

```
static const std::string type_string ( ) [inline], [static]
```

16.278.2.2 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x ) [inline], [static]
```

16.278.2.3 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3 ) [inline], [static]
```

16.278.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx ) [inline], [static]
```

16.278.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p ) [inline], [static]
```

16.278.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.278.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.278.2.8 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.278.2.9 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.278.2.10 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.278.2.11 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.278.2.12 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.278.2.13 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.278.2.14 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.278.2.15 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.278.2.16 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.278.2.17 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.18 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.19 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.20 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.21 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.22 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.278.2.23 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.278.2.24 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr], [inherited]
```

16.278.2.25 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr], [inherited]
```

16.278.2.26 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.27 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.28 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.29 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.30 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.31 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.32 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.33 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.34 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.35 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.36 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.37 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3 ) [inline], [static], [inherited]
```

16.278.2.38 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.39 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.40 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.41 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.42 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.43 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.44 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.45 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.46 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.47 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.48 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.49 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.278.2.50 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.51 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.52 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.53 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static], [inherited]
```

16.278.2.54 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.278.2.55 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.56 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.278.2.57 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.58 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.59 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.2.60 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.278.3 Field Documentation

16.278.3.1 vect_size

```
constexpr const size_t vect_size = 4  [static], [constexpr], [inherited]
```

16.278.3.2 alignment

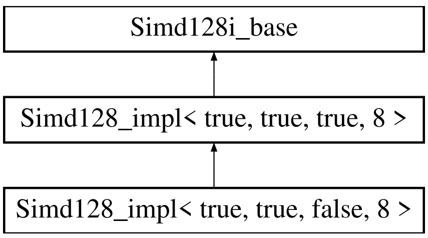
```
constexpr const size_t alignment = 16  [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd128_int32.inl

16.279 Simd128_impl< true, true, false, 8 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, false, 8 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint64_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >

- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using vect_t = __m128i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t x0, const vect_t x1)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- template<int idx>
  static INLINE CONST scalar_t get (vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)

- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m128d &P, const __m128d &INVP, const __m128d &NEGP, const vect_t &POW50REM, const __m128d &MIN, const __m128d &MAX, __m128d &Q, __m128d &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 2
- static constexpr const size_t alignment = 16

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.279.1 Member Typedef Documentation

16.279.1.1 scalar_t

```
using scalar_t = uint64_t
```

16.279.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.279.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.279.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.279.1.5 vect_t

```
using vect_t = __m128i  [inherited]
```

16.279.2 Member Function Documentation

16.279.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.279.2.2 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.279.2.3 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1 )  [inline], [static]
```

16.279.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.279.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.279.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.279.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.279.2.8 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.279.2.9 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.279.2.10 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.279.2.11 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.279.2.12 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.279.2.13 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.14 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.15 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t x0,
            const vect_t x1 ) [inline], [static]
```

16.279.2.16 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.17 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.18 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.19 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.20 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.21 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.22 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.23 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.279.2.24 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.279.2.25 valid()

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr], [inherited]
```

16.279.2.26 compliant()

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr], [inherited]
```

16.279.2.27 get()

```
static INLINE CONST scalar_t get (
            vect_t v ) [inline], [static], [inherited]
```

16.279.2.28 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static], [inherited]
```

16.279.2.29 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static], [inherited]
```

16.279.2.30 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static], [inherited]
```

16.279.2.31 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.32 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.33 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.34 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.35 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.36 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.37 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.38 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.39 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1 ) [inline], [static], [inherited]
```

16.279.2.40 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.41 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.42 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.43 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.44 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.45 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.46 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.47 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.48 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.279.2.49 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.50 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.51 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.52 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static], [inherited]
```

16.279.2.54 mask_high()

```
static INLINE CONST vect_t mask_high ( )  [inline], [static], [inherited]
```

16.279.2.55 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y )  [static], [inherited]
```

16.279.2.56 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m128d & P,
            const __m128d & INVP,
            const __m128d & NEGP,
            const vect_t & POW50REM,
            const __m128d & MIN,
            const __m128d & MAX,
```

```
            __m128d & Q,
            __m128d & T )  [static], [inherited]
```

16.279.2.57 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x )  [inline], [static], [protected], [inherited]
```

16.279.2.58 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.279.2.59 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.279.2.60 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.279.2.61 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.62 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.63 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.2.64 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.279.3 Field Documentation

16.279.3.1 vect_size

```
constexpr const size_t vect_size = 2  [static], [constexpr], [inherited]
```

16.279.3.2 alignment

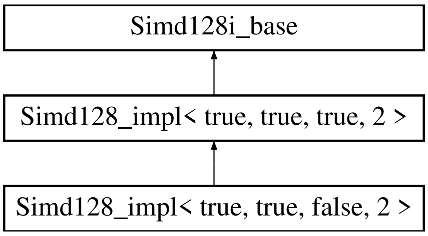
```
constexpr const size_t alignment = 16  [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd128_int64.inl

16.280 Simd128_impl< true, true, true, 2 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, true, 2 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m128i
- using scalar_t = int16_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)

- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint32_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const __m64 &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 16

16.280.1 Member Typedef Documentation

16.280.1.1 vect_t

```
using vect_t = __m128i
```

16.280.1.2 scalar_t

```
using scalar_t = int16_t
```

16.280.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.280.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.280.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.280.2 Member Function Documentation

16.280.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.280.2.2 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr]
```

16.280.2.3 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr]
```

16.280.2.4 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.280.2.5 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.280.2.6 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.280.2.7 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.280.2.8 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.280.2.9 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.280.2.10 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.280.2.11 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.280.2.12 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static]
```

16.280.2.13 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static]
```

16.280.2.14 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.280.2.15 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static]
```

16.280.2.16 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.17 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.18 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.19 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.20 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.21 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.22 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.280.2.23 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.280.2.24 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 ) [inline], [static]
```

16.280.2.25 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.280.2.26 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.280.2.27 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b ) [inline], [static]
```

16.280.2.28 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.280.2.29 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.280.2.30 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.31 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.32 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.33 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.34 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.35 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.36 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.37 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.38 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.39 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.40 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.41 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.42 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.43 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.44 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.45 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.46 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.47 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.48 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.49 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.50 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.280.2.51 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.280.2.52 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.280.2.53 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const __m64 & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static]
```

16.280.2.54 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.280.2.55 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.280.2.56 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.280.2.57 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.280.2.58 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.280.2.59 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.280.2.60 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.280.3 Field Documentation

16.280.3.1 vect_size

```
constexpr const size_t vect_size = 8  [static], [constexpr]
```

16.280.3.2 alignment

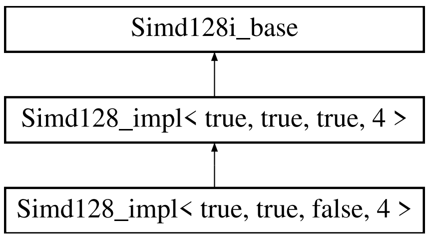
```
constexpr const size_t alignment = 16  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd128_int16.inl

16.281 Simd128_impl< true, true, true, 4 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, true, 4 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m128i
- using scalar_t = int32_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)

- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 4
- static constexpr const size_t alignment = 16

16.281.1 Member Typedef Documentation

16.281.1.1 vect_t

```
using vect_t = __m128i
```

16.281.1.2 scalar_t

```
using scalar_t = int32_t
```

16.281.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.281.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.281.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.281.2 Member Function Documentation

16.281.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.281.2.2 valid()

```
static constexpr bool valid (
             T * p )  [inline], [static], [constexpr]
```

16.281.2.3 compliant()

```
static constexpr bool compliant (
             T n )  [inline], [static], [constexpr]
```

16.281.2.4 set1()

```
static INLINE CONST vect_t set1 (
             const scalar_t x )  [inline], [static]
```

16.281.2.5 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3 )  [inline], [static]
```

16.281.2.6 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.281.2.7 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.281.2.8 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.281.2.9 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.281.2.10 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.281.2.11 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.281.2.12 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static]
```

16.281.2.13 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static]
```

16.281.2.14 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.281.2.15 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static]
```

16.281.2.16 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.17 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.18 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.19 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.20 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.21 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.22 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.23 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.24 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3 )  [inline], [static]
```

16.281.2.25 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.26 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.27 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.281.2.28 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.29 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.281.2.30 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.31 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.32 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.33 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.34 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.35 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.36 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.37 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.38 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.39 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.40 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.41 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.42 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.43 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.44 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.45 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.46 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.47 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.48 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.49 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.50 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.281.2.51 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.281.2.52 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.281.2.53 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
```

```
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static]
```

16.281.2.54 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.281.2.55 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.281.2.56 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.281.2.57 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.281.2.58 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.281.2.59 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.281.2.60 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.281.3 Field Documentation

16.281.3.1 vect_size

```
constexpr const size_t vect_size = 4  [static], [constexpr]
```

16.281.3.2 alignment

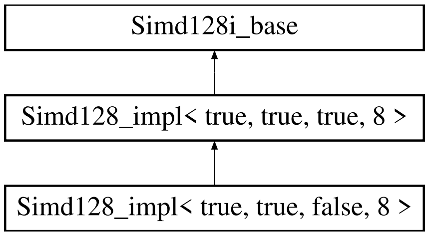
`constexpr const size_t alignment = 16 [static], [constexpr]`

The documentation for this struct was generated from the following file:

- simd128_int32.inl

16.282 Simd128_impl< true, true, true, 8 > Struct Reference

Inheritance diagram for Simd128_impl< true, true, true, 8 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m128i
- using scalar_t = int64_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- template<int idx>
  static INLINE CONST scalar_t get (vect_t v)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)

- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t x0, const vect_t x1)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m128d &P, const __m128d &INVP, const __m128d &NEGP, const vect_t &POW50REM, const __m128d &MIN, const __m128d &MAX, __m128d &Q, __m128d &T)
- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 2
- static constexpr const size_t alignment = 16

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.282.1 Member Typedef Documentation

16.282.1.1 vect_t

```
using vect_t = __m128i
```

16.282.1.2 scalar_t

```
using scalar_t = int64_t
```

16.282.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.282.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.282.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.282.2 Member Function Documentation

16.282.2.1 type_string()

```
static const std::string type_string ( ) [inline], [static]
```

16.282.2.2 valid()

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr]
```

16.282.2.3 compliant()

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr]
```

16.282.2.4 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.282.2.5 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1 )  [inline], [static]
```

16.282.2.6 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.282.2.7 get()

```
static INLINE CONST scalar_t get (
            vect_t v )  [inline], [static]
```

16.282.2.8 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.282.2.9 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.282.2.10 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.282.2.11 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.282.2.12 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.282.2.13 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static]
```

16.282.2.14 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static]
```

16.282.2.15 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.282.2.16 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static]
```

16.282.2.17 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.18 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.19 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.20 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.21 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.22 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.23 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.24 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.25 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1 )  [inline], [static]
```

16.282.2.26 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.27 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.28 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.282.2.29 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.30 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static]
```

16.282.2.31 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t x0,
            const vect_t x1 ) [inline], [static]
```

16.282.2.32 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.33 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.34 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.35 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.36 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.37 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.282.2.38 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.39 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.40 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.41 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.42 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.43 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.44 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.45 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.46 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.47 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.48 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.49 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.50 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.51 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.282.2.52 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.282.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.282.2.54 mask_high()

```
static INLINE CONST vect_t mask_high ( )  [inline], [static]
```

16.282.2.55 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y )  [static]
```

16.282.2.56 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m128d & P,
            const __m128d & INVP,
            const __m128d & NEGP,
            const vect_t & POW50REM,
            const __m128d & MIN,
            const __m128d & MAX,
            __m128d & Q,
            __m128d & T )  [static]
```

16.282.2.57 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x )  [inline], [static], [protected]
```

16.282.2.58 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.282.2.59 sll128()

```
static INLINE CONST vect_t sll128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.282.2.60 srl128()

```
static INLINE CONST vect_t srl128 (
            const vect_t a )  [inline], [static], [inherited]
```

16.282.2.61 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.282.2.62 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.282.2.63 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.282.2.64 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.282.3 Field Documentation

16.282.3.1 vect_size

```
constexpr const size_t vect_size = 2  [static], [constexpr]
```

16.282.3.2 alignment

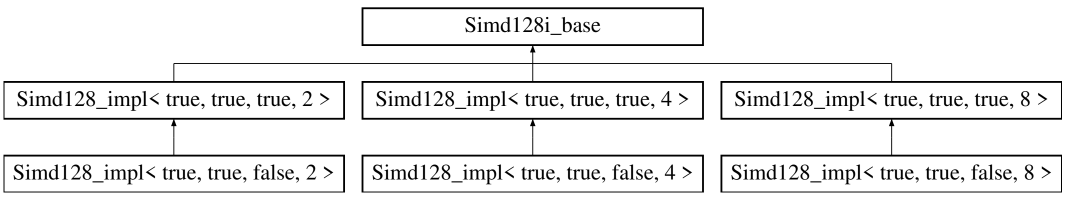
```
constexpr const size_t alignment = 16  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd128_int64.inl

16.283 Simd128i_base Struct Reference

Inheritance diagram for Simd128i_base:



Public Types

- using vect_t = __m128i

Static Public Member Functions

- static INLINE CONST vect_t zero ()
- template<uint8_t s>
  static INLINE CONST vect_t sll128 (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t srl128 (const vect_t a)

- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

16.283.1 Member Typedef Documentation

16.283.1.1 vect_t

```
using vect_t = __m128i
```

16.283.2 Member Function Documentation

16.283.2.1 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static]
```

16.283.2.2 sll128()

```
static INLINE CONST vect_t sll128 (
             const vect_t a )  [inline], [static]
```

16.283.2.3 srl128()

```
static INLINE CONST vect_t srl128 (
             const vect_t a )  [inline], [static]
```

16.283.2.4 vand()

```
static INLINE CONST vect_t vand (
             const vect_t a,
             const vect_t b )  [inline], [static]
```

16.283.2.5 vor()

```
static INLINE CONST vect_t vor (
             const vect_t a,
             const vect_t b )  [inline], [static]
```

16.283.2.6 vxor()

```
static INLINE CONST vect_t vxor (
             const vect_t a,
             const vect_t b )  [inline], [static]
```

16.283.2.7 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

The documentation for this struct was generated from the following file:

- simd128.inl

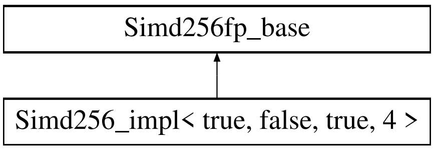
16.284 Simd256_impl< ArithType, Int, Signed, Size > Struct Template Reference

The documentation for this struct was generated from the following file:

- simd256.inl

16.285 Simd256_impl< true, false, true, 4 > Struct Reference

Inheritance diagram for Simd256_impl< true, false, true, 4 >:

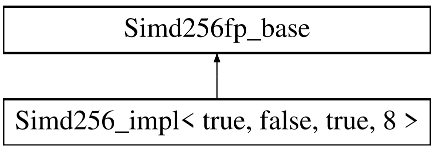


The documentation for this struct was generated from the following file:

- simd256_float.inl

16.286 Simd256_impl< true, false, true, 8 > Struct Reference

Inheritance diagram for Simd256_impl< true, false, true, 8 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m256d
- using scalar_t = double
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template< class T >
  static constexpr bool valid (T *p)
- template< class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4)
- template< class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (const scalar_t *p, const vect_t v)
- static INLINE void storeu (const scalar_t *p, const vect_t v)
- static INLINE void stream (const scalar_t *p, const vect_t v)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3)
- template< uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t blendv (const vect_t a, const vect_t b, const vect_t mask)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE CONST vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t div (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)
- static INLINE CONST vect_t floor (const vect_t a)
- static INLINE CONST vect_t ceil (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t hadd (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)

Static Public Attributes

- static constexpr const size_t vect_size = 4
- static constexpr const size_t alignment = 32

16.286.1 Member Typedef Documentation

16.286.1.1 vect_t

```
using vect_t = __m256d
```

16.286.1.2 scalar_t

```
using scalar_t = double
```

16.286.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.286.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.286.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.286.2 Member Function Documentation

16.286.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.286.2.2 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr]
```

16.286.2.3 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr]
```

16.286.2.4 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static]
```

16.286.2.5 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.286.2.6 set()

```
static INLINE CONST vect_t set (
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4 )  [inline], [static]
```

16.286.2.7 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.286.2.8 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.286.2.9 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.286.2.10 store()

```
static INLINE void store (
            const scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.286.2.11 storeu()

```
static INLINE void storeu (
            const scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.286.2.12 stream()

```
static INLINE void stream (
            const scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.286.2.13 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.14 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.15 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.16 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.17 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.18 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.19 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.20 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.21 transpose()

```
static INLINE void transpose (
            vect_t & r0,
```

```
            vect_t & r1,
            vect_t & r2,
            vect_t & r3 )  [inline], [static]
```

16.286.2.22 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.23 blendv()

```
static INLINE CONST vect_t blendv (
            const vect_t a,
            const vect_t b,
            const vect_t mask )  [inline], [static]
```

16.286.2.24 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.25 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.286.2.26 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.27 subin()

```
static INLINE CONST vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.286.2.28 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.29 mulin()

```
static INLINE CONST vect_t mulin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.286.2.30 div()

```
static INLINE CONST vect_t div (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.31 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.32 fmaddin()

```
static INLINE CONST vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.33 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.34 fnmaddin()

```
static INLINE CONST vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.35 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.36 fmsubin()

```
static INLINE CONST vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.37 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.38 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.39 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.40 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.41 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.42 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.43 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.44 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.286.2.45 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.286.2.46 floor()

```
static INLINE CONST vect_t floor (
            const vect_t a ) [inline], [static]
```

16.286.2.47 ceil()

```
static INLINE CONST vect_t ceil (
            const vect_t a ) [inline], [static]
```

16.286.2.48 round()

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static]
```

16.286.2.49 hadd()

```
static INLINE CONST vect_t hadd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.286.2.50 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.286.2.51 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T ) [inline], [static]
```

16.286.3 Field Documentation

16.286.3.1 vect_size

```
constexpr const size_t vect_size = 4 [static], [constexpr]
```

16.286.3.2 alignment

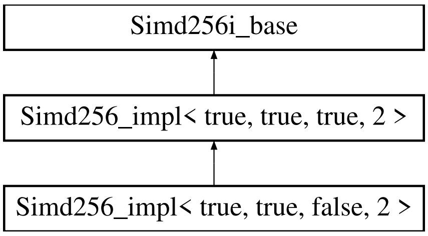
```
constexpr const size_t alignment = 32 [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd256_double.inl

16.287 Simd256_impl< true, true, false, 2 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, false, 2 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint16_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using simdHalf = Simd128< scalar_t >
- using vect_t = __m256i
- using half_t = __m128i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7, const scalar_t x8, const scalar_t x9, const scalar_t x10, const scalar_t x11, const scalar_t x12, const scalar_t x13, const scalar_t x14, const scalar_t x15)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)

- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint64_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7, vect_t &r8, vect_t &r9, vect_t &r10, vect_t &r11, vect_t &r12, vect_t &r13, vect_t &r14, vect_t &r15)
- template<uint16_t s, typename std::enable_if<(s &0x00ff)==(s >> 8)>::type * = nullptr>
  static INLINE vect_t blend (const vect_t a, const vect_t b)
- template<uint16_t s, typename std::enable_if<(s &0x00ff) !=(s >> 8)>::type * = nullptr>
  static INLINE vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()

Static Public Attributes

- static constexpr const size_t vect_size = 16
- static constexpr const size_t alignment = 32

16.287.1 Member Typedef Documentation

16.287.1.1 scalar_t

```
using scalar_t = uint16_t
```

16.287.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.287.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.287.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.287.1.5 simdHalf

```
using simdHalf = Simd128<scalar_t>
```

16.287.1.6 vect_t

```
using vect_t = __m256i  [inherited]
```

16.287.1.7 half_t

```
using half_t = __m128i  [inherited]
```

16.287.2 Member Function Documentation

16.287.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.287.2.2 set1()

```
static INLINE CONST vect_t set1 (
             const scalar_t x )  [inline], [static]
```

16.287.2.3 set()

```
static INLINE CONST vect_t set (
             const scalar_t x0,
             const scalar_t x1,
             const scalar_t x2,
             const scalar_t x3,
```

```
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7,
            const scalar_t x8,
            const scalar_t x9,
            const scalar_t x10,
            const scalar_t x11,
            const scalar_t x12,
            const scalar_t x13,
            const scalar_t x14,
            const scalar_t x15 )  [inline], [static]
```

16.287.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.287.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.287.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.287.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.287.2.8 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.287.2.9 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.287.2.10 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.287.2.11 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.287.2.12 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.287.2.13 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.14 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.15 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.16 mulx()

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.287.2.17 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.18 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.19 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.20 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.21 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.22 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.287.2.23 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.287.2.24 valid()

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr], [inherited]
```

16.287.2.25 compliant()

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr], [inherited]
```

16.287.2.26 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static], [inherited]
```

16.287.2.27 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static], [inherited]
```

16.287.2.28 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static], [inherited]
```

16.287.2.29 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.30 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.31 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.32 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.33 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.34 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.35 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.36 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.37 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7,
            vect_t & r8,
            vect_t & r9,
            vect_t & r10,
            vect_t & r11,
            vect_t & r12,
            vect_t & r13,
            vect_t & r14,
            vect_t & r15 )  [inline], [static], [inherited]
```

16.287.2.38 blend() [1/2]

```
static INLINE vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.39 blend() [2/2]

```
static INLINE vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.40 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.41 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.287.2.42 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.43 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.44 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.45 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.46 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.47 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.48 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.49 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.50 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.51 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.52 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.287.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static], [inherited]
```

16.287.2.54 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T ) [inline], [static], [inherited]
```

16.287.2.55 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static], [inherited]
```

16.287.3 Field Documentation

16.287.3.1 vect_size

```
constexpr const size_t vect_size = 16 [static], [constexpr], [inherited]
```

16.287.3.2 alignment

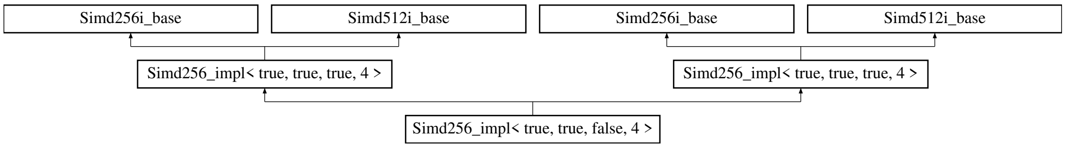
```
constexpr const size_t alignment = 32 [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd256_int16.inl

16.288 Simd256_impl< true, true, false, 4 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, false, 4 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint32_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using simdHalf = Simd128< scalar_t >
- using scalar_t = uint32_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using simdHalf = Simd128< scalar_t >
- using vect_t = __m256i
- using vect_t = __m512i
- using half_t = __m128i
- using half_t = __m256i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)

- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7, const scalar_t x8, const scalar_t x9, const scalar_t x10, const scalar_t x11, const scalar_t x12, const scalar_t x13, const scalar_t x14, const scalar_t x15)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle_twice (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle_twice (const vect_t a)

- template<uint32_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- template<uint64_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7, vect_t &r8, vect_t &r9, vect_t &r10, vect_t &r11, vect_t &r12, vect_t &r13, vect_t &r14, vect_t &r15)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- template<uint16_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)

- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 32

16.288.1 Member Typedef Documentation

16.288.1.1 scalar_t [1/2]

```
using scalar_t = uint32_t
```

16.288.1.2 aligned_allocator [1/2]

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.288.1.3 aligned_vector [1/2]

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.288.1.4 is_same_element [1/2]

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.288.1.5 simdHalf [1/2]

```
using simdHalf = Simd128<scalar_t>
```

16.288.1.6 scalar_t [2/2]

```
using scalar_t = uint32_t
```

16.288.1.7 aligned_allocator [2/2]

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.288.1.8 aligned_vector [2/2]

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.288.1.9 is_same_element [2/2]

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.288.1.10 simdHalf [2/2]

```
using simdHalf = Simd128<scalar_t>
```

16.288.1.11 vect_t [1/2]

```
using vect_t = __m256i  [inherited]
```

16.288.1.12 vect_t [2/2]

```
using vect_t = __m512i  [inherited]
```

16.288.1.13 half_t [1/2]

```
using half_t = __m128i  [inherited]
```

16.288.1.14 half_t [2/2]

```
using half_t = __m256i  [inherited]
```

16.288.2 Member Function Documentation

16.288.2.1 type_string() [1/2]

```
static const std::string type_string ( )  [inline], [static]
```

16.288.2.2 set1() [1/2]

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.288.2.3 set() [1/3]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.288.2.4 gather() [1/2]

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx ) [inline], [static]
```

16.288.2.5 load() [1/2]

```
static INLINE PURE vect_t load (
            const scalar_t *const p ) [inline], [static]
```

16.288.2.6 loadu() [1/2]

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.288.2.7 store() [1/2]

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.288.2.8 storeu() [1/2]

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.288.2.9 stream() [1/2]

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.288.2.10 sra() [1/2]

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.288.2.11 greater() [1/2]

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.288.2.12 lesser() [1/2]

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.288.2.13 greater_eq() [1/2]

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.14 lesser_eq() [1/2]

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.15 mulhi() [1/2]

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.16 mulx() [1/2]

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.288.2.17 fmaddx() [1/2]

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.18 fmaddxin() [1/2]

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.19 fnmaddx() [1/2]

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.20 fnmaddxin() [1/2]

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.21 fmsubx() [1/2]

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.22 fmsubxin() [1/2]

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.23 hadd_to_scal() [1/2]

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.288.2.24 type_string() [2/2]

```
static const std::string type_string ( )  [inline], [static]
```

16.288.2.25 set1() [2/2]

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.288.2.26 set() [2/3]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.288.2.27 gather() [2/2]

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.288.2.28 load() [2/2]

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.288.2.29 loadu() [2/2]

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.288.2.30 store() [2/2]

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.288.2.31 storeu() [2/2]

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.288.2.32 stream() [2/2]

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.288.2.33 sra() [2/2]

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.288.2.34 greater() [2/2]

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.288.2.35 lesser() [2/2]

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.288.2.36 greater_eq() [2/2]

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.37 lesser_eq() [2/2]

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.288.2.38 mulhi() [2/2]

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.39 mulx() [2/2]

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b )  [inline], [static]
```

16.288.2.40 fmaddx() [2/2]

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.41 fmaddxin() [2/2]

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.42 fnmaddx() [2/2]

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.43 fnmaddxin() [2/2]

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.44 fmsubx() [2/2]

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.45 fmsubxin() [2/2]

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.288.2.46 hadd_to_scal() [2/2]

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.288.2.47 valid() [1/2]

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr], [inherited]
```

16.288.2.48 valid() [2/2]

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr], [inherited]
```

16.288.2.49 compliant() [1/2]

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr], [inherited]
```

16.288.2.50 compliant() [2/2]

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr], [inherited]
```

16.288.2.51 set() [3/3]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7,
            const scalar_t x8,
            const scalar_t x9,
            const scalar_t x10,
            const scalar_t x11,
            const scalar_t x12,
            const scalar_t x13,
            const scalar_t x14,
            const scalar_t x15 ) [inline], [static], [inherited]
```

16.288.2.52 sll() [1/2]

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.53 sll() [2/2]

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.54 srl() [1/2]

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.55 srl() [2/2]

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.56 shuffle_twice() [1/2]

```
static INLINE CONST vect_t shuffle_twice (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.57 shuffle_twice() [2/2]

```
static INLINE CONST vect_t shuffle_twice (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.58 shuffle() [1/2]

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.59 shuffle() [2/2]

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static], [inherited]
```

16.288.2.60 unpacklo_intrinsic() [1/2]

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.61 unpacklo_intrinsic() [2/2]

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.62 unpackhi_intrinsic() [1/2]

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.63 unpackhi_intrinsic() [2/2]

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.64 unpacklo() [1/2]

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.65 unpacklo() [2/2]

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.66 unpackhi() [1/2]

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.67 unpackhi() [2/2]

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.68 unpacklohi() [1/2]

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.69 unpacklohi() [2/2]

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.70 pack_even() [1/2]

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.71 pack_even() [2/2]

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.72 pack_odd() [1/2]

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.73 pack_odd() [2/2]

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.74 pack() [1/2]

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.75 pack() [2/2]

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.288.2.76 transpose() [1/2]

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 ) [inline], [static], [inherited]
```

16.288.2.77 transpose() [2/2]

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7,
            vect_t & r8,
            vect_t & r9,
            vect_t & r10,
            vect_t & r11,
            vect_t & r12,
            vect_t & r13,
            vect_t & r14,
            vect_t & r15 )  [inline], [static], [inherited]
```

16.288.2.78 blend() [1/2]

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.79 blend() [2/2]

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.80 add() [1/2]

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.81 add() [2/2]

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.82 addin() [1/2]

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.83 addin() [2/2]

```
static INLINE vect_t addin (
            vect_t & a,
```

```
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.84 sub() [1/2]

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.85 sub() [2/2]

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.86 subin() [1/2]

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.87 subin() [2/2]

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.88 mullo() [1/2]

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.89 mullo() [2/2]

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.90 mul() [1/2]

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.91 mul() [2/2]

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.92 fmadd() [1/2]

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.93 fmadd() [2/2]

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.94 fmaddin() [1/2]

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.95 fmaddin() [2/2]

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.96 fnmadd() [1/2]

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.97 fnmadd() [2/2]

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.98 fnmaddin() [1/2]

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.99 fnmaddin() [2/2]

```
static INLINE vect_t fnmaddin (
            vect_t & c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.100 fmsub() [1/2]

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.101 fmsub() [2/2]

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.102 fmsubin() [1/2]

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.103 fmsubin() [2/2]

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.104 eq() [1/2]

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.105 eq() [2/2]

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.106 round() [1/2]

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static], [inherited]
```

16.288.2.107 round() [2/2]

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static], [inherited]
```

16.288.2.108 mod() [1/2]

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static], [inherited]
```

16.288.2.109 mod() [2/2]

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static], [inherited]
```

16.288.2.110 zero() [1/2]

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.288.2.111 zero() [2/2]

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.288.2.112 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.113 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.2.114 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
```

```
const vect_t b )  [inline], [static], [inherited]
```

16.288.2.115 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.288.3 Field Documentation

16.288.3.1 vect_size

```
static constexpr const size_t vect_size = 8  [static], [constexpr], [inherited]
```

16.288.3.2 alignment

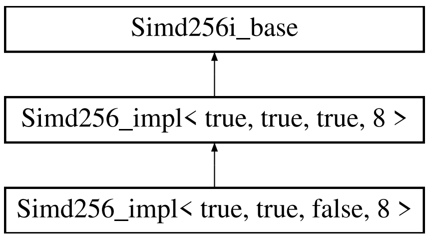
```
static constexpr const size_t alignment = 32  [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following files:

- simd256_int32.inl
- simd512_int32.inl

16.289 Simd256_impl< true, true, false, 8 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, false, 8 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint64_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template< class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using simdHalf = Simd128< scalar_t >
- using vect_t = __m256i
- using half_t = __m128i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mullo (vect_t a, vect_t b)
- static INLINE CONST vect_t mulhi (vect_t a, vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- template<int idx>
  static INLINE CONST scalar_t get (vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)

- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m256d &P, const __m256d &INVP, const __m256d &NEGP, const vect_t &POW50REM, const __m256d &MIN, const __m256d &MAX, __m256d &Q, __m256d &T)
- static INLINE CONST vect_t zero ()

Static Public Attributes

- static constexpr const size_t vect_size = 4
- static constexpr const size_t alignment = 32

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.289.1 Member Typedef Documentation

16.289.1.1 scalar_t

```
using scalar_t = uint64_t
```

16.289.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.289.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.289.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.289.1.5 simdHalf

```
using simdHalf = Simd128<scalar_t>
```

16.289.1.6 vect_t

```
using vect_t = __m256i  [inherited]
```

16.289.1.7 half_t

```
using half_t = __m128i [inherited]
```

16.289.2 Member Function Documentation

16.289.2.1 type_string()

```
static const std::string type_string ( ) [inline], [static]
```

16.289.2.2 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x ) [inline], [static]
```

16.289.2.3 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3 ) [inline], [static]
```

16.289.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx ) [inline], [static]
```

16.289.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p ) [inline], [static]
```

16.289.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.289.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.289.2.8 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.289.2.9 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.289.2.10 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.289.2.11 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.289.2.12 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.289.2.13 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.289.2.14 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.289.2.15 mullo()

```
static INLINE CONST vect_t mullo (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.289.2.16 mulhi()

```
static INLINE CONST vect_t mulhi (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.289.2.17 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.289.2.18 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.19 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.20 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.21 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.22 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.23 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.289.2.24 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.289.2.25 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr], [inherited]
```

16.289.2.26 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr], [inherited]
```

16.289.2.27 get()

```
static INLINE CONST scalar_t get (
            vect_t v )  [inline], [static], [inherited]
```

16.289.2.28 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static], [inherited]
```

16.289.2.29 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static], [inherited]
```

16.289.2.30 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static], [inherited]
```

16.289.2.31 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.32 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.33 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.34 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.35 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.36 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.37 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.38 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.39 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3 ) [inline], [static], [inherited]
```

16.289.2.40 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.41 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.42 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.43 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.44 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.45 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.46 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.47 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.48 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.49 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.289.2.50 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.51 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.52 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.289.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static], [inherited]
```

16.289.2.54 mask_high()

```
static INLINE CONST vect_t mask_high ( )  [inline], [static], [inherited]
```

16.289.2.55 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y )  [static], [inherited]
```

16.289.2.56 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m256d & P,
            const __m256d & INVP,
            const __m256d & NEGP,
            const vect_t & POW50REM,
            const __m256d & MIN,
            const __m256d & MAX,
            __m256d & Q,
            __m256d & T )  [static], [inherited]
```

16.289.2.57 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x )  [inline], [static], [protected], [inherited]
```

16.289.2.58 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.289.3 Field Documentation

16.289.3.1 vect_size

```
constexpr const size_t vect_size = 4  [static], [constexpr], [inherited]
```

16.289.3.2 alignment

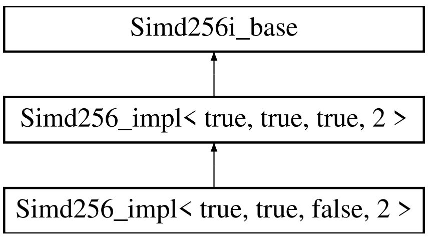
```
constexpr const size_t alignment = 32  [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd256_int64.inl

16.290 Simd256_impl< true, true, true, 2 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, true, 2 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m256i
- using half_t = __m128i
- using scalar_t = int16_t
- using simdHalf = Simd128< scalar_t >
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7, const scalar_t x8, const scalar_t x9, const scalar_t x10, const scalar_t x11, const scalar_t x12, const scalar_t x13, const scalar_t x14, const scalar_t x15)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint64_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7, vect_t &r8, vect_t &r9, vect_t &r10, vect_t &r11, vect_t &r12, vect_t &r13, vect_t &r14, vect_t &r15)
- template<uint16_t s, typename std::enable_if<(s &0x00ff)==(s >> 8)>::type ∗ = nullptr>
  static INLINE vect_t blend (const vect_t a, const vect_t b)
- template<uint16_t s, typename std::enable_if<(s &0x00ff) !=(s >> 8)>::type ∗ = nullptr>
  static INLINE vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)

- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()

Static Public Attributes

- static constexpr const size_t vect_size = 16
- static constexpr const size_t alignment = 32

16.290.1 Member Typedef Documentation

16.290.1.1 vect_t

```
using vect_t = __m256i
```

16.290.1.2 half_t

```
using half_t = __m128i
```

16.290.1.3 scalar_t

```
using scalar_t = int16_t
```

16.290.1.4 simdHalf

```
using simdHalf = Simd128<scalar_t>
```

16.290.1.5 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.290.1.6 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.290.1.7 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.290.2 Member Function Documentation

16.290.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.290.2.2 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr]
```

16.290.2.3 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr]
```

16.290.2.4 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.290.2.5 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7,
            const scalar_t x8,
            const scalar_t x9,
            const scalar_t x10,
            const scalar_t x11,
            const scalar_t x12,
            const scalar_t x13,
            const scalar_t x14,
            const scalar_t x15 )  [inline], [static]
```

16.290.2.6 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.290.2.7 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.290.2.8 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.290.2.9 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.290.2.10 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.290.2.11 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.290.2.12 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static]
```

16.290.2.13 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static]
```

16.290.2.14 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.290.2.15 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static]
```

16.290.2.16 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.17 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.18 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.19 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.20 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.21 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.22 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.23 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.24 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
```

```
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7,
            vect_t & r8,
            vect_t & r9,
            vect_t & r10,
            vect_t & r11,
            vect_t & r12,
            vect_t & r13,
            vect_t & r14,
            vect_t & r15 )  [inline], [static]
```

16.290.2.25 blend() [1/2]

```
static INLINE vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.26 blend() [2/2]

```
static INLINE vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.27 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.28 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.290.2.29 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.30 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.290.2.31 mullo()

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.32 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.33 mulhi()

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.34 mulx()

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.290.2.35 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.36 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.37 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.38 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.290.2.39 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.40 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.41 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.42 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.43 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.44 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.45 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.46 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.47 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.48 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.49 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.50 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.51 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.290.2.52 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.290.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.290.2.54 mod()

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
```

```
const vect_t & MAX,
vect_t & Q,
vect_t & T )  [inline], [static]
```

16.290.2.55 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.290.3 Field Documentation

16.290.3.1 vect_size

```
constexpr const size_t vect_size = 16  [static], [constexpr]
```

16.290.3.2 alignment

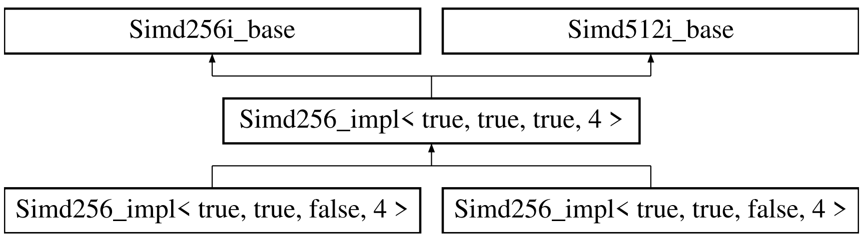
```
constexpr const size_t alignment = 32  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd256_int16.inl

16.291 Simd256_impl< true, true, true, 4 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, true, 4 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m256i
- using half_t = __m128i
- using scalar_t = int32_t
- using simdHalf = Simd128< scalar_t >
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using vect_t = __m512i
- using half_t = __m256i
- using scalar_t = int32_t
- using simdHalf = Simd256< scalar_t >
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>

- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T ∗p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle_twice (const vect_t a)
- template<uint32_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)

- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static const std::string type_string ()
- template< class T >
  static constexpr bool valid (T ∗p)
- template< class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7, const scalar_t x8, const scalar_t x9, const scalar_t x10, const scalar_t x11, const scalar_t x12, const scalar_t x13, const scalar_t x14, const scalar_t x15)
- template< class T >
  static INLINE PURE vect_t gather (const scalar_t ∗const p, const T ∗const idx)
- static INLINE PURE vect_t load (const scalar_t ∗const p)
- static INLINE PURE vect_t loadu (const scalar_t ∗const p)
- static INLINE void store (scalar_t ∗p, vect_t v)
- static INLINE void storeu (scalar_t ∗p, vect_t v)
- static INLINE void stream (scalar_t ∗p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle_twice (const vect_t a)
- template<uint64_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7, vect_t &r8, vect_t &r9, vect_t &r10, vect_t &r11, vect_t &r12, vect_t &r13, vect_t &r14, vect_t &r15)
- template<uint16_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)

- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulx (vect_t a, vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE vect_t mod (vect_t &C, const vect_t &P, const vect_t &INVP, const vect_t &NEGP, const vect_t &MIN, const vect_t &MAX, vect_t &Q, vect_t &T)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 32

16.291.1 Member Typedef Documentation

16.291.1.1 vect_t [1/2]

```
using vect_t = __m256i
```

16.291.1.2 half_t [1/2]

```
using half_t = __m128i
```

16.291.1.3 scalar_t [1/2]

```
using scalar_t = int32_t
```

16.291.1.4 simdHalf [1/2]

```
using simdHalf = Simd128<scalar_t>
```

16.291.1.5 aligned_allocator [1/2]

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.291.1.6 aligned_vector [1/2]

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.291.1.7 is_same_element [1/2]

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.291.1.8 vect_t [2/2]

```
using vect_t = __m512i
```

16.291.1.9 half_t [2/2]

```
using half_t = __m256i
```

16.291.1.10 scalar_t [2/2]

```
using scalar_t = int32_t
```

16.291.1.11 simdHalf [2/2]

```
using simdHalf = Simd256<scalar_t>
```

16.291.1.12 aligned_allocator [2/2]

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.291.1.13 aligned_vector [2/2]

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.291.1.14 is_same_element [2/2]

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.291.2 Member Function Documentation

16.291.2.1 type_string() [1/2]

```
static const std::string type_string ( )  [inline], [static]
```

16.291.2.2 valid() [1/2]

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr]
```

16.291.2.3 compliant() [1/2]

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr]
```

16.291.2.4 set1() [1/2]

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.291.2.5 set() [1/2]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.291.2.6 gather() [1/2]

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.291.2.7 load() [1/2]

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.291.2.8 loadu() [1/2]

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.291.2.9 store() [1/2]

```
static INLINE void store (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.291.2.10 storeu() [1/2]

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.291.2.11 stream() [1/2]

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.291.2.12 sll() [1/2]

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static]
```

16.291.2.13 srl() [1/2]

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static]
```

16.291.2.14 sra() [1/2]

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.291.2.15 shuffle_twice() [1/2]

```
static INLINE CONST vect_t shuffle_twice (
            const vect_t a ) [inline], [static]
```

16.291.2.16 shuffle() [1/2]

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static]
```

16.291.2.17 unpacklo_intrinsic() [1/2]

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.18 unpackhi_intrinsic() [1/2]

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.19 unpacklo() [1/2]

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.20 unpackhi() [1/2]

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.21 unpacklohi() [1/2]

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.22 pack_even() [1/2]

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.23 pack_odd() [1/2]

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.24 pack() [1/2]

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.25 transpose() [1/2]

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
```

```
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 )  [inline], [static]
```

16.291.2.26 blend() [1/2]

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.27 add() [1/2]

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.28 addin() [1/2]

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.291.2.29 sub() [1/2]

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.30 subin() [1/2]

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.291.2.31 mullo() [1/2]

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.32 mul() [1/2]

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.33 mulhi() [1/2]

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.34 mulx() [1/2]

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b )  [inline], [static]
```

16.291.2.35 fmadd() [1/2]

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.36 fmaddin() [1/2]

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.37 fmaddx() [1/2]

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.38 fmaddxin() [1/2]

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.39 fnmadd() [1/2]

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.40 fnmaddin() [1/2]

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.41 fnmaddx() [1/2]

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.42 fnmaddxin() [1/2]

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.43 fmsub() [1/2]

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.44 fmsubin() [1/2]

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.45 fmsubx() [1/2]

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.46 fmsubxin() [1/2]

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.47 eq() [1/2]

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.48 greater() [1/2]

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.49 lesser() [1/2]

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.50 greater_eq() [1/2]

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.51 lesser_eq() [1/2]

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.52 hadd_to_scal() [1/2]

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.291.2.53 round() [1/2]

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static]
```

16.291.2.54 mod() [1/2]

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T ) [inline], [static]
```

16.291.2.55 type_string() [2/2]

```
static const std::string type_string ( ) [inline], [static]
```

16.291.2.56 valid() [2/2]

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr]
```

16.291.2.57 compliant() [2/2]

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr]
```

16.291.2.58 set1() [2/2]

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.291.2.59 set() [2/2]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7,
            const scalar_t x8,
            const scalar_t x9,
            const scalar_t x10,
            const scalar_t x11,
            const scalar_t x12,
            const scalar_t x13,
            const scalar_t x14,
            const scalar_t x15 )  [inline], [static]
```

16.291.2.60 gather() [2/2]

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.291.2.61 load() [2/2]

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.291.2.62 loadu() [2/2]

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.291.2.63 store() [2/2]

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.291.2.64 storeu() [2/2]

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v ) [inline], [static]
```

16.291.2.65 stream() [2/2]

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.291.2.66 sll() [2/2]

```
static INLINE CONST vect_t sll (
            const vect_t a ) [inline], [static]
```

16.291.2.67 srl() [2/2]

```
static INLINE CONST vect_t srl (
            const vect_t a ) [inline], [static]
```

16.291.2.68 sra() [2/2]

```
static INLINE CONST vect_t sra (
            const vect_t a ) [inline], [static]
```

16.291.2.69 shuffle_twice() [2/2]

```
static INLINE CONST vect_t shuffle_twice (
            const vect_t a ) [inline], [static]
```

16.291.2.70 shuffle() [2/2]

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static]
```

16.291.2.71 unpacklo_intrinsic() [2/2]

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.72 unpackhi_intrinsic() [2/2]

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.73 unpacklo() [2/2]

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.74 unpackhi() [2/2]

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.75 unpacklohi() [2/2]

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.76 pack_even() [2/2]

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.77 pack_odd() [2/2]

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.78 pack() [2/2]

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.79 transpose() [2/2]

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7,
            vect_t & r8,
            vect_t & r9,
            vect_t & r10,
```

```
            vect_t & r11,
            vect_t & r12,
            vect_t & r13,
            vect_t & r14,
            vect_t & r15 )  [inline], [static]
```

16.291.2.80 blend() [2/2]

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.81 add() [2/2]

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.82 addin() [2/2]

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.291.2.83 sub() [2/2]

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.84 subin() [2/2]

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.291.2.85 mullo() [2/2]

```
static INLINE CONST vect_t mullo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.86 mul() [2/2]

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.87 mulhi() [2/2]

```
static INLINE CONST vect_t mulhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.88 mulx() [2/2]

```
static INLINE CONST vect_t mulx (
            vect_t a,
            vect_t b )  [inline], [static]
```

16.291.2.89 fmadd() [2/2]

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.90 fmaddin() [2/2]

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.91 fmaddx() [2/2]

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.92 fmaddxin() [2/2]

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.93 fnmadd() [2/2]

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.94 fnmaddin() [2/2]

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.95 fnmaddx() [2/2]

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.96 fnmaddxin() [2/2]

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.97 fmsub() [2/2]

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.98 fmsubin() [2/2]

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.99 fmsubx() [2/2]

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.100 fmsubxin() [2/2]

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.101 eq() [2/2]

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.291.2.102 greater() [2/2]

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.103 lesser() [2/2]

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.104 greater_eq() [2/2]

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.105 lesser_eq() [2/2]

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.291.2.106 hadd_to_scal() [2/2]

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.291.2.107 round() [2/2]

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.291.2.108 mod() [2/2]

```
static INLINE vect_t mod (
            vect_t & C,
            const vect_t & P,
            const vect_t & INVP,
            const vect_t & NEGP,
            const vect_t & MIN,
            const vect_t & MAX,
            vect_t & Q,
            vect_t & T )  [inline], [static]
```

16.291.2.109 zero() [1/2]

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.291.2.110 zero() [2/2]

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.291.2.111 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.291.2.112 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.291.2.113 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.291.2.114 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.291.3 Field Documentation

16.291.3.1 vect_size

```
static constexpr const size_t vect_size = 8  [static], [constexpr]
```

16.291.3.2 alignment

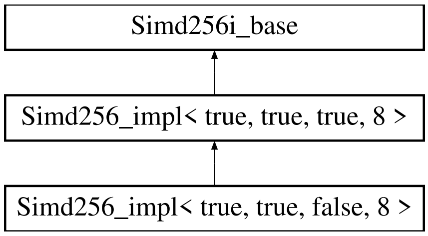
```
static constexpr const size_t alignment = 32  [static], [constexpr]
```

The documentation for this struct was generated from the following files:

- simd256_int32.inl
- simd512_int32.inl

16.292 Simd256_impl< true, true, true, 8 > Struct Reference

Inheritance diagram for Simd256_impl< true, true, true, 8 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m256i
- using half_t = __m128i
- using scalar_t = int64_t
- using simdHalf = Simd128< scalar_t >
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- template<int idx>
  static INLINE CONST scalar_t get (vect_t v)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)

- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (vect_t a, vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (vect_t a, vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m256d &P, const __m256d &INVP, const __m256d &NEGP, const vect_t &POW50REM, const __m256d &MIN, const __m256d &MAX, __m256d &Q, __m256d &T)
- static INLINE CONST vect_t zero ()

Static Public Attributes

- static constexpr const size_t vect_size = 4
- static constexpr const size_t alignment = 32

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.292.1 Member Typedef Documentation

16.292.1.1 vect_t

```
using vect_t = __m256i
```

16.292.1.2 half_t

```
using half_t = __m128i
```

16.292.1.3 scalar_t

```
using scalar_t = int64_t
```

16.292.1.4 simdHalf

```
using simdHalf = Simd128<scalar_t>
```

16.292.1.5 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.292.1.6 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.292.1.7 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.292.2 Member Function Documentation

16.292.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.292.2.2 valid()

```
static constexpr bool valid (
             T * p )  [inline], [static], [constexpr]
```

16.292.2.3 compliant()

```
static constexpr bool compliant (
             T n )  [inline], [static], [constexpr]
```

16.292.2.4 set1()

```
static INLINE CONST vect_t set1 (
             const scalar_t x )  [inline], [static]
```

16.292.2.5 set()

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3 )  [inline], [static]
```

16.292.2.6 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.292.2.7 get()

```
static INLINE CONST scalar_t get (
            vect_t v )  [inline], [static]
```

16.292.2.8 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.292.2.9 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.292.2.10 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.292.2.11 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.292.2.12 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.292.2.13 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static]
```

16.292.2.14 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static]
```

16.292.2.15 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.292.2.16 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static]
```

16.292.2.17 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.18 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.19 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.20 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.21 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.22 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.23 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.24 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.25 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3 )  [inline], [static]
```

16.292.2.26 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.27 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.28 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.292.2.29 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.30 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.292.2.31 mullo()

```
static INLINE CONST vect_t mullo (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.292.2.32 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.33 mulhi()

```
static INLINE CONST vect_t mulhi (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.292.2.34 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.35 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.36 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.37 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.38 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.39 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.40 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.41 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.42 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.43 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.44 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.45 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.292.2.46 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.47 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.48 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.49 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.50 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.51 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.292.2.52 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.292.2.53 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.292.2.54 mask_high()

```
static INLINE CONST vect_t mask_high ( )  [inline], [static]
```

16.292.2.55 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y )  [static]
```

16.292.2.56 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m256d & P,
            const __m256d & INVP,
            const __m256d & NEGP,
            const vect_t & POW50REM,
            const __m256d & MIN,
            const __m256d & MAX,
            __m256d & Q,
            __m256d & T )  [static]
```

16.292.2.57 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x )  [inline], [static], [protected]
```

16.292.2.58 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static], [inherited]
```

16.292.3 Field Documentation

16.292.3.1 vect_size

```
constexpr const size_t vect_size = 4  [static], [constexpr]
```

16.292.3.2 alignment

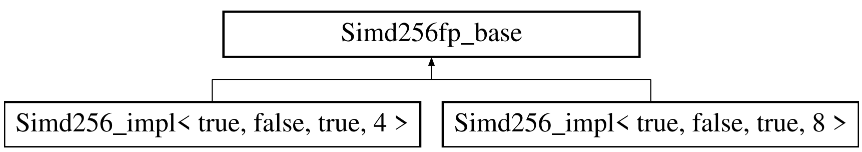
```
constexpr const size_t alignment = 32  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd256_int64.inl

16.293 Simd256fp_base Struct Reference

Inheritance diagram for Simd256fp_base:

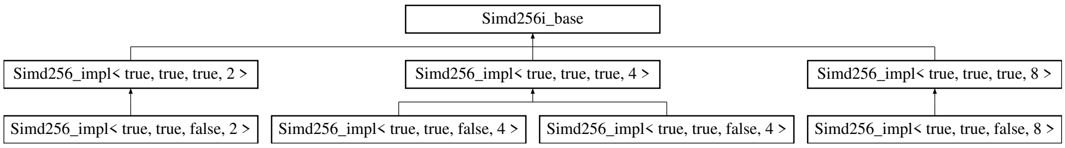


The documentation for this struct was generated from the following file:

- simd256.inl

16.294 Simd256i_base Struct Reference

Inheritance diagram for Simd256i_base:



Public Types

- using vect_t = __m256i

Static Public Member Functions

- static INLINE CONST vect_t zero ()

16.294.1 Member Typedef Documentation

16.294.1.1 vect_t

```
using vect_t = __m256i
```

16.294.2 Member Function Documentation

16.294.2.1 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static]
```

The documentation for this struct was generated from the following file:

- simd256.inl

16.295 Simd512_impl$<$ ArithType, Int, Signed, Size $>$ Struct Template Reference

The documentation for this struct was generated from the following file:

- simd512.inl

16.296 Simd512_impl$<$ true, false, true, 4 $>$ Struct Reference

The documentation for this struct was generated from the following file:

- simd512_float.inl

16.297 Simd512_impl$<$ true, false, true, 8 $>$ Struct Reference

Public Types

- using vect_t = __m512d
- using scalar_t = double
- using aligned_allocator = AlignedAllocator$<$ scalar_t, Alignment(alignment)$>$

- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7, const scalar_t x8)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (const scalar_t *p, const vect_t v)
- static INLINE void storeu (const scalar_t *p, const vect_t v)
- static INLINE void stream (const scalar_t *p, const vect_t v)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t blendv (const vect_t a, const vect_t b, const vect_t mask)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE CONST vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t div (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)

- static INLINE CONST vect_t floor (const vect_t a)
- static INLINE CONST vect_t ceil (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t hadd (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 64

16.297.1 Member Typedef Documentation

16.297.1.1 vect_t

```
using vect_t = __m512d
```

16.297.1.2 scalar_t

```
using scalar_t = double
```

16.297.1.3 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.297.1.4 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.297.1.5 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.297.2 Member Function Documentation

16.297.2.1 type_string()

```
static const std::string type_string ( ) [inline], [static]
```

16.297.2.2 valid()

```
static constexpr bool valid (
            T * p ) [inline], [static], [constexpr]
```

16.297.2.3 compliant()

```
static constexpr bool compliant (
            T n ) [inline], [static], [constexpr]
```

16.297.2.4 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static]
```

16.297.2.5 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x ) [inline], [static]
```

16.297.2.6 set()

```
static INLINE CONST vect_t set (
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7,
            const scalar_t x8 ) [inline], [static]
```

16.297.2.7 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx ) [inline], [static]
```

16.297.2.8 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p ) [inline], [static]
```

16.297.2.9 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p ) [inline], [static]
```

16.297.2.10 store()

```
static INLINE void store (
            const scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.297.2.11 storeu()

```
static INLINE void storeu (
            const scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.297.2.12 stream()

```
static INLINE void stream (
            const scalar_t * p,
            const vect_t v ) [inline], [static]
```

16.297.2.13 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a ) [inline], [static]
```

16.297.2.14 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.15 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.16 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.17 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.18 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.19 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.20 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.21 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.22 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 )  [inline], [static]
```

16.297.2.23 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.24 blendv()

```
static INLINE CONST vect_t blendv (
            const vect_t a,
            const vect_t b,
            const vect_t mask )  [inline], [static]
```

16.297.2.25 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.26 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.297.2.27 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.28 subin()

```
static INLINE CONST vect_t subin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.297.2.29 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.30 mulin()

```
static INLINE CONST vect_t mulin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.297.2.31 div()

```
static INLINE CONST vect_t div (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.32 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.33 fmaddin()

```
static INLINE CONST vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.34 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.297.2.35 fnmaddin()

```
static INLINE CONST vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.36 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.37 fmsubin()

```
static INLINE CONST vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.38 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.39 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.40 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.41 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.42 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.43 floor()

```
static INLINE CONST vect_t floor (
            const vect_t a ) [inline], [static]
```

16.297.2.44 ceil()

```
static INLINE CONST vect_t ceil (
            const vect_t a ) [inline], [static]
```

16.297.2.45 round()

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static]
```

16.297.2.46 hadd()

```
static INLINE CONST vect_t hadd (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.297.2.47 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a ) [inline], [static]
```

16.297.3 Field Documentation

16.297.3.1 vect_size

```
constexpr const size_t vect_size = 8 [static], [constexpr]
```

16.297.3.2 alignment

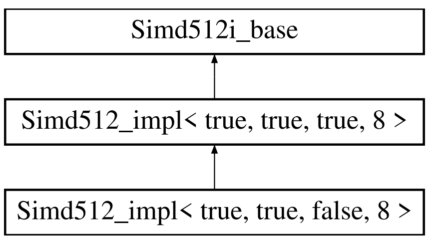
```
constexpr const size_t alignment = 64 [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd512_double.inl

16.298 Simd512_impl< true, true, false, 8 > Struct Reference

Inheritance diagram for Simd512_impl< true, true, false, 8 >:



Data Structures

- union Converter

Public Types

- using scalar_t = uint64_t
- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >
- using simdHalf = Simd256< scalar_t >
- using vect_t = __m512i
- using half_t = __m256i

Static Public Member Functions

- static const std::string type_string ()
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- template<uint8_t k>
  static INLINE void maskstore (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- static INLINE CONST vect_t greater (vect_t a, vect_t b)
- static INLINE CONST vect_t lesser (vect_t a, vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mullo (vect_t a, vect_t b)
- static INLINE CONST vect_t mulhi (vect_t a, vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)

- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m512d &P, const __m512d &INVP, const __m512d &NEGP, const vect_t &POW50REM, const __m512d &MIN, const __m512d &MAX, __m512d &Q, __m512d &T)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 64

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.298.1 Member Typedef Documentation

16.298.1.1 scalar_t

```
using scalar_t = uint64_t
```

16.298.1.2 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.298.1.3 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.298.1.4 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.298.1.5 simdHalf

```
using simdHalf = Simd256<scalar_t>
```

16.298.1.6 vect_t

```
using vect_t = __m512i  [inherited]
```

16.298.1.7 half_t

```
using half_t = __m256i  [inherited]
```

16.298.2 Member Function Documentation

16.298.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.298.2.2 set1()

```
static INLINE CONST vect_t set1 (
            const scalar_t x )  [inline], [static]
```

16.298.2.3 set() [1/2]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3,
            const scalar_t x4,
            const scalar_t x5,
            const scalar_t x6,
            const scalar_t x7 )  [inline], [static]
```

16.298.2.4 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.298.2.5 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.298.2.6 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.298.2.7 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.298.2.8 maskstore()

```
static INLINE void maskstore (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.298.2.9 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.298.2.10 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.298.2.11 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.298.2.12 greater()

```
static INLINE CONST vect_t greater (
            vect_t a,
            vect_t b )  [inline], [static]
```

16.298.2.13 lesser()

```
static INLINE CONST vect_t lesser (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.298.2.14 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.298.2.15 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.298.2.16 mullo()

```
static INLINE CONST vect_t mullo (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.298.2.17 mulhi()

```
static INLINE CONST vect_t mulhi (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.298.2.18 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.298.2.19 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.298.2.20 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.298.2.21 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.298.2.22 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.298.2.23 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.298.2.24 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.298.2.25 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.298.2.26 valid()

```
static constexpr bool valid (
            T * p )  [inline], [static], [constexpr], [inherited]
```

16.298.2.27 compliant()

```
static constexpr bool compliant (
            T n )  [inline], [static], [constexpr], [inherited]
```

16.298.2.28 set() [2/2]

```
static INLINE CONST vect_t set (
            const scalar_t x0,
            const scalar_t x1,
            const scalar_t x2,
            const scalar_t x3 )  [inline], [static], [inherited]
```

16.298.2.29 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static], [inherited]
```

16.298.2.30 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static], [inherited]
```

16.298.2.31 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static], [inherited]
```

16.298.2.32 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.33 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.34 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.35 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.36 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.37 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.38 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.39 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.40 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 )  [inline], [static], [inherited]
```

16.298.2.41 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.42 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.43 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.44 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static], [inherited]
```

16.298.2.45 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.46 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.47 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.48 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.49 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.50 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.51 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.52 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.53 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.54 round()

```
static INLINE CONST vect_t round (
            const vect_t a ) [inline], [static], [inherited]
```

16.298.2.55 mask_high()

```
static INLINE CONST vect_t mask_high ( ) [inline], [static], [inherited]
```

16.298.2.56 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y ) [static], [inherited]
```

16.298.2.57 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m512d & P,
            const __m512d & INVP,
            const __m512d & NEGP,
            const vect_t & POW50REM,
            const __m512d & MIN,
            const __m512d & MAX,
            __m512d & Q,
            __m512d & T ) [static], [inherited]
```

16.298.2.58 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x ) [inline], [static], [protected], [inherited]
```

16.298.2.59 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static], [inherited]
```

16.298.2.60 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.61 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.62 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.2.63 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.298.3 Field Documentation

16.298.3.1 vect_size

```
constexpr const size_t vect_size = 8 [static], [constexpr], [inherited]
```

16.298.3.2 alignment

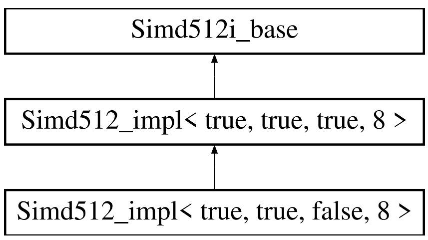
```
constexpr const size_t alignment = 64 [static], [constexpr], [inherited]
```

The documentation for this struct was generated from the following file:

- simd512_int64.inl

16.299 Simd512_impl< true, true, true, 8 > Struct Reference

Inheritance diagram for Simd512_impl< true, true, true, 8 >:



Data Structures

- union Converter

Public Types

- using vect_t = __m512i
- using half_t = __m256i
- using scalar_t = int64_t
- using simdHalf = Simd256< scalar_t >

- using aligned_allocator = AlignedAllocator< scalar_t, Alignment(alignment)>
- using aligned_vector = std::vector< scalar_t, aligned_allocator >
- template<class Field >
  using is_same_element = std::is_same< typename Field::Element, scalar_t >

Static Public Member Functions

- static const std::string type_string ()
- template<class T >
  static constexpr bool valid (T *p)
- template<class T >
  static constexpr bool compliant (T n)
- static INLINE CONST vect_t set1 (const scalar_t x)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3, const scalar_t x4, const scalar_t x5, const scalar_t x6, const scalar_t x7)
- static INLINE CONST vect_t set (const scalar_t x0, const scalar_t x1, const scalar_t x2, const scalar_t x3)
- template<class T >
  static INLINE PURE vect_t gather (const scalar_t *const p, const T *const idx)
- static INLINE PURE vect_t load (const scalar_t *const p)
- static INLINE PURE vect_t loadu (const scalar_t *const p)
- static INLINE void store (scalar_t *p, vect_t v)
- template<uint8_t k>
  static INLINE void maskstore (scalar_t *p, vect_t v)
- static INLINE void storeu (scalar_t *p, vect_t v)
- static INLINE void stream (scalar_t *p, const vect_t v)
- template<int s>
  static INLINE CONST vect_t sll (const vect_t a)
- template<int s>
  static INLINE CONST vect_t srl (const vect_t a)
- template<int s>
  static INLINE CONST vect_t sra (const vect_t a)
- template<uint8_t s>
  static INLINE CONST vect_t shuffle (const vect_t a)
- static INLINE CONST vect_t unpacklo_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi_intrinsic (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpacklo (const vect_t a, const vect_t b)
- static INLINE CONST vect_t unpackhi (const vect_t a, const vect_t b)
- static INLINE void unpacklohi (vect_t &lo, vect_t &hi, const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_even (const vect_t a, const vect_t b)
- static INLINE CONST vect_t pack_odd (const vect_t a, const vect_t b)
- static INLINE void pack (vect_t &even, vect_t &odd, const vect_t a, const vect_t b)
- static INLINE void transpose (vect_t &r0, vect_t &r1, vect_t &r2, vect_t &r3, vect_t &r4, vect_t &r5, vect_t &r6, vect_t &r7)
- template<uint8_t s>
  static INLINE CONST vect_t blend (const vect_t a, const vect_t b)
- static INLINE CONST vect_t add (const vect_t a, const vect_t b)
- static INLINE vect_t addin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t sub (const vect_t a, const vect_t b)
- static INLINE vect_t subin (vect_t &a, const vect_t b)
- static INLINE CONST vect_t mullo (vect_t a, vect_t b)
- static INLINE CONST vect_t mul (const vect_t a, const vect_t b)
- static INLINE CONST vect_t mulhi (vect_t a, vect_t b)
- static INLINE CONST vect_t mulx (const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmaddx (const vect_t c, const vect_t a, const vect_t b)

- static INLINE vect_t fmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmadd (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fnmaddx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fnmaddxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsub (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t fmsubx (const vect_t c, const vect_t a, const vect_t b)
- static INLINE vect_t fmsubxin (vect_t &c, const vect_t a, const vect_t b)
- static INLINE CONST vect_t eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser (const vect_t a, const vect_t b)
- static INLINE CONST vect_t greater_eq (const vect_t a, const vect_t b)
- static INLINE CONST vect_t lesser_eq (const vect_t a, const vect_t b)
- static INLINE CONST scalar_t hadd_to_scal (const vect_t a)
- static INLINE CONST vect_t round (const vect_t a)
- static INLINE CONST vect_t mask_high ()
- static INLINE CONST vect_t mulhi_fast (vect_t x, vect_t y)
- static INLINE vect_t mod (vect_t &C, const __m512d &P, const __m512d &INVP, const __m512d &NEGP, const vect_t &POW50REM, const __m512d &MIN, const __m512d &MAX, __m512d &Q, __m512d &T)
- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

Static Public Attributes

- static constexpr const size_t vect_size = 8
- static constexpr const size_t alignment = 64

Static Protected Member Functions

- static INLINE CONST vect_t signbits (const vect_t x)

16.299.1 Member Typedef Documentation

16.299.1.1 vect_t

```
using vect_t = __m512i
```

16.299.1.2 half_t

```
using half_t = __m256i
```

16.299.1.3 scalar_t

```
using scalar_t = int64_t
```

16.299.1.4 simdHalf

```
using simdHalf = Simd256<scalar_t>
```

16.299.1.5 aligned_allocator

```
using aligned_allocator = AlignedAllocator<scalar_t, Alignment(alignment)>
```

16.299.1.6 aligned_vector

```
using aligned_vector = std::vector<scalar_t, aligned_allocator>
```

16.299.1.7 is_same_element

```
using is_same_element = std::is_same<typename Field::Element, scalar_t>
```

16.299.2 Member Function Documentation

16.299.2.1 type_string()

```
static const std::string type_string ( )  [inline], [static]
```

16.299.2.2 valid()

```
static constexpr bool valid (
             T * p )  [inline], [static], [constexpr]
```

16.299.2.3 compliant()

```
static constexpr bool compliant (
             T n )  [inline], [static], [constexpr]
```

16.299.2.4 set1()

```
static INLINE CONST vect_t set1 (
             const scalar_t x )  [inline], [static]
```

16.299.2.5 set() [1/2]

```
static INLINE CONST vect_t set (
             const scalar_t x0,
             const scalar_t x1,
             const scalar_t x2,
             const scalar_t x3,
             const scalar_t x4,
             const scalar_t x5,
             const scalar_t x6,
             const scalar_t x7 )  [inline], [static]
```

16.299.2.6 set() [2/2]

```
static INLINE CONST vect_t set (
             const scalar_t x0,
             const scalar_t x1,
```

```
            const scalar_t x2,
            const scalar_t x3 )  [inline], [static]
```

16.299.2.7 gather()

```
static INLINE PURE vect_t gather (
            const scalar_t *const p,
            const T *const idx )  [inline], [static]
```

16.299.2.8 load()

```
static INLINE PURE vect_t load (
            const scalar_t *const p )  [inline], [static]
```

16.299.2.9 loadu()

```
static INLINE PURE vect_t loadu (
            const scalar_t *const p )  [inline], [static]
```

16.299.2.10 store()

```
static INLINE void store (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.299.2.11 maskstore()

```
static INLINE void maskstore (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.299.2.12 storeu()

```
static INLINE void storeu (
            scalar_t * p,
            vect_t v )  [inline], [static]
```

16.299.2.13 stream()

```
static INLINE void stream (
            scalar_t * p,
            const vect_t v )  [inline], [static]
```

16.299.2.14 sll()

```
static INLINE CONST vect_t sll (
            const vect_t a )  [inline], [static]
```

16.299.2.15 srl()

```
static INLINE CONST vect_t srl (
            const vect_t a )  [inline], [static]
```

16.299.2.16 sra()

```
static INLINE CONST vect_t sra (
            const vect_t a )  [inline], [static]
```

16.299.2.17 shuffle()

```
static INLINE CONST vect_t shuffle (
            const vect_t a )  [inline], [static]
```

16.299.2.18 unpacklo_intrinsic()

```
static INLINE CONST vect_t unpacklo_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.19 unpackhi_intrinsic()

```
static INLINE CONST vect_t unpackhi_intrinsic (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.20 unpacklo()

```
static INLINE CONST vect_t unpacklo (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.21 unpackhi()

```
static INLINE CONST vect_t unpackhi (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.22 unpacklohi()

```
static INLINE void unpacklohi (
            vect_t & lo,
            vect_t & hi,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.23 pack_even()

```
static INLINE CONST vect_t pack_even (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.24 pack_odd()

```
static INLINE CONST vect_t pack_odd (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.25 pack()

```
static INLINE void pack (
            vect_t & even,
            vect_t & odd,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.26 transpose()

```
static INLINE void transpose (
            vect_t & r0,
            vect_t & r1,
            vect_t & r2,
            vect_t & r3,
            vect_t & r4,
            vect_t & r5,
            vect_t & r6,
            vect_t & r7 )  [inline], [static]
```

16.299.2.27 blend()

```
static INLINE CONST vect_t blend (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.28 add()

```
static INLINE CONST vect_t add (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.29 addin()

```
static INLINE vect_t addin (
            vect_t & a,
            const vect_t b )  [inline], [static]
```

16.299.2.30 sub()

```
static INLINE CONST vect_t sub (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.31 subin()

```
static INLINE vect_t subin (
            vect_t & a,
            const vect_t b ) [inline], [static]
```

16.299.2.32 mullo()

```
static INLINE CONST vect_t mullo (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.299.2.33 mul()

```
static INLINE CONST vect_t mul (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.299.2.34 mulhi()

```
static INLINE CONST vect_t mulhi (
            vect_t a,
            vect_t b ) [inline], [static]
```

16.299.2.35 mulx()

```
static INLINE CONST vect_t mulx (
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.299.2.36 fmadd()

```
static INLINE CONST vect_t fmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.299.2.37 fmaddin()

```
static INLINE vect_t fmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.299.2.38 fmaddx()

```
static INLINE CONST vect_t fmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b ) [inline], [static]
```

16.299.2.39 fmaddxin()

```
static INLINE vect_t fmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.40 fnmadd()

```
static INLINE CONST vect_t fnmadd (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.41 fnmaddin()

```
static INLINE vect_t fnmaddin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.42 fnmaddx()

```
static INLINE CONST vect_t fnmaddx (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.43 fnmaddxin()

```
static INLINE vect_t fnmaddxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.44 fmsub()

```
static INLINE CONST vect_t fmsub (
            const vect_t c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.45 fmsubin()

```
static INLINE vect_t fmsubin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.46 fmsubx()

```
static INLINE CONST vect_t fmsubx (
            const vect_t c,
```

```
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.47 fmsubxin()

```
static INLINE vect_t fmsubxin (
            vect_t & c,
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.48 eq()

```
static INLINE CONST vect_t eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.49 greater()

```
static INLINE CONST vect_t greater (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.50 lesser()

```
static INLINE CONST vect_t lesser (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.51 greater_eq()

```
static INLINE CONST vect_t greater_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.52 lesser_eq()

```
static INLINE CONST vect_t lesser_eq (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.299.2.53 hadd_to_scal()

```
static INLINE CONST scalar_t hadd_to_scal (
            const vect_t a )  [inline], [static]
```

16.299.2.54 round()

```
static INLINE CONST vect_t round (
            const vect_t a )  [inline], [static]
```

16.299.2.55 mask_high()

```
static INLINE CONST vect_t mask_high ( ) [inline], [static]
```

16.299.2.56 mulhi_fast()

```
INLINE CONST vect_t mulhi_fast (
            vect_t x,
            vect_t y ) [static]
```

16.299.2.57 mod()

```
INLINE vect_t mod (
            vect_t & C,
            const __m512d & P,
            const __m512d & INVP,
            const __m512d & NEGP,
            const vect_t & POW50REM,
            const __m512d & MIN,
            const __m512d & MAX,
            __m512d & Q,
            __m512d & T ) [static]
```

16.299.2.58 signbits()

```
static INLINE CONST vect_t signbits (
            const vect_t x ) [inline], [static], [protected]
```

16.299.2.59 zero()

```
static INLINE CONST vect_t zero ( ) [inline], [static], [inherited]
```

16.299.2.60 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.299.2.61 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.299.2.62 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.299.2.63 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b ) [inline], [static], [inherited]
```

16.299.3 Field Documentation

16.299.3.1 vect_size

```
constexpr const size_t vect_size = 8 [static], [constexpr]
```

16.299.3.2 alignment

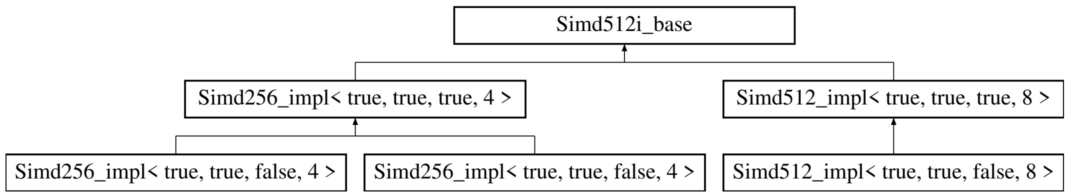
```
constexpr const size_t alignment = 64 [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- simd512_int64.inl

16.300 Simd512i_base Struct Reference

Inheritance diagram for Simd512i_base:



Public Types

- using vect_t = __m512i

Static Public Member Functions

- static INLINE CONST vect_t zero ()
- static INLINE CONST vect_t vor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vxor (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vand (const vect_t a, const vect_t b)
- static INLINE CONST vect_t vandnot (const vect_t a, const vect_t b)

16.300.1 Member Typedef Documentation

16.300.1.1 vect_t

```
using vect_t = __m512i
```

16.300.2 Member Function Documentation

16.300.2.1 zero()

```
static INLINE CONST vect_t zero ( )  [inline], [static]
```

16.300.2.2 vor()

```
static INLINE CONST vect_t vor (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.300.2.3 vxor()

```
static INLINE CONST vect_t vxor (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.300.2.4 vand()

```
static INLINE CONST vect_t vand (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

16.300.2.5 vandnot()

```
static INLINE CONST vect_t vandnot (
            const vect_t a,
            const vect_t b )  [inline], [static]
```

The documentation for this struct was generated from the following file:

- simd512.inl

16.301 SimdChooser< T, bool, bool > Struct Template Reference

```
#include <fflas_simd.h>
```

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.302 SimdChooser< T, false, b > Struct Template Reference

```
#include <fflas_simd.h>
```

Public Types

- using value = NoSimd< T >

16.302.1 Member Typedef Documentation

16.302.1.1 value

```
using value = NoSimd<T>
```

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.303 SimdChooser< T, true, false > Struct Template Reference

```
#include <fflas_simd.h>
```

Public Types

- using value = NoSimd< T >

16.303.1 Member Typedef Documentation

16.303.1.1 value

```
using value = NoSimd<T>
```

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.304 SimdChooser< T, true, true > Struct Template Reference

```
#include <fflas_simd.h>
```

Public Types

- using value = NoSimd< T >

16.304.1 Member Typedef Documentation

16.304.1.1 value

```
using value = NoSimd<T>
```

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.305 simdToType< T > Struct Template Reference

The documentation for this struct was generated from the following file:

- fflas_simd.h

16.306 Single Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.307 Sparse< Field, SparseMatrix_t, IdxT, PtrT > Struct Template Reference

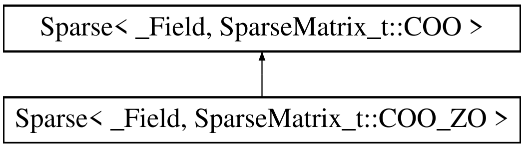
The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.308 Sparse< _Field, SparseMatrix_t::COO > Struct Template Reference

`#include <coo.h>`

Inheritance diagram for Sparse< _Field, SparseMatrix_t::COO >:



Public Types

- using Field = _Field

Data Fields

- index_t ∗ col = nullptr
- index_t ∗ row = nullptr
- _Field::Element_ptr dat
- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0

16.308.1 Member Typedef Documentation

16.308.1.1 Field

```
using Field = _Field
```

16.308.2 Field Documentation

16.308.2.1 col

```
index_t* col = nullptr
```

16.308.2.2 row

```
index_t* row = nullptr
```

16.308.2.3 dat

```
_Field::Element_ptr dat
```

16.308.2.4 delayed

```
bool delayed = false
```

16.308.2.5 kmax

```
uint64_t kmax = 0
```

16.308.2.6 m

```
index_t m = 0
```

16.308.2.7 n

```
index_t n = 0
```

16.308.2.8 nnz

```
uint64_t nnz = 0
```

16.308.2.9 nElements

```
uint64_t nElements = 0
```

16.308.2.10 maxrow

```
uint64_t maxrow = 0
```

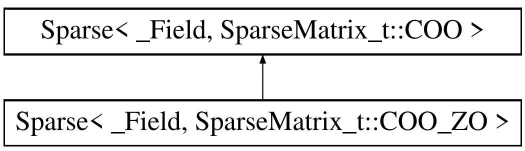
The documentation for this struct was generated from the following file:

- coo.h

16.309 Sparse< _Field, SparseMatrix_t::COO_ZO > Struct Template Reference

```
#include <coo.h>
```

Inheritance diagram for Sparse< _Field, SparseMatrix_t::COO_ZO >:



Public Types

- using Field = _Field

Data Fields

- _Field::Element cst = 1
- index_t ∗ col = nullptr
- index_t ∗ row = nullptr

- _Field::Element_ptr dat
- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0

16.309.1 Member Typedef Documentation

16.309.1.1 Field

```
using Field = _Field
```

16.309.2 Field Documentation

16.309.2.1 cst

```
_Field::Element cst = 1
```

16.309.2.2 col

```
index_t* col = nullptr [inherited]
```

16.309.2.3 row

```
index_t* row = nullptr [inherited]
```

16.309.2.4 dat

```
_Field::Element_ptr dat [inherited]
```

16.309.2.5 delayed

```
bool delayed = false [inherited]
```

16.309.2.6 kmax

```
uint64_t kmax = 0 [inherited]
```

16.309.2.7 m

```
index_t m = 0 [inherited]
```

16.309.2.8 n

```
index_t n = 0 [inherited]
```

16.309.2.9 nnz

`uint64_t nnz = 0 [inherited]`

16.309.2.10 nElements

`uint64_t nElements = 0 [inherited]`

16.309.2.11 maxrow

`uint64_t maxrow = 0 [inherited]`

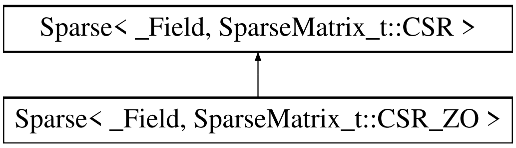
The documentation for this struct was generated from the following file:

- coo.h

16.310 Sparse< _Field, SparseMatrix_t::CSR > Struct Template Reference

`#include <csr.h>`

Inheritance diagram for Sparse< _Field, SparseMatrix_t::CSR >:



Public Types

- using Field = _Field

Data Fields

- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- index_t ∗ col = nullptr
- index_t ∗ st = nullptr
- index_t ∗ stend = nullptr
- _Field::Element_ptr dat

16.310.1 Member Typedef Documentation

16.310.1.1 Field

`using Field = _Field`

16.310.2 Field Documentation

16.310.2.1 delayed

`bool delayed = false`

16.310.2.2 kmax

`uint64_t kmax = 0`

16.310.2.3 m

`index_t m = 0`

16.310.2.4 n

`index_t n = 0`

16.310.2.5 nnz

`uint64_t nnz = 0`

16.310.2.6 nElements

`uint64_t nElements = 0`

16.310.2.7 maxrow

`uint64_t maxrow = 0`

16.310.2.8 col

`index_t* col = nullptr`

16.310.2.9 st

`index_t* st = nullptr`

16.310.2.10 stend

`index_t* stend = nullptr`

16.310.2.11 dat

`_Field::Element_ptr dat`

The documentation for this struct was generated from the following file:

- csr.h

16.311 Sparse< _Field, SparseMatrix_t::CSR_HYB > Struct Template Reference

```
#include <csr_hyb.h>
```

Public Types

- using Field = _Field

Data Fields

- bool delayed = false
- index_t ∗ col = nullptr
- index_t ∗ st = nullptr
- _Field::Element_ptr dat
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- uint64_t nOnes = 0
- uint64_t nMOnes = 0
- uint64_t nOthers = 0

16.311.1 Member Typedef Documentation

16.311.1.1 Field

```
using Field = _Field
```

16.311.2 Field Documentation

16.311.2.1 delayed

```
bool delayed = false
```

16.311.2.2 col

```
index_t* col = nullptr
```

16.311.2.3 st

```
index_t* st = nullptr
```

16.311.2.4 dat

```
_Field::Element_ptr dat
```

16.311.2.5 kmax

```
uint64_t kmax = 0
```

16.311.2.6 m

```
index_t m = 0
```

16.311.2.7 n

```
index_t n = 0
```

16.311.2.8 nnz

```
uint64_t nnz = 0
```

16.311.2.9 nElements

```
uint64_t nElements = 0
```

16.311.2.10 maxrow

```
uint64_t maxrow = 0
```

16.311.2.11 nOnes

```
uint64_t nOnes = 0
```

16.311.2.12 nMOnes

```
uint64_t nMOnes = 0
```

16.311.2.13 nOthers

```
uint64_t nOthers = 0
```

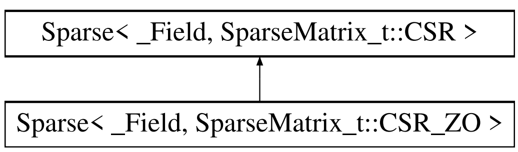
The documentation for this struct was generated from the following file:

- csr_hyb.h

16.312 Sparse< _Field, SparseMatrix_t::CSR_ZO > Struct Template Reference

```
#include <csr.h>
```

Inheritance diagram for Sparse< _Field, SparseMatrix_t::CSR_ZO >:



Public Types

- using Field = _Field

Data Fields

- int64_t cst = 1
- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- index_t * col = nullptr
- index_t * st = nullptr
- index_t * stend = nullptr
- _Field::Element_ptr dat

16.312.1 Member Typedef Documentation

16.312.1.1 Field

```
using Field = _Field
```

16.312.2 Field Documentation

16.312.2.1 cst

```
int64_t cst = 1
```

16.312.2.2 delayed

```
bool delayed = false
```

16.312.2.3 kmax

```
uint64_t kmax = 0 [inherited]
```

16.312.2.4 m

```
index_t m = 0 [inherited]
```

16.312.2.5 n

```
index_t n = 0 [inherited]
```

16.312.2.6 nnz

```
uint64_t nnz = 0 [inherited]
```

16.312.2.7 nElements

`uint64_t nElements = 0 [inherited]`

16.312.2.8 maxrow

`uint64_t maxrow = 0 [inherited]`

16.312.2.9 col

`index_t* col = nullptr [inherited]`

16.312.2.10 st

`index_t* st = nullptr [inherited]`

16.312.2.11 stend

`index_t* stend = nullptr [inherited]`

16.312.2.12 dat

`_Field::Element_ptr dat [inherited]`

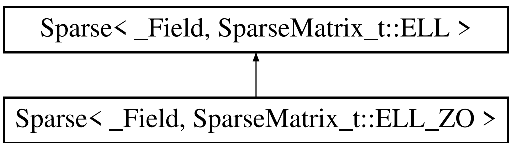
The documentation for this struct was generated from the following file:

- csr.h

16.313 Sparse< _Field, SparseMatrix_t::ELL > Struct Template Reference

`#include <ell.h>`

Inheritance diagram for Sparse< _Field, SparseMatrix_t::ELL >:



Public Types

- using Field = _Field

Data Fields

- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- index_t ld = 0
- uint64_t nnz = 0
- uint64_t nElements = 0

- uint64_t maxrow = 0
- index_t * col = nullptr
- _Field::Element_ptr dat

16.313.1 Member Typedef Documentation

16.313.1.1 Field

```
using Field = _Field
```

16.313.2 Field Documentation

16.313.2.1 delayed

```
bool delayed = false
```

16.313.2.2 kmax

```
uint64_t kmax = 0
```

16.313.2.3 m

```
index_t m = 0
```

16.313.2.4 n

```
index_t n = 0
```

16.313.2.5 ld

```
index_t ld = 0
```

16.313.2.6 nnz

```
uint64_t nnz = 0
```

16.313.2.7 nElements

```
uint64_t nElements = 0
```

16.313.2.8 maxrow

```
uint64_t maxrow = 0
```

16.313.2.9 col

```
index_t* col = nullptr
```

16.313.2.10 dat

`_Field::Element_ptr dat`

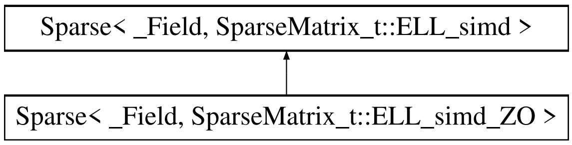
The documentation for this struct was generated from the following file:

- ell.h

16.314 Sparse< _Field, SparseMatrix_t::ELL_simd > Struct Template Reference

`#include <ell_simd.h>`

Inheritance diagram for Sparse< _Field, SparseMatrix_t::ELL_simd >:



Data Fields

- bool delayed = false
- int chunk = 0
- index_t m = 0
- index_t n = 0
- index_t ld = 0
- uint64_t kmax = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- uint64_t nChunks = 0
- index_t ∗ col = nullptr
- _Field::Element_ptr dat

16.314.1 Field Documentation

16.314.1.1 delayed

`bool delayed = false`

16.314.1.2 chunk

`int chunk = 0`

16.314.1.3 m

`index_t m = 0`

16.314.1.4 n

`index_t n = 0`

16.314.1.5 ld

`index_t ld = 0`

16.314.1.6 kmax

`uint64_t kmax = 0`

16.314.1.7 nnz

`uint64_t nnz = 0`

16.314.1.8 nElements

`uint64_t nElements = 0`

16.314.1.9 maxrow

`uint64_t maxrow = 0`

16.314.1.10 nChunks

`uint64_t nChunks = 0`

16.314.1.11 col

`index_t* col = nullptr`

16.314.1.12 dat

`_Field::Element_ptr dat`

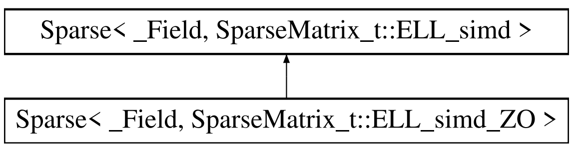
The documentation for this struct was generated from the following file:

- ell_simd.h

16.315 Sparse< _Field, SparseMatrix_t::ELL_simd_ZO > Struct Template Reference

`#include <ell_simd.h>`

Inheritance diagram for Sparse< _Field, SparseMatrix_t::ELL_simd_ZO >:



Data Fields

- _Field::Element cst = 1
- bool delayed = false
- int chunk = 0
- index_t m = 0
- index_t n = 0
- index_t ld = 0
- uint64_t kmax = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- uint64_t nChunks = 0
- index_t * col = nullptr
- _Field::Element_ptr dat

16.315.1 Field Documentation

16.315.1.1 cst

```
_Field::Element cst = 1
```

16.315.1.2 delayed

```
bool delayed = false  [inherited]
```

16.315.1.3 chunk

```
int chunk = 0  [inherited]
```

16.315.1.4 m

```
index_t m = 0  [inherited]
```

16.315.1.5 n

```
index_t n = 0  [inherited]
```

16.315.1.6 ld

```
index_t ld = 0  [inherited]
```

16.315.1.7 kmax

```
uint64_t kmax = 0  [inherited]
```

16.315.1.8 nnz

```
uint64_t nnz = 0  [inherited]
```

16.315.1.9 nElements

`uint64_t nElements = 0 [inherited]`

16.315.1.10 maxrow

`uint64_t maxrow = 0 [inherited]`

16.315.1.11 nChunks

`uint64_t nChunks = 0 [inherited]`

16.315.1.12 col

`index_t* col = nullptr [inherited]`

16.315.1.13 dat

`_Field::Element_ptr dat [inherited]`

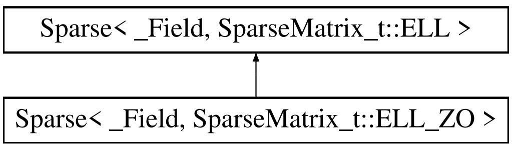
The documentation for this struct was generated from the following file:

- ell_simd.h

16.316 Sparse< _Field, SparseMatrix_t::ELL_ZO > Struct Template Reference

#include <ell.h>

Inheritance diagram for Sparse< _Field, SparseMatrix_t::ELL_ZO >:



Public Types

- using Field = _Field

Data Fields

- _Field::Element cst = 1
- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- index_t ld = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- uint64_t maxrow = 0
- index_t * col = nullptr
- _Field::Element_ptr dat

16.316.1 Member Typedef Documentation

16.316.1.1 Field

```
using Field = _Field
```

16.316.2 Field Documentation

16.316.2.1 cst

```
_Field::Element cst = 1
```

16.316.2.2 delayed

```
bool delayed = false  [inherited]
```

16.316.2.3 kmax

```
uint64_t kmax = 0  [inherited]
```

16.316.2.4 m

```
index_t m = 0  [inherited]
```

16.316.2.5 n

```
index_t n = 0  [inherited]
```

16.316.2.6 ld

```
index_t ld = 0  [inherited]
```

16.316.2.7 nnz

```
uint64_t nnz = 0  [inherited]
```

16.316.2.8 nElements

```
uint64_t nElements = 0  [inherited]
```

16.316.2.9 maxrow

```
uint64_t maxrow = 0  [inherited]
```

16.316.2.10 col

```
index_t* col = nullptr  [inherited]
```

16.316.2.11 dat

`_Field::Element_ptr dat [inherited]`

The documentation for this struct was generated from the following file:

- ell.h

16.317 Sparse< _Field, SparseMatrix_t::HYB_ZO > Struct Template Reference

`#include <hyb_zo.h>`

Public Types

- using Field = _Field
- typedef Sparse< _Field, SparseMatrix_t::HYB_ZO > Self_t

Data Fields

- bool delayed = false
- uint64_t kmax = 0
- index_t m = 0
- index_t n = 0
- uint64_t nnz = 0
- uint64_t maxrow = 0
- uint64_t nElements = 0
- Sparse< _Field, SparseMatrix_t::CSR > ∗ dat = nullptr
- Sparse< _Field, SparseMatrix_t::CSR_ZO > ∗ one = nullptr
- Sparse< _Field, SparseMatrix_t::CSR_ZO > ∗ mone = nullptr

16.317.1 Member Typedef Documentation

16.317.1.1 Field

`using Field = _Field`

16.317.1.2 Self_t

`typedef Sparse<_Field, SparseMatrix_t::HYB_ZO> Self_t`

16.317.2 Field Documentation

16.317.2.1 delayed

`bool delayed = false`

16.317.2.2 kmax

`uint64_t kmax = 0`

16.317.2.3 m

```
index_t m = 0
```

16.317.2.4 n

```
index_t n = 0
```

16.317.2.5 nnz

```
uint64_t nnz = 0
```

16.317.2.6 maxrow

```
uint64_t maxrow = 0
```

16.317.2.7 nElements

```
uint64_t nElements = 0
```

16.317.2.8 dat

```
Sparse<_Field, SparseMatrix_t::CSR>* dat = nullptr
```

16.317.2.9 one

```
Sparse<_Field, SparseMatrix_t::CSR_ZO>* one = nullptr
```

16.317.2.10 mone

```
Sparse<_Field, SparseMatrix_t::CSR_ZO>* mone = nullptr
```

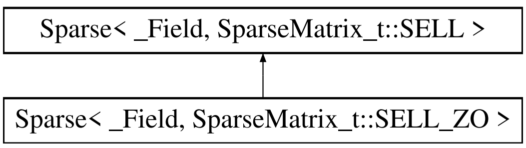
The documentation for this struct was generated from the following file:

- hyb_zo.h

16.318 Sparse< _Field, SparseMatrix_t::SELL > Struct Template Reference

```
#include <sell.h>
```

Inheritance diagram for Sparse< _Field, SparseMatrix_t::SELL >:



Public Types

- using Field = _Field

Data Fields

- bool delayed = false
- int chunk = 0
- index_t kmax = 0
- index_t m = 0
- index_t n = 0
- index_t maxrow = 0
- index_t sigma = 0
- index_t nChunks = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- index_t * perm = nullptr
- uint64_t * st = nullptr
- index_t * chunkSize = nullptr
- index_t * col = nullptr
- _Field::Element_ptr dat

16.318.1 Member Typedef Documentation

16.318.1.1 Field

```
using Field = _Field
```

16.318.2 Field Documentation

16.318.2.1 delayed

```
bool delayed = false
```

16.318.2.2 chunk

```
int chunk = 0
```

16.318.2.3 kmax

```
index_t kmax = 0
```

16.318.2.4 m

```
index_t m = 0
```

16.318.2.5 n

```
index_t n = 0
```

16.318.2.6 maxrow

```
index_t maxrow = 0
```

16.318.2.7 sigma

```
index_t sigma = 0
```

16.318.2.8 nChunks

```
index_t nChunks = 0
```

16.318.2.9 nnz

```
uint64_t nnz = 0
```

16.318.2.10 nElements

```
uint64_t nElements = 0
```

16.318.2.11 perm

```
index_t* perm = nullptr
```

16.318.2.12 st

```
uint64_t* st = nullptr
```

16.318.2.13 chunkSize

```
index_t* chunkSize = nullptr
```

16.318.2.14 col

```
index_t* col = nullptr
```

16.318.2.15 dat

```
_Field::Element_ptr dat
```

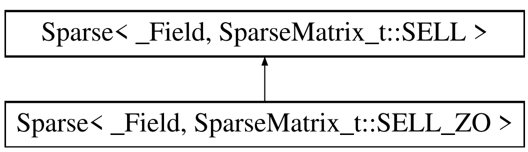
The documentation for this struct was generated from the following file:

- sell.h

16.319 Sparse< _Field, SparseMatrix_t::SELL_ZO > Struct Template Reference

```
#include <sell.h>
```

Inheritance diagram for Sparse< _Field, SparseMatrix_t::SELL_ZO >:



Public Types

- using Field = _Field

Data Fields

- _Field::Element cst = 1
- bool delayed = false
- int chunk = 0
- index_t kmax = 0
- index_t m = 0
- index_t n = 0
- index_t maxrow = 0
- index_t sigma = 0
- index_t nChunks = 0
- uint64_t nnz = 0
- uint64_t nElements = 0
- index_t ∗ perm = nullptr
- uint64_t ∗ st = nullptr
- index_t ∗ chunkSize = nullptr
- index_t ∗ col = nullptr
- _Field::Element_ptr dat

16.319.1 Member Typedef Documentation

16.319.1.1 Field

```
using Field = _Field
```

16.319.2 Field Documentation

16.319.2.1 cst

```
_Field::Element cst = 1
```

16.319.2.2 delayed

```
bool delayed = false [inherited]
```

16.319.2.3 chunk

```
int chunk = 0 [inherited]
```

16.319.2.4 kmax

```
index_t kmax = 0 [inherited]
```

16.319.2.5 m

```
index_t m = 0 [inherited]
```

16.319.2.6 n

```
index_t n = 0 [inherited]
```

16.319.2.7 maxrow

```
index_t maxrow = 0 [inherited]
```

16.319.2.8 sigma

```
index_t sigma = 0 [inherited]
```

16.319.2.9 nChunks

```
index_t nChunks = 0 [inherited]
```

16.319.2.10 nnz

```
uint64_t nnz = 0 [inherited]
```

16.319.2.11 nElements

```
uint64_t nElements = 0 [inherited]
```

16.319.2.12 perm

```
index_t* perm = nullptr [inherited]
```

16.319.2.13 st

```
uint64_t* st = nullptr [inherited]
```

16.319.2.14 chunkSize

```
index_t* chunkSize = nullptr [inherited]
```

16.319.2.15 col

```
index_t* col = nullptr [inherited]
```

16.319.2.16 dat

```
_Field::Element_ptr dat [inherited]
```

The documentation for this struct was generated from the following file:

- sell.h

16.320 SpMat< Field, flag > Struct Template Reference

```
#include <fflas_sparse.h>
```

Data Fields

- FFLAS::CooMat< Field > * _coo = nullptr
- FFLAS::CsrMat< Field > * _csr = nullptr
- FFLAS::EllMat< Field > * _ell = nullptr

16.320.1 Field Documentation

16.320.1.1 _coo

```
FFLAS::CooMat<Field>* _coo = nullptr
```

16.320.1.2 _csr

```
FFLAS::CsrMat<Field>* _csr = nullptr
```

16.320.1.3 _ell

```
FFLAS::EllMat<Field>* _ell = nullptr
```

The documentation for this struct was generated from the following file:

- fflas_sparse.h

16.321 StatsMatrix Struct Reference

```
#include <utils.h>
```

Data Fields

- uint64_t rowdim = 0
- uint64_t coldim = 0
- uint64_t nOnes = 0
- uint64_t nMOnes = 0
- uint64_t nOthers = 0
- uint64_t nnz = 0
- uint64_t maxRow = 0
- uint64_t minRow = 0
- uint64_t averageRow = 0
- uint64_t deviationRow = 0
- uint64_t maxCol = 0
- uint64_t minCol = 0
- uint64_t averageCol = 0
- uint64_t deviationCol = 0
- uint64_t minColDifference = 0
- uint64_t maxColDifference = 0
- uint64_t averageColDifference = 0
- uint64_t deviationColDifference = 0
- uint64_t minRowDifference = 0
- uint64_t maxRowDifference = 0
- uint64_t averageRowDifference = 0
- uint64_t deviationRowDifference = 0
- uint64_t nDenseRows = 0
- uint64_t nDenseCols = 0

- uint64_t nEmptyRows = 0
- uint64_t nEmptyCols = 0
- uint64_t nEmptyColsEnd = 0
- std::vector< uint64_t > denseRows
- std::vector< uint64_t > denseCols

16.321.1 Field Documentation

16.321.1.1 rowdim

```
uint64_t rowdim = 0
```

16.321.1.2 coldim

```
uint64_t coldim = 0
```

16.321.1.3 nOnes

```
uint64_t nOnes = 0
```

16.321.1.4 nMOnes

```
uint64_t nMOnes = 0
```

16.321.1.5 nOthers

```
uint64_t nOthers = 0
```

16.321.1.6 nnz

```
uint64_t nnz = 0
```

16.321.1.7 maxRow

```
uint64_t maxRow = 0
```

16.321.1.8 minRow

```
uint64_t minRow = 0
```

16.321.1.9 averageRow

```
uint64_t averageRow = 0
```

16.321.1.10 deviationRow

```
uint64_t deviationRow = 0
```

16.321.1.11 maxCol

```
uint64_t maxCol = 0
```

16.321.1.12 minCol

```
uint64_t minCol = 0
```

16.321.1.13 averageCol

```
uint64_t averageCol = 0
```

16.321.1.14 deviationCol

```
uint64_t deviationCol = 0
```

16.321.1.15 minColDifference

```
uint64_t minColDifference = 0
```

16.321.1.16 maxColDifference

```
uint64_t maxColDifference = 0
```

16.321.1.17 averageColDifference

```
uint64_t averageColDifference = 0
```

16.321.1.18 deviationColDifference

```
uint64_t deviationColDifference = 0
```

16.321.1.19 minRowDifference

```
uint64_t minRowDifference = 0
```

16.321.1.20 maxRowDifference

```
uint64_t maxRowDifference = 0
```

16.321.1.21 averageRowDifference

```
uint64_t averageRowDifference = 0
```

16.321.1.22 deviationRowDifference

```
uint64_t deviationRowDifference = 0
```

16.321.1.23 nDenseRows

```
uint64_t nDenseRows = 0
```

16.321.1.24 nDenseCols

```
uint64_t nDenseCols = 0
```

16.321.1.25 nEmptyRows

```
uint64_t nEmptyRows = 0
```

16.321.1.26 nEmptyCols

```
uint64_t nEmptyCols = 0
```

16.321.1.27 nEmptyColsEnd

```
uint64_t nEmptyColsEnd = 0
```

16.321.1.28 denseRows

```
std::vector<uint64_t> denseRows
```

16.321.1.29 denseCols

```
std::vector<uint64_t> denseCols
```

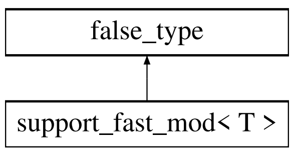
The documentation for this struct was generated from the following file:

- utils.h

16.322 support_fast_mod< T > Struct Template Reference

```
#include <fflas_freduce.h>
```

Inheritance diagram for support_fast_mod< T >:



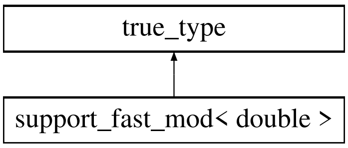
The documentation for this struct was generated from the following file:

- fflas_freduce.h

16.323 support_fast_mod< double > Struct Reference

```
#include <fflas_freduce.h>
```

Inheritance diagram for support_fast_mod< double >:

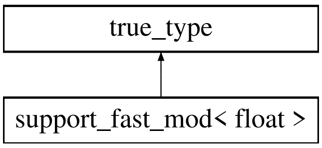


The documentation for this struct was generated from the following file:

- fflas_freduce.h

16.324 support_fast_mod< float > Struct Reference

`#include <fflas_freduce.h>`
Inheritance diagram for support_fast_mod< float >:

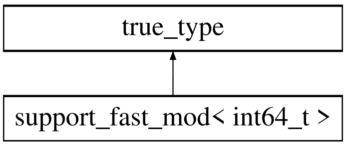


The documentation for this struct was generated from the following file:

- fflas_freduce.h

16.325 support_fast_mod< int64_t > Struct Reference

`#include <fflas_freduce.h>`
Inheritance diagram for support_fast_mod< int64_t >:

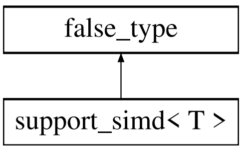


The documentation for this struct was generated from the following file:

- fflas_freduce.h

16.326 support_simd< T > Struct Template Reference

#include <fflas_simd.h>
Inheritance diagram for support_simd< T >:

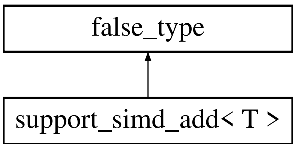


The documentation for this struct was generated from the following file:

- fflas_simd.h

16.327 support_simd_add< T > Struct Template Reference

#include <fflas_fadd.h>
Inheritance diagram for support_simd_add< T >:

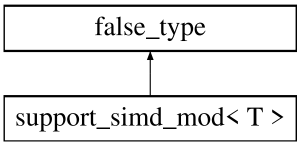


The documentation for this struct was generated from the following file:

- fflas_fadd.h

16.328 support_simd_mod< T > Struct Template Reference

#include <fflas_freduce.h>
Inheritance diagram for support_simd_mod< T >:



The documentation for this struct was generated from the following file:

- fflas_freduce.h

16.329 Test< Elt > Class Template Reference

Public Types

- using Field = Modular< Elt >
- using Elt_ptr = typename Field::Element_ptr
- using Residu = typename Field::Residu_t
- template<bool B, class T = void>
  using enable_if_t = typename std::enable_if< B, T >::type
- template<typename Simd >
  using is_same_element = typename Simd::template is_same_element< Field >
- template<typename E >
  using enable_if_no_simd_t = enable_if_t< Simd< E >::vect_size==1 >
- template<typename E >
  using enable_if_simd128_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==16 >
- template<typename E >
  using enable_if_simd256_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==32 >
- template<typename E >
  using enable_if_simd512_t = enable_if_t< sizeof(E) *Simd< E >::vect_size==64 >

Public Member Functions

- Test (size_t mm, size_t nn)
- template<typename Simd = NoSimd<Elt>, enable_if_t< is_same_element< Simd >::value > * = nullptr>
  bool test_ftranspose (size_t m, size_t n, Elt_ptr A, size_t lda, Elt_ptr B, size_t ldb)

- template<typename Simd = NoSimd<Elt>, enable_if_t< is_same_element< Simd >::value > * = nullptr>
  bool doTests ()
- template<typename _E = Elt, enable_if_t< is_same< _E, Elt >::value > * = nullptr, enable_if_no_simd_t< _E > * = nullptr>
  bool run ()

Static Public Member Functions

- template<typename _E = Elt, enable_if_t<!is_same< _E, Givaro::Integer >::value > * = nullptr>
  static Residu cardinality ()
- template<typename _E = Elt, enable_if_t< is_same< _E, Givaro::Integer >::value > * = nullptr>
  static Residu cardinality ()

Protected Attributes

- Field F
- size_t _mm
- size_t _nn

16.329.1 Member Typedef Documentation

16.329.1.1 Field

```
using Field = Modular<Elt>
```

16.329.1.2 Elt_ptr

```
using Elt_ptr = typename Field::Element_ptr
```

16.329.1.3 Residu

```
using Residu = typename Field::Residu_t
```

16.329.1.4 enable_if_t

```
using enable_if_t = typename std::enable_if<B, T>::type
```

16.329.1.5 is_same_element

```
using is_same_element = typename Simd::template is_same_element<Field>
```

16.329.1.6 enable_if_no_simd_t

```
using enable_if_no_simd_t = enable_if_t<Simd<E>::vect_size == 1>
```

16.329.1.7 enable_if_simd128_t

```
using enable_if_simd128_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 16>
```

16.329.1.8 enable_if_simd256_t

```
using enable_if_simd256_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 32>
```

16.329.1.9 enable_if_simd512_t

```
using enable_if_simd512_t = enable_if_t<sizeof(E)*Simd<E>::vect_size == 64>
```

16.329.2 Constructor & Destructor Documentation

16.329.2.1 Test()

```
Test (
            size_t mm,
            size_t nn )  [inline]
```

16.329.3 Member Function Documentation

16.329.3.1 cardinality() [1/2]

```
static Residu cardinality ( )  [inline], [static]
```

16.329.3.2 cardinality() [2/2]

```
static Residu cardinality ( )  [inline], [static]
```

16.329.3.3 test_ftranspose()

```
bool test_ftranspose (
            size_t m,
            size_t n,
            Elt_ptr A,
            size_t lda,
            Elt_ptr B,
            size_t ldb )  [inline]
```

16.329.3.4 doTests()

```
bool doTests ( )  [inline]
```

16.329.3.5 run()

```
bool run ( )  [inline]
```

16.329.4 Field Documentation

16.329.4.1 F

`Field F [protected]`

16.329.4.2 _mm

`size_t _mm [protected]`

16.329.4.3 _nn

`size_t _nn [protected]`

The documentation for this class was generated from the following file:

- test-storage-transpose.C

16.330 TestOneMethod< Simd > Class Template Reference

Public Types

- using Element = typename Simd::scalar_t
- using vect_t = typename Simd::vect_t
- using vectElt = vector< Element >
- template<bool B, typename T = void>
  using enable_if_t = typename enable_if< B, T >::type

Public Member Functions

- template<typename... AScal, typename RScal , typename... ASimd, typename RSimd , enable_if_t< sizeof...(AScal)==sizeof...(↩ ASimd)> * = nullptr, enable_if_t< count_nonconst_lvalue_reference< AScal... >::n==count_nonconst_lvalue_reference< ASimd... >::n > * = nullptr, enable_if_t< is_all_same< AScal... >::value > * = nullptr, enable_if_t< is_all_same< vect_t, ASimd... >::value > * = nullptr>
  TestOneMethod (function< RSimd(ASimd...)> fsimd, function< RScal(AScal...)> fscal, function< void(vector< vectElt > &)> genInputs, string fname)
- template<typename Ret , typename... AScal>
  enable_if_t< is_all_same< Element, AScal... >::value &&std::is_convertible< Ret, Element >::value, void > evaluate_scalar_method (function< Ret(AScal...)> fscal)
- template<typename... AScal>
  enable_if_t< is_all_same< vectElt, AScal... >::value, void > evaluate_scalar_method (function< vectElt(AScal...)> fscal)
- template<typename... AScal>
  enable_if_t< is_all_same< vectElt, AScal... >::value, void > evaluate_scalar_method (function< void(AScal...)> fscal)
- template<typename Ret , typename... ASimd>
  enable_if_t< is_all_same< vect_t, ASimd... >::value &&std::is_convertible< Ret, vect_t >::value, void > evaluate_simd_method (function< Ret(ASimd...)> fsimd, array< vect_t, sizeof...(ASimd)> &simd_in)
- template<typename... ASimd>
  enable_if_t< is_all_same< vect_t, ASimd... >::value, void > evaluate_simd_method (function< void(ASimd...)> fsimd, array< vect_t, sizeof...(ASimd)> &simd_in)
- bool getStatus () const
- string getTestName () const
- bool writeResultLine () const
- void writeDebugData () const

Static Public Attributes

- constexpr static size_t vect_size = Simd::vect_size

Protected Attributes

- size_t nb_lref
- string name
- vector< vectElt > inputs
- vector< vectElt > outputs_simd
- vector< vectElt > outputs_scalar

16.330.1 Member Typedef Documentation

16.330.1.1 Element

```
using Element = typename Simd::scalar_t
```

16.330.1.2 vect_t

```
using vect_t = typename Simd::vect_t
```

16.330.1.3 vectElt

```
using vectElt = vector<Element>
```

16.330.1.4 enable_if_t

```
using enable_if_t = typename enable_if<B, T>::type
```

16.330.2 Constructor & Destructor Documentation

16.330.2.1 TestOneMethod()

```
TestOneMethod (
            function< RSimd(ASimd...)> fsimd,
            function< RScal(AScal...)> fscal,
            function< void(vector< vectElt > &)> genInputs,
            string fname )  [inline]
```

16.330.3 Member Function Documentation

16.330.3.1 evaluate_scalar_method() [1/3]

```
enable_if_t<is_all_same<Element, AScal...>::value && std::is_convertible<Ret, Element>↩
::value, void> evaluate_scalar_method (
            function< Ret(AScal...)> fscal )  [inline]
```

16.330.3.2 evaluate_scalar_method() [2/3]

```
enable_if_t<is_all_same<vectElt, AScal...>::value, void> evaluate_scalar_method (
            function< vectElt(AScal...)> fscal )  [inline]
```

16.330.3.3 evaluate_scalar_method() [3/3]

```
enable_if_t<is_all_same<vectElt, AScal...>::value, void> evaluate_scalar_method (
            function< void(AScal...)> fscal )  [inline]
```

16.330.3.4 evaluate_simd_method() [1/2]

```
enable_if_t<is_all_same<vect_t, ASimd...>::value && std::is_convertible<Ret, vect_t>::value,
void> evaluate_simd_method (
            function< Ret(ASimd...)> fsimd,
            array< vect_t, sizeof...(ASimd)> & simd_in )  [inline]
```

16.330.3.5 evaluate_simd_method() [2/2]

```
enable_if_t<is_all_same<vect_t, ASimd...>::value, void> evaluate_simd_method (
            function< void(ASimd...)> fsimd,
            array< vect_t, sizeof...(ASimd)> & simd_in )  [inline]
```

16.330.3.6 getStatus()

```
bool getStatus ( ) const  [inline]
```

16.330.3.7 getTestName()

```
string getTestName ( ) const  [inline]
```

16.330.3.8 writeResultLine()

```
bool writeResultLine ( ) const  [inline]
```

16.330.3.9 writeDebugData()

```
void writeDebugData ( ) const  [inline]
```

16.330.4 Field Documentation

16.330.4.1 vect_size

```
constexpr static size_t vect_size = Simd::vect_size  [static], [constexpr]
```

16.330.4.2 nb_lref

```
size_t nb_lref  [protected]
```

16.330.4.3 name

```
string name  [protected]
```

16.330.4.4 inputs

`vector<vectElt> inputs [protected]`

16.330.4.5 outputs_simd

`vector<vectElt> outputs_simd [protected]`

16.330.4.6 outputs_scalar

`vector<vectElt> outputs_scalar [protected]`

The documentation for this class was generated from the following file:

- test-simd.C

16.331 tfn_minus Struct Reference

`#include <sparse_matrix_traits.h>`

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.331.1 Member Function Documentation

16.331.1.1 operator()()

```
auto operator() (
            Args &&...  args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.332 tfn_minus_eq Struct Reference

`#include <sparse_matrix_traits.h>`

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.332.1 Member Function Documentation

16.332.1.1 operator()()

```
auto operator() (
            Args &&...  args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.333 tfn_mul Struct Reference

`#include <sparse_matrix_traits.h>`

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.333.1 Member Function Documentation

16.333.1.1 operator()()

```
auto operator() (
            Args &&...  args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.334 tfn_mul_eq Struct Reference

`#include <sparse_matrix_traits.h>`

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.334.1 Member Function Documentation

16.334.1.1 operator()()

```
auto operator() (
            Args &&...  args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.335 tfn_plus Struct Reference

`#include <sparse_matrix_traits.h>`

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.335.1 Member Function Documentation

16.335.1.1 operator()()

```
auto operator() (
            Args &&... args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.336 tfn_plus_eq Struct Reference

```
#include <sparse_matrix_traits.h>
```

Public Member Functions

- template<typename... Args>
  auto operator() (Args &&... args) const -> decltype(operator+(std::forward< Args >(args)...))

16.336.1 Member Function Documentation

16.336.1.1 operator()()

```
auto operator() (
            Args &&... args ) const -> decltype(operator+(std::forward<Args>(args)...))
[inline]
```

The documentation for this struct was generated from the following file:

- sparse_matrix_traits.h

16.337 Threads Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.338 ThreeD Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.339 ThreeDAdaptive Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.340 ThreeDInPlace Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.341 TRSMHelper< RecIterTrait, ParSeqTrait > Struct Template Reference

TRSM Helper.

Public Member Functions

- template< class Cut , class Param >
  TRSMHelper (ParSeqHelper::Parallel< Cut, Param > _PS)
- TRSMHelper (ParSeqHelper::Sequential _PS)
- template< typename RIT , typename PST >
  TRSMHelper (TRSMHelper< RIT, PST > &_TH)
- template< class Dom , class Algo = FFLAS::MMHelperAlgo::Winograd, class ModeT = typename FFLAS::ModeTraits< Dom >::value>
  FFLAS::MMHelper< Dom, Algo, ModeT, ParSeqTrait > pMMH (Dom &D, size_t m, size_t k, size_t n, Par←SeqTrait p) const
- template< class Dom , class Algo = FFLAS::MMHelperAlgo::Winograd, class ModeT = typename FFLAS::ModeTraits< Dom >::value>
  FFLAS::MMHelper< Dom, Algo, ModeT, ParSeqTrait > pMMH (Dom &D, size_t m, size_t k, size_t n) const

Data Fields

- ParSeqTrait parseq

16.341.1 Detailed Description

template< typename RecIterTrait = StructureHelper::Recursive, typename ParSeqTrait = ParSeqHelper::Sequential>
struct FFLAS::TRSMHelper< RecIterTrait, ParSeqTrait >

TRSM Helper.

16.341.2 Constructor & Destructor Documentation

16.341.2.1 TRSMHelper() [1/3]

```
TRSMHelper (
            ParSeqHelper::Parallel< Cut, Param > _PS )  [inline]
```

16.341.2.2 TRSMHelper() [2/3]

```
TRSMHelper (
            ParSeqHelper::Sequential _PS )  [inline]
```

16.341.2.3 TRSMHelper() [3/3]

```
TRSMHelper (
            TRSMHelper< RIT, PST > & _TH )  [inline]
```

16.341.3 Member Function Documentation

16.341.3.1 pMMH() [1/2]

```
FFLAS::MMHelper<Dom, Algo, ModeT, ParSeqTrait> pMMH (
            Dom & D,
            size_t m,
            size_t k,
            size_t n,
            ParSeqTrait p ) const [inline]
```

16.341.3.2 pMMH() [2/2]

```
FFLAS::MMHelper<Dom, Algo, ModeT, ParSeqTrait> pMMH (
            Dom & D,
            size_t m,
            size_t k,
            size_t n ) const [inline]
```

16.341.4 Field Documentation

16.341.4.1 parseq

```
ParSeqTrait parseq
```

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.342 TwoD Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.343 TwoDAdaptive Struct Reference

The documentation for this struct was generated from the following file:

- blockcuts.inl

16.344 UnparametricTag Struct Reference

If the field uses a representation with infix operators.

```
#include <field-traits.h>
```

16.344.1 Detailed Description

If the field uses a representation with infix operators.
The documentation for this struct was generated from the following file:

- field-traits.h

16.345 width< T > Struct Template Reference

Static Public Attributes

- static constexpr size_t value = 2+2*sizeof(T)

16.345.1 Field Documentation

16.345.1.1 value

```
constexpr size_t value = 2+2*sizeof(T)  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.346 width< double > Struct Reference

Static Public Attributes

- static constexpr size_t value = 24

16.346.1 Field Documentation

16.346.1.1 value

```
constexpr size_t value = 24  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.347 width< float > Struct Reference

Static Public Attributes

- static constexpr size_t value = 16

16.347.1 Field Documentation

16.347.1.1 value

```
constexpr size_t value = 16  [static], [constexpr]
```

The documentation for this struct was generated from the following file:

- test-simd.C

16.348 Winograd Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

16.349 WinogradPar Struct Reference

The documentation for this struct was generated from the following file:

- fflas_helpers.inl

Chapter 17

File Documentation

17.1 101-fgemm.C File Reference

```
#include <fflas-ffpack/fflas-ffpack-config.h>
#include <givaro/modular-balanced.h>
#include <fflas-ffpack/fflas/fflas.h>
#include <fflas-ffpack/utils/timer.h>
#include <fflas-ffpack/utils/fflas_io.h>
#include <fflas-ffpack/utils/args-parser.h>
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.1.1 Function Documentation

17.1.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.2 2x2-fgemm.C File Reference

```
#include <fflas-ffpack/fflas-ffpack-config.h>
#include <givaro/modular-balanced.h>
#include <fflas-ffpack/fflas/fflas.h>
#include <fflas-ffpack/utils/timer.h>
#include <fflas-ffpack/utils/fflas_io.h>
#include <fflas-ffpack/utils/args-parser.h>
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.2.1 Function Documentation

17.2.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.3 2x2-ftrsv.C File Reference

```
#include <fflas-ffpack/fflas-ffpack-config.h>
#include <givaro/modular-balanced.h>
#include <fflas-ffpack/fflas/fflas.h>
#include <fflas-ffpack/utils/timer.h>
#include <fflas-ffpack/utils/fflas_io.h>
#include <fflas-ffpack/utils/args-parser.h>
#include <iostream>
#include <array>
```

Functions

- int main (int argc, char **argv)

17.3.1 Function Documentation

17.3.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.4 2x2-pluq.C File Reference

```
#include <iostream>
#include <vector>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Functions

- int main (int argc, char **argv)

17.4.1 Function Documentation

17.4.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.5 align-allocator.h File Reference

```
#include "fflas-ffpack/config.h"
```

17.6 args-parser.h File Reference

```
#include <fflas-ffpack/fflas-ffpack-config.h>
#include <givaro/givinteger.h>
#include <givaro/givprint.h>
#include <iostream>
#include <fstream>
#include <vector>
#include <string>
#include <cstring>
#include <list>
#include <stdlib.h>
```

Data Structures

- struct Argument

Namespaces

- FFLAS

Macros

- #define TYPE_BOOL TYPE_NONE
- #define END_OF_ARGUMENTS { '\0', "\0", "\0", TYPE_NONE, NULL }
- #define type_integer long int

Enumerations

- enum ArgumentType {
  TYPE_NONE , TYPE_INT , TYPE_UINT64 , TYPE_LONGLONG ,
  TYPE_INTEGER , TYPE_DOUBLE , TYPE_INTLIST , TYPE_STR }

Functions

- void parseArguments (int argc, char ∗∗argv, Argument ∗args, bool printDefaults=true)
- void printHelpMessage (const char ∗program, Argument ∗args, bool printDefaults=false)
- Argument ∗ findArgument (Argument ∗args, char c)
- int getListArgs (std::list< int > &outlist, std::string &instring)

  transforms a string list of ints to a list of int string "12,13,15" is turned into list of ints {12,13,15}
- char ∗ getArgumentValue (int argc, char ∗∗argv, int i)

  Get the value of an argument and avoid core dump when no value was given after an argument.
- std::ostream & writeCommandString (std::ostream &os, Argument ∗args, const char ∗programName=nullptr)

  writes the values of all arguments, preceded by the programName

17.6.1 Macro Definition Documentation

17.6.1.1 TYPE_BOOL

```
#define TYPE_BOOL TYPE_NONE
```

17.6.1.2 END_OF_ARGUMENTS

```
#define END_OF_ARGUMENTS { '\0', "\0", "\0", TYPE_NONE, NULL }
```

17.6.1.3 type_integer

```
#define type_integer long int
```

17.6.2 Enumeration Type Documentation

17.6.2.1 ArgumentType

```
enum ArgumentType
```

Enumerator

TYPE_NONE	
TYPE_INT	
TYPE_UINT64	
TYPE_LONGLONG	
TYPE_INTEGER	
TYPE_DOUBLE	
TYPE_INTLIST	
TYPE_STR	

17.6.3 Function Documentation

17.6.3.1 printHelpMessage()

```
void printHelpMessage (
            const char * program,
            Argument * args,
            bool printDefaults = false )
```

17.6.3.2 findArgument()

```
Argument* findArgument (
            Argument * args,
            char c )
```

17.6.3.3 getListArgs()

```
int getListArgs (
            std::list< int > & outlist,
            std::string & instring )
```

transforms a string list of ints to a list of int string "12,13,15" is turned into list of ints {12,13,15}

Parameters

outlist	list once converted
instring	list to be converted

Returns

status message.

17.7 arithprog.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))
- #define GFOPS(m, n, r, t) (2.7∗CUBE(double(n)/1000.0))/t

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main (int argc, char ∗∗argv)

17.7.1 Macro Definition Documentation

17.7.1.1 CUBE

```
#define CUBE(
            x )  ((x)*(x)*(x))
```

17.7.1.2 GFOPS

```
#define GFOPS(
            m,
            n,
            r,
            t )  (2.7*CUBE(double(n)/1000.0))/t
```

17.7.2 Typedef Documentation

17.7.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.7.3 Function Documentation

17.7.3.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.8 benchmark-charpoly-mp.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/Matio.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_FORCE_SEQ

Functions

- int main (int argc, char **argv)

17.8.1 Macro Definition Documentation

17.8.1.1 __FFLASFFPACK_FORCE_SEQ

```
#define __FFLASFFPACK_FORCE_SEQ
```

17.8.2 Function Documentation

17.8.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.9 benchmark-charpoly.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include <givaro/givpoly1.h>
```

```
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<class Field >
  void run_with_field (int q, uint64_t bits, size_t n, size_t d, size_t iter, std::string file, int variant, uint64_t seed)
- int main (int argc, char **argv)

17.9.1 Macro Definition Documentation

17.9.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.9.2 Function Documentation

17.9.2.1 run_with_field()

```
void run_with_field (
            int q,
            uint64_t bits,
            size_t n,
            size_t d,
            size_t iter,
            std::string file,
            int variant,
            uint64_t seed )
```

17.9.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.10 benchmark-checkers.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <stdlib.h>
#include <time.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
```

```
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/checkers/checkers_fflas.h"
#include "fflas-ffpack/checkers/checkers_ffpack.h"
#include <fstream>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1
- #define _NR_TESTS 5
- #define _MAX_SIZE_MATRICES 1000
- #define CUBE(x) ((x)∗(x)∗(x))

Functions

- int main (int argc, char ∗∗argv)

17.10.1 Macro Definition Documentation

17.10.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.10.1.2 _NR_TESTS

```
#define _NR_TESTS 5
```

17.10.1.3 _MAX_SIZE_MATRICES

```
#define _MAX_SIZE_MATRICES 1000
```

17.10.1.4 CUBE

```
#define CUBE(
              x ) ((x)*(x)*(x))
```

17.10.2 Function Documentation

17.10.2.1 main()

```
int main (
             int argc,
             char ** argv )
```

17.11 benchmark-dgemm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/config-blas.h"
```

```
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define CBLAS_GEMM cblas_dgemm

Typedefs

- typedef FFLAS::Timer TTimer
- typedef double Floats

Functions

- int main (int argc, char **argv)

17.11.1 Macro Definition Documentation

17.11.1.1 CBLAS_GEMM

```
#define CBLAS_GEMM cblas_dgemm
```

17.11.2 Typedef Documentation

17.11.2.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.11.2.2 Floats

```
typedef double Floats
```

17.11.3 Function Documentation

17.11.3.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.12 benchmark-dgetrf.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <vector>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
```

```
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_HAVE_DGETRF 1

Typedefs

- typedef FFLAS::Timer TTimer

Functions

- int main (int argc, char **argv)

17.12.1 Macro Definition Documentation

17.12.1.1 __FFLASFFPACK_HAVE_DGETRF

```
#define __FFLASFFPACK_HAVE_DGETRF 1
```

17.12.2 Typedef Documentation

17.12.2.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.12.3 Function Documentation

17.12.3.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.13 benchmark-dgetri.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <vector>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Typedefs

- typedef FFLAS::Timer TTimer

Functions

- int main (int argc, char **argv)

17.13.1 Typedef Documentation

17.13.1.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.13.2 Function Documentation

17.13.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.14 benchmark-dsytrf.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <vector>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define EFFGFF(n, t, i) ((double(n)/1000.*double(n)/1000.*double(n)/1000.0) / double(t) * double(i) / 3.)

Typedefs

- typedef FFLAS::Timer TTimer

Functions

- int main (int argc, char **argv)

17.14.1 Macro Definition Documentation

17.14.1.1 EFFGFF

```
#define EFFGFF(
              n,
              t,
              i ) ( (double(n)/1000.*double(n)/1000.*double(n)/1000.0) / double(t) * double(i)
/ 3.)
```

17.14.2 Typedef Documentation

17.14.2.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.14.3 Function Documentation

17.14.3.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.15 benchmark-dtrsm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Typedefs

- typedef FFLAS::Timer TTimer

Functions

- int main (int argc, char **argv)

17.15.1 Typedef Documentation

17.15.1.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.15.2 Function Documentation

17.15.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.16 benchmark-dtrtri.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_HAVE_DTRTRI 1

Typedefs

- typedef FFLAS::Timer TTimer

Functions

- int main (int argc, char **argv)

17.16.1 Macro Definition Documentation

17.16.1.1 __FFLASFFPACK_HAVE_DTRTRI

```
#define __FFLASFFPACK_HAVE_DTRTRI 1
```

17.16.2 Typedef Documentation

17.16.2.1 TTimer

```
typedef FFLAS::Timer TTimer
```

17.16.3 Function Documentation

17.16.3.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.17 benchmark-fadd-lvl2.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.17.1 Macro Definition Documentation

17.17.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.17.2 Function Documentation

17.17.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.18 benchmark-fdot.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include <givaro/givrational.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/paladin/parallel.h"
#include "fflas-ffpack/paladin/fflas_plevel1.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<class Field >
  Field::Element run_with_field (int q, size_t iter, size_t N, const uint64_t BS, const size_t p, const size_↩
  t threads, uint64_t seed)
- int main (int argc, char **argv)

17.18.1 Macro Definition Documentation

17.18.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.18.2 Function Documentation

17.18.2.1 run_with_field()

```
Field::Element run_with_field (
            int q,
            size_t iter,
            size_t N,
            const uint64_t BS,
            const size_t p,
            const size_t threads,
            uint64_t seed )
```

17.18.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.19 benchmark-fgemm-mp.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <typeinfo>
#include <vector>
#include <string>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "givaro/modular-integer.h"
#include "givaro/givcaster.h"
#include "fflas-ffpack/paladin/parallel.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<typename Ints >
  int tmain ()
- int main (int argc, char **argv)

17.19.1 Macro Definition Documentation

17.19.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.19.2 Function Documentation

17.19.2.1 tmain()

```
int tmain ( )
```

17.19.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.20 benchmark-fgemm-rns.C File Reference

```
#include "fflas-ffpack/fflas/fflas.h"
#include <iostream>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Typedefs

- typedef FFPACK::rns_double RNS
- typedef FFPACK::RNSInteger< RNS > Field
- typedef Field::Element_ptr Element_ptr
- typedef Field::ConstElement_ptr ConstElement_ptr
- typedef StrategyParameter::Threads THREADS
- typedef StrategyParameter::Grain GRAIN
- typedef StrategyParameter::TwoD TWOD
- typedef StrategyParameter::TwoDAdaptive TWODA
- typedef StrategyParameter::ThreeD THREED
- typedef StrategyParameter::ThreeDAdaptive THREEDA
- typedef StrategyParameter::ThreeDInPlace THREEDIP
- typedef ParSeqHelper::Sequential PSeq

Functions

- int main (int argc, char *argv[ ])

17.20.1 Macro Definition Documentation

17.20.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.20.2 Typedef Documentation

17.20.2.1 RNS

```
typedef FFPACK::rns_double RNS
```

17.20.2.2 Field

```
typedef FFPACK::RNSInteger<RNS> Field
```

17.20.2.3 Element_ptr

```
typedef Field::Element_ptr Element_ptr
```

17.20.2.4 ConstElement_ptr

```
typedef Field::ConstElement_ptr ConstElement_ptr
```

17.20.2.5 THREADS

```
typedef StrategyParameter::Threads THREADS
```

17.20.2.6 GRAIN

```
typedef StrategyParameter::Grain GRAIN
```

17.20.2.7 TWOD

```
typedef StrategyParameter::TwoD TWOD
```

17.20.2.8 TWODA

```
typedef StrategyParameter::TwoDAdaptive TWODA
```

17.20.2.9 THREED

```
typedef StrategyParameter::ThreeD THREED
```

17.20.2.10 THREEDA

```
typedef StrategyParameter::ThreeDAdaptive THREEDA
```

17.20.2.11 THREEDIP

```
typedef StrategyParameter::ThreeDInPlace THREEDIP
```

17.20.2.12 PSeq

```
typedef ParSeqHelper::Sequential PSeq
```

17.20.3 Function Documentation

17.20.3.1 main()

```
int main (
            int argc,
            char * argv[] )
```

17.21 benchmark-fgemm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define CLASSIC_HYBRID

Functions

- int main (int argc, char **argv)

17.21.1 Macro Definition Documentation

17.21.1.1 CLASSIC_HYBRID

```
#define CLASSIC_HYBRID
```

17.21.2 Function Documentation

17.21.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.22 benchmark-fgemv-mp.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <typeinfo>
#include <vector>
#include <string>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "givaro/modular-integer.h"
#include "givaro/givcaster.h"
#include "fflas-ffpack/paladin/parallel.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<typename T >
  std::ostream & write_matrix (std::ostream &out, Givaro::Integer p, size_t m, size_t n, T ∗C, size_t ldc)

17.22.1 Macro Definition Documentation

17.22.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.22.2 Function Documentation

17.22.2.1 write_matrix()

```
std::ostream& write_matrix (
            std::ostream & out,
            Givaro::Integer p,
            size_t m,
            size_t n,
            T * C,
            size_t ldc )
```

17.23 benchmark-fgemv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "givaro/modular-integer.h"
#include "givaro/givcaster.h"
```

Data Structures

- struct need_field_characteristic< Field >
- struct need_field_characteristic< Givaro::Modular< Field > >
- struct need_field_characteristic< Givaro::ModularBalanced< Field > >
- struct compatible_data_type< Field >
- struct compatible_data_type< Givaro::ZRing< float > >
- struct compatible_data_type< Givaro::ZRing< double > >

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<class Field , class RandIter , class Matrix , class Vector >
  void fill_value (Field &F, RandIter &Rand, Matrix &A, Vector &X, Vector &Y, size_t m, size_t k, size_t incX, size_t incY, size_t lda, int NBK)
- template<class Field , class Matrix , class Vector >
  void genData (Field &F, Matrix &A, Vector &X, Vector &Y, size_t m, size_t k, size_t incX, size_t incY, size_t lda, int NBK, uint64_t bitsize, uint64_t seed)
- template<class Field , class Matrix , class Vector >
  bool check_result (Field &F, size_t m, size_t lda, Matrix &A, Vector &X, size_t incX, Vector &Y, size_t incY)
- template<class Field , class Matrix , class Vector >
  bool benchmark_with_timer (Field &F, int p, Matrix &A, Vector &X, Vector &Y, size_t m, size_t k, size_t incX, size_t incY, size_t lda, size_t iters, int t, double &time, size_t GrainSize)
- template<class Field , class arg >
  void benchmark_disp (Field &F, bool pass, double &time, size_t iters, int p, size_t m, size_t k, arg &as)
- template<class Field , class arg >
  void benchmark_in_Field (Field &F, int p, size_t m, size_t k, int NBK, uint64_t bitsize, uint64_t seed, size_t iters, int t, arg &as, size_t GrainSize)
- template<class Field , class arg >
  void benchmark_with_field (int p, size_t m, size_t k, int NBK, uint64_t bitsize, uint64_t seed, size_t iters, int t, arg &as, size_t GrainSize)
- template<class Field , class arg >
  void benchmark_with_field (const Givaro::Integer &q, int p, size_t m, size_t k, int NBK, uint64_t bitsize, uint64_t seed, size_t iters, int t, arg &as, size_t GrainSize)
- int main (int argc, char **argv)

17.23.1 Macro Definition Documentation

17.23.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.23.2 Function Documentation

17.23.2.1 fill_value()

```
void fill_value (
            Field & F,
            RandIter & Rand,
            Matrix & A,
            Vector & X,
            Vector & Y,
            size_t m,
            size_t k,
            size_t incX,
            size_t incY,
            size_t lda,
            int NBK )
```

17.23.2.2 genData()

```
void genData (
            Field & F,
            Matrix & A,
```

```
            Vector & X,
            Vector & Y,
            size_t m,
            size_t k,
            size_t incX,
            size_t incY,
            size_t lda,
            int NBK,
            uint64_t bitsize,
            uint64_t seed )
```

17.23.2.3 check_result()

```
bool check_result (
            Field & F,
            size_t m,
            size_t lda,
            Matrix & A,
            Vector & X,
            size_t incX,
            Vector & Y,
            size_t incY )
```

17.23.2.4 benchmark_with_timer()

```
bool benchmark_with_timer (
            Field & F,
            int p,
            Matrix & A,
            Vector & X,
            Vector & Y,
            size_t m,
            size_t k,
            size_t incX,
            size_t incY,
            size_t lda,
            size_t iters,
            int t,
            double & time,
            size_t GrainSize )
```

17.23.2.5 benchmark_disp()

```
void benchmark_disp (
            Field & F,
            bool pass,
            double & time,
            size_t iters,
            int p,
            size_t m,
            size_t k,
            arg & as )
```

17.23.2.6 benchmark_in_Field()

```
void benchmark_in_Field (
            Field & F,
            int p,
            size_t m,
            size_t k,
            int NBK,
            uint64_t bitsize,
            uint64_t seed,
            size_t iters,
            int t,
            arg & as,
            size_t GrainSize )
```

17.23.2.7 benchmark_with_field() [1/2]

```
void benchmark_with_field (
            int p,
            size_t m,
            size_t k,
            int NBK,
            uint64_t bitsize,
            uint64_t seed,
            size_t iters,
            int t,
            arg & as,
            size_t GrainSize )
```

17.23.2.8 benchmark_with_field() [2/2]

```
void benchmark_with_field (
            const Givaro::Integer & q,
            int p,
            size_t m,
            size_t k,
            int NBK,
            uint64_t bitsize,
            uint64_t seed,
            size_t iters,
            int t,
            arg & as,
            size_t GrainSize )
```

17.23.2.9 main()

```
int main (
            int argc,
            char ** argv )
```

17.24 benchmark-fgesv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
```

```
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.24.1 Macro Definition Documentation

17.24.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.24.2 Function Documentation

17.24.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.25 benchmark-fsyr2k.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Functions

- int main (int argc, char **argv)

17.25.1 Function Documentation

17.25.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.26 benchmark-fsyrk.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.26.1 Macro Definition Documentation

17.26.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.26.2 Function Documentation

17.26.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.27 benchmark-fsytrf.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFPACK_FSYTRF_BC_CROUT
- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
- #define CUBE(x) ((x)*(x)*(x))

Functions

- int main (int argc, char **argv)

17.27.1 Macro Definition Documentation

17.27.1.1 __FFPACK_FSYTRF_BC_CROUT

```
#define __FFPACK_FSYTRF_BC_CROUT
```

17.27.1.2 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.27.1.3 CUBE

```
#define CUBE(
             x ) ((x)*(x)*(x))
```

17.27.2 Function Documentation

17.27.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.28 benchmark-ftrsm-mp.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <vector>
#include <string>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "givaro/modular-integer.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.28.1 Macro Definition Documentation

17.28.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.28.2 Function Documentation

17.28.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.29 benchmark-ftrsm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.29.1 Macro Definition Documentation

17.29.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.29.2 Function Documentation

17.29.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.30 benchmark-ftrsv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- int main (int argc, char **argv)

17.30.1 Macro Definition Documentation

17.30.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.30.2 Function Documentation

17.30.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.31 benchmark-ftrtri.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
- #define CUBE(x) ((x)*(x)*(x))

Functions

- int main (int argc, char **argv)

17.31.1 Macro Definition Documentation

17.31.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.31.1.2 CUBE

```
#define CUBE(
             x ) ((x)*(x)*(x))
```

17.31.2 Function Documentation

17.31.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.32 benchmark-inverse.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))

Functions

- int main (int argc, char ∗∗argv)

17.32.1 Macro Definition Documentation

17.32.1.1 CUBE

```
#define CUBE(
              x ) ((x)*(x)*(x))
```

17.32.2 Function Documentation

17.32.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.33 benchmark-lqup-mp.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <vector>
#include <string>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
```

```
#include "givaro/modular-integer.h"
```

Functions

- int main (int argc, char **argv)

17.33.1 Function Documentation

17.33.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.34 benchmark-lqup.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define CUBE(x) ((x)*(x)*(x))

Functions

- int main (int argc, char **argv)

17.34.1 Macro Definition Documentation

17.34.1.1 CUBE

```
#define CUBE(
            x ) ((x)*(x)*(x))
```

17.34.2 Function Documentation

17.34.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.35 benchmark-pluq.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular.h>
#include <givaro/givranditer.h>
#include <iostream>
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/ffpack/ffpack.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
- #define CUBE(x) ((x)∗(x)∗(x))

Typedefs

- typedef Givaro::ModularBalanced< double > Field

Functions

- void verification_PLUQ (const Field &F, typename Field::Element ∗B, typename Field::Element ∗A, size_t ∗P, size_t ∗Q, size_t m, size_t n, size_t R)
- void Rec_Initialize (Field &F, Field::Element ∗C, size_t m, size_t n, size_t ldc)
- int main (int argc, char ∗∗argv)

17.35.1 Macro Definition Documentation

17.35.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.35.1.2 CUBE

```
#define CUBE(
              x ) ((x)*(x)*(x))
```

17.35.2 Typedef Documentation

17.35.2.1 Field

```
typedef Givaro::ModularBalanced<double> Field
```

17.35.3 Function Documentation

17.35.3.1 verification_PLUQ()

```
void verification_PLUQ (
            const Field & F,
            typename Field::Element * B,
            typename Field::Element * A,
            size_t * P,
            size_t * Q,
            size_t m,
            size_t n,
            size_t R )
```

17.35.3.2 Rec_Initialize()

```
void Rec_Initialize (
            Field & F,
            Field::Element * C,
            size_t m,
            size_t n,
            size_t ldc )
```

17.35.3.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.36 benchmark-quasisep.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include <givaro/givpoly1.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1

Functions

- template<class Field >
  void run_with_field (int q, size_t n, size_t m, size_t t, size_t r, size_t iter, uint64_t seed)
- int main (int argc, char **argv)

17.36.1 Macro Definition Documentation

17.36.1.1 __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET

```
#define __FFLASFFPACK_OPENBLAS_NT_ALREADY_SET 1
```

17.36.2 Function Documentation

17.36.2.1 run_with_field()

```
void run_with_field (
            int q,
            size_t n,
            size_t m,
            size_t t,
            size_t r,
            size_t iter,
            uint64_t seed )
```

17.36.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.37 benchmark-storage-transpose.C File Reference

```
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/fflas_memory.h"
#include <givaro/modular.h>
#include <recint/rint.h>
#include "fflas-ffpack/fflas/fflas_transpose.h"
```

Data Structures

- class Bench< Elt >

Functions

- int main (int argc, char **argv)

17.37.1 Function Documentation

17.37.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.38 benchmark-wino.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <fstream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))

Functions

- template<class Field >
  void launch_wino (const Field &F, const size_t &n, const size_t &NB, const size_t &wino, const bool &asmax, const size_t &seed, const bool compare)
- int main (int argc, char ∗∗argv)

17.38.1 Macro Definition Documentation

17.38.1.1 CUBE

```
#define CUBE(
              x ) ((x)*(x)*(x))
```

17.38.2 Function Documentation

17.38.2.1 launch_wino()

```
void launch_wino (
             const Field & F,
             const size_t & n,
             const size_t & NB,
             const size_t & wino,
             const bool & asmax,
             const size_t & seed,
             const bool compare )
```

17.38.2.2 main()

```
int main (
             int argc,
             char ** argv )
```

17.39 bit_manipulation.h File Reference

```
#include <givaro/udl.h>
#include "fflas-ffpack/fflas-ffpack-config.h"
```

Macros

- #define __has_builtin(x) 0

Functions

- int32_t clz (uint64_t val)
- int32_t clz (uint32_t val)
- int32_t ctz (uint32_t val)
- int32_t ctz (uint64_t val)

17.39.1 Macro Definition Documentation

17.39.1.1 __has_builtin

```
#define __has_builtin(
              x ) 0
```

17.39.2 Function Documentation

17.39.2.1 clz() [1/2]

```
int32_t clz (
             uint64_t val )  [inline]
```

17.39.2.2 clz() [2/2]

```
int32_t clz (
             uint32_t val )  [inline]
```

17.39.2.3 ctz() [1/2]

```
int32_t ctz (
             uint32_t val )  [inline]
```

17.39.2.4 ctz() [2/2]

```
int32_t ctz (
             uint64_t val )  [inline]
```

17.40 blockcuts.inl File Reference

```
#include <fflas-ffpack/fflas/fflas_enum.h>
#include <math.h>
#include <cassert>
```

Data Structures

- struct Single
- struct Row
- struct Column
- struct Block
- struct Recursive
- struct Fixed
- struct Threads
- struct Grain
- struct TwoD
- struct TwoDAdaptive
- struct ThreeD
- struct ThreeDInPlace
- struct ThreeDAdaptive
- struct Parallel< C, P >
- struct Sequential
- struct Compose< H1, H2 >
- struct ForStrategy1D< blocksize_t, Cut, Param >
- struct ForStrategy2D< blocksize_t, Cut, Param >

Namespaces

- FFLAS
- FFLAS::CuttingStrategy
- FFLAS::StrategyParameter
- FFLAS::ParSeqHelper

  ParSeqHelper for both fgemm and ftrsm.

Macros

- #define __FFLASFFPACK_fflas_blockcuts_INL
- #define __FFLASFFPACK_MINBLOCKCUTS ((size_t)256)

Typedefs

- typedef Row RNSModulus

Functions

- template<class Cut = CuttingStrategy::Block, class Strat = StrategyParameter::Threads>
  void BlockCuts (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Single, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)
- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Grain > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t grainsize)
- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Fixed > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)

- template<> void BlockCuts< CuttingStrategy::Row, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Column, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<> void BlockCuts< CuttingStrategy::Block, StrategyParameter::Threads > (size_t &RBLOCKSIZE, size_t &CBLOCKSIZE, const size_t m, const size_t n, const size_t numthreads)
- template<class Cut = CuttingStrategy::Block, class Param = StrategyParameter::Threads>
  void BlockCuts (size_t &rowBlockSize, size_t &colBlockSize, size_t &lastRBS, size_t &lastCBS, size_t &changeRBS, size_t &changeCBS, size_t &numRowBlock, size_t &numColBlock, size_t m, size_t n, const size_t numthreads)

17.40.1 Macro Definition Documentation

17.40.1.1 __FFLASFFPACK_fflas_blockcuts_INL

```
#define __FFLASFFPACK_fflas_blockcuts_INL
```

17.40.1.2 __FFLASFFPACK_MINBLOCKCUTS

```
#define __FFLASFFPACK_MINBLOCKCUTS ((size_t)256)
```

17.41 cast.h File Reference

Namespaces

- FFPACK

  F*inite* ***F****ield* ***PACK*** *Set of elimination based routines for dense linear algebra.*

Functions

- template<class T , class CT = const T>
  T fflas_const_cast (CT x)

17.42 cblas.C File Reference

```
#include "fflas-ffpack/config-blas.h"
```

Macros

- #define __FFLASFFPACK_CONFIGURATION
- #define __FFLASFFPACK_HAVE_CBLAS 1

Functions

- int main ()

17.42.1 Macro Definition Documentation

17.42.1.1 __FFLASFFPACK_CONFIGURATION

```
#define __FFLASFFPACK_CONFIGURATION
```

17.42.1.2 __FFLASFFPACK_HAVE_CBLAS

```
#define __FFLASFFPACK_HAVE_CBLAS 1
```

17.42.2 Function Documentation

17.42.2.1 main()

```
int main (
            void )
```

17.43 charpoly.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))
- #define GFOPS(m, n, r, t) (2.7∗CUBE(double(n)/1000.0))/t

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main ()

17.43.1 Macro Definition Documentation

17.43.1.1 CUBE

```
#define CUBE(
            x ) ((x)*(x)*(x))
```

17.43.1.2 GFOPS

```
#define GFOPS(
            m,
            n,
            r,
            t ) (2.7*CUBE(double(n)/1000.0))/t
```

17.43.2 Typedef Documentation

17.43.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.43.3 Function Documentation

17.43.3.1 main()

```
int main (
            void )
```

17.44 charpoly.C File Reference

```
#include <iostream>
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- int main (int argc, char **argv)

  This example computes the characteristic polynomial of a matrix over a defined finite field.

17.44.1 Function Documentation

17.44.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

This example computes the characteristic polynomial of a matrix over a defined finite field.
Outputs the characteristic polynomial.

17.45 checker_charpoly.inl File Reference

```
#include "fflas-ffpack/ffpack/ffpack.h"
```

Data Structures

- class CheckerImplem_charpoly< Field, Polynomial >
- class CheckerImplem_charpoly< Givaro::ZRing< Givaro::Integer >, Polynomial >

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_checker_charpoly_INL

17.45.1 Macro Definition Documentation

17.45.1.1 __FFLASFFPACK_checker_charpoly_INL

```
#define __FFLASFFPACK_checker_charpoly_INL
```

17.46 checker_det.inl File Reference

```
#include "fflas-ffpack/ffpack/ffpack.h"
```

Data Structures

- class CheckerImplem_Det< Field >

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_checker_det_INL

17.46.1 Macro Definition Documentation

17.46.1.1 __FFLASFFPACK_checker_det_INL

```
#define __FFLASFFPACK_checker_det_INL
```

17.47 checker_empty.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
```

Data Structures

- struct Checker_Empty< Field >

Namespaces

- FFLAS

17.48 checker_fgemm.inl File Reference

Data Structures

- class CheckerImplem_fgemm< Field >

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_checker_fgemm_INL

17.48.1 Macro Definition Documentation

17.48.1.1 __FFLASFFPACK_checker_fgemm_INL

```
#define __FFLASFFPACK_checker_fgemm_INL
```

17.49 checker_ftrsm.inl File Reference

Data Structures

- class CheckerImplem_ftrsm< Field >

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_checker_ftrsm_INL

17.49.1 Macro Definition Documentation

17.49.1.1 __FFLASFFPACK_checker_ftrsm_INL

```
#define __FFLASFFPACK_checker_ftrsm_INL
```

17.50 checker_invert.inl File Reference

Data Structures

- class CheckerImplem_invert< Field >

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_checker_invert_INL

17.50.1 Macro Definition Documentation

17.50.1.1 __FFLASFFPACK_checker_invert_INL

```
#define __FFLASFFPACK_checker_invert_INL
```

17.51 checker_pluq.inl File Reference

```
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Data Structures

- class CheckerImplem_PLUQ< Field >

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_checker_pluq_INL

17.51.1 Macro Definition Documentation

17.51.1.1 __FFLASFFPACK_checker_pluq_INL

```
#define __FFLASFFPACK_checker_pluq_INL
```

17.52 checkers.doxy File Reference

17.53 checkers_fflas.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "checker_empty.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_enum.h"
#include "fflas-ffpack/utils/fflas_memory.h"
```

Data Structures

- class FailureFgemmCheck
- class FailureTrsmCheck

Namespaces

- FFLAS

Typedefs

- template<class Field >
  using Checker_fgemm = FFLAS::Checker_Empty< Field >
- template<class Field >
  using Checker_ftrsm = FFLAS::Checker_Empty< Field >

17.54 checkers_fflas.inl File Reference

```
#include "checker_fgemm.inl"
#include "checker_ftrsm.inl"
```

Namespaces

- FFLAS

Macros

- #define FFLASFFPACK_checkers_fflas_inl_H

Typedefs

- template< class Field >
  using ForceCheck_fgemm = CheckerImplem_fgemm< Field >
- template< class Field >
  using ForceCheck_ftrsm = CheckerImplem_ftrsm< Field >

17.54.1 Macro Definition Documentation

17.54.1.1 FFLASFFPACK_checkers_fflas_inl_H

```
#define FFLASFFPACK_checkers_fflas_inl_H
```

17.55 checkers_ffpack.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "checker_empty.h"
#include "fflas-ffpack/ffpack/ffpack.h"
```

Data Structures

- class FailurePLUQCheck
- class FailureDetCheck
- class FailureInvertCheck
- class FailureCharpolyCheck

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Typedefs

- template< class Field >
  using Checker_PLUQ = FFLAS::Checker_Empty< Field >
- template< class Field >
  using Checker_Det = FFLAS::Checker_Empty< Field >
- template< class Field >
  using Checker_invert = FFLAS::Checker_Empty< Field >
- template< class Field , class Polynomial >
  using Checker_charpoly = FFLAS::Checker_Empty< Field >

17.56 checkers_ffpack.inl File Reference

```
#include "checker_pluq.inl"
#include "checker_det.inl"
#include "checker_invert.inl"
#include "checker_charpoly.inl"
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define FFLASFFPACK_checkers_ffpack_inl_H

Typedefs

- template<class Field >
  using ForceCheck_PLUQ = CheckerImplem_PLUQ< Field >
- template<class Field >
  using ForceCheck_Det = CheckerImplem_Det< Field >
- template<class Field >
  using ForceCheck_invert = CheckerImplem_invert< Field >
- template<class Field , class Polynomial >
  using ForceCheck_charpoly = CheckerImplem_charpoly< Field, Polynomial >

17.56.1 Macro Definition Documentation

17.56.1.1 FFLASFFPACK_checkers_ffpack_inl_H

```
#define FFLASFFPACK_checkers_ffpack_inl_H
```

17.57 clapack.C File Reference

```
#include "fflas-ffpack/config-blas.h"
```

Macros

- #define __FFLASFFPACK_CONFIGURATION
- #define __FFLASFFPACK_HAVE_LAPACK 1
- #define __FFLASFFPACK_HAVE_CLAPACK 1

Functions

- int main ()

17.57.1 Macro Definition Documentation

17.57.1.1 __FFLASFFPACK_CONFIGURATION

```
#define __FFLASFFPACK_CONFIGURATION
```

17.57.1.2 __FFLASFFPACK_HAVE_LAPACK

```
#define __FFLASFFPACK_HAVE_LAPACK 1
```

17.57.1.3 __FFLASFFPACK_HAVE_CLAPACK

```
#define __FFLASFFPACK_HAVE_CLAPACK 1
```

17.57.2 Function Documentation

17.57.2.1 main()

```
int main (
            void )
```

17.58 config-blas.h File Reference

Macros

- #define CBLAS_INT int
- #define CBLAS_ENUM_DEFINED_H
- #define CBLAS_EXTERNALS
- #define blas_enum enum

Enumerations

- enum CBLAS_ORDER { CblasRowMajor =101 , CblasColMajor =102 }
- enum CBLAS_TRANSPOSE { CblasNoTrans =111 , CblasTrans =112 , CblasConjTrans =113 , AtlasConj =114 }
- enum CBLAS_UPLO { CblasUpper =121 , CblasLower =122 }
- enum CBLAS_DIAG { CblasNonUnit =131 , CblasUnit =132 }
- enum CBLAS_SIDE { CblasLeft =141 , CblasRight =142 }

Functions

- void daxpy_ (const int ∗, const double ∗, const double ∗, const int ∗, double ∗, const int ∗)
- void saxpy_ (const int ∗, const float ∗, const float ∗, const int ∗, float ∗, const int ∗)
- double ddot_ (const int ∗, const double ∗, const int ∗, const double ∗, const int ∗)
- float sdot_ (const int ∗, const float ∗, const int ∗, const float ∗, const int ∗)
- double dasum_ (const int ∗, const double ∗, const int ∗)
- int idamax_ (const int ∗, const double ∗, const int ∗)
- double dnrm2_ (const int ∗, const double ∗, const int ∗)
- void dgemv_ (const char ∗, const int ∗, const int ∗, const double ∗, const double ∗, const int ∗, const double ∗, const int ∗, const double ∗, double ∗, const int ∗)
- void sgemv_ (const char ∗, const int ∗, const int ∗, const float ∗, const float ∗, const int ∗, const float ∗, const int ∗, const float ∗, float ∗, const int ∗)
- void dger_ (const int ∗, const int ∗, const double ∗, const double ∗, const int ∗, const double ∗, const int ∗, double ∗, const int ∗)
- void sger_ (const int ∗, const int ∗, const float ∗, const float ∗, const int ∗, const float ∗, const int ∗, float ∗, const int ∗)

- void dcopy_ (const int ∗, const double ∗, const int ∗, double ∗, const int ∗)
- void scopy_ (const int ∗, const float ∗, const int ∗, float ∗, const int ∗)
- void dscal_ (const int ∗, const double ∗, double ∗, const int ∗)
- void sscal_ (const int ∗, const float ∗, float ∗, const int ∗)
- void dtrsm_ (const char ∗, const char ∗, const char ∗, const char ∗, const int ∗, const int ∗, const double ∗, const double ∗, const int ∗, double ∗, const int ∗)
- void strsm_ (const char ∗, const char ∗, const char ∗, const char ∗, const int ∗, const int ∗, const float ∗, const float ∗, const int ∗, float ∗, const int ∗)
- void dtrmm_ (const char ∗, const char ∗, const char ∗, const char ∗, const int ∗, const int ∗, const double ∗, const double ∗, const int ∗, double ∗, const int ∗)
- void strmm_ (const char ∗, const char ∗, const char ∗, const char ∗, const int ∗, const int ∗, const float ∗, const float ∗, const int ∗, float ∗, const int ∗)
- void sgemm_ (const char ∗, const char ∗, const int ∗, const int ∗, const int ∗, const float ∗, const float ∗, const int ∗, const float ∗, const int ∗, const float ∗, float ∗, const int ∗)
- void dgemm_ (const char ∗, const char ∗, const int ∗, const int ∗, const int ∗, const double ∗, const double ∗, const int ∗, const double ∗, const int ∗, const double ∗, double ∗, const int ∗)
- void cblas_dsyrk (const enum CBLAS_ORDER Order, const enum CBLAS_UPLO Uplo, const enum CBLAS_TRANSPOSE Trans, const int N, const int K, const double alpha, const double ∗A, const int lda, const double beta, double ∗C, const int ldc)

17.58.1 Macro Definition Documentation

17.58.1.1 CBLAS_INT

```
#define CBLAS_INT int
```

17.58.1.2 CBLAS_ENUM_DEFINED_H

```
#define CBLAS_ENUM_DEFINED_H
```

17.58.1.3 CBLAS_EXTERNALS

```
#define CBLAS_EXTERNALS
```

17.58.1.4 blas_enum

```
#define blas_enum enum
```

17.58.2 Enumeration Type Documentation

17.58.2.1 CBLAS_ORDER

```
enum CBLAS_ORDER
```

Enumerator

CblasRowMajor	
CblasColMajor	

17.58.2.2 CBLAS_TRANSPOSE

enum CBLAS_TRANSPOSE

Enumerator

CblasNoTrans	
CblasTrans	
CblasConjTrans	
AtlasConj	

17.58.2.3 CBLAS_UPLO

enum CBLAS_UPLO

Enumerator

CblasUpper	
CblasLower	

17.58.2.4 CBLAS_DIAG

enum CBLAS_DIAG

Enumerator

CblasNonUnit	
CblasUnit	

17.58.2.5 CBLAS_SIDE

enum CBLAS_SIDE

Enumerator

CblasLeft	
CblasRight	

17.58.3 Function Documentation

17.58.3.1 daxpy_()

```
void daxpy_ (
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            double * ,
            const int *  )
```

17.58.3.2 saxpy_()

```
void saxpy_ (
            const int * ,
            const float * ,
            const float * ,
            const int * ,
            float * ,
            const int * )
```

17.58.3.3 ddot_()

```
double ddot_ (
            const int * ,
            const double * ,
            const int * ,
            const double * ,
            const int * )
```

17.58.3.4 sdot_()

```
float sdot_ (
            const int * ,
            const float * ,
            const int * ,
            const float * ,
            const int * )
```

17.58.3.5 dasum_()

```
double dasum_ (
            const int * ,
            const double * ,
            const int * )
```

17.58.3.6 idamax_()

```
int idamax_ (
            const int * ,
            const double * ,
            const int * )
```

17.58.3.7 dnrm2_()

```
double dnrm2_ (
            const int * ,
            const double * ,
            const int * )
```

17.58.3.8 dgemv_()

```
void dgemv_ (
            const char * ,
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            const double * ,
            const int * ,
            const double * ,
            double * ,
            const int * )
```

17.58.3.9 sgemv_()

```
void sgemv_ (
            const char * ,
            const int * ,
            const int * ,
            const float * ,
            const float * ,
            const int * ,
            const float * ,
            const int * ,
            const float * ,
            float * ,
            const int * )
```

17.58.3.10 dger_()

```
void dger_ (
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            const double * ,
            const int * ,
            double * ,
            const int * )
```

17.58.3.11 sger_()

```
void sger_ (
            const int * ,
            const int * ,
            const float * ,
            const float * ,
            const int * ,
            const float * ,
            const int * ,
            float * ,
            const int * )
```

17.58.3.12 dcopy_()

```
void dcopy_ (
            const int * ,
            const double * ,
            const int * ,
            double * ,
            const int *  )
```

17.58.3.13 scopy_()

```
void scopy_ (
            const int * ,
            const float * ,
            const int * ,
            float * ,
            const int *  )
```

17.58.3.14 dscal_()

```
void dscal_ (
            const int * ,
            const double * ,
            double * ,
            const int *  )
```

17.58.3.15 sscal_()

```
void sscal_ (
            const int * ,
            const float * ,
            float * ,
            const int *  )
```

17.58.3.16 dtrsm_()

```
void dtrsm_ (
            const char * ,
            const char * ,
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            double * ,
            const int *  )
```

17.58.3.17 strsm_()

```
void strsm_ (
            const char * ,
            const char * ,
```

```
const char * ,
const char * ,
const int * ,
const int * ,
const float * ,
const float * ,
const int * ,
float * ,
const int * )
```

17.58.3.18 dtrmm_()

```
void dtrmm_ (
            const char * ,
            const char * ,
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            double * ,
            const int * )
```

17.58.3.19 strmm_()

```
void strmm_ (
            const char * ,
            const char * ,
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const float * ,
            const float * ,
            const int * ,
            float * ,
            const int * )
```

17.58.3.20 sgemm_()

```
void sgemm_ (
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const int * ,
            const float * ,
            const float * ,
            const int * ,
            const float * ,
            const int * ,
            const float * ,
            float * ,
            const int * )
```

17.58.3.21 dgemm_()

```
void dgemm_ (
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            const double * ,
            const int * ,
            const double * ,
            double * ,
            const int *  )
```

17.58.3.22 cblas_dsyrk()

```
void cblas_dsyrk (
            const enum CBLAS_ORDER Order,
            const enum CBLAS_UPLO Uplo,
            const enum CBLAS_TRANSPOSE Trans,
            const int N,
            const int K,
            const double alpha,
            const double * A,
            const int lda,
            const double beta,
            double * C,
            const int ldc )
```

17.59 config.h File Reference

Macros

- #define HAVE_BLAS 1
- #define HAVE_CBLAS 1
- #define HAVE_CXX11 1
- #define HAVE_DLFCN_H 1
- #define HAVE_FLOAT_H 1
- #define HAVE_INT128 1
- #define HAVE_INTTYPES_H 1
- #define HAVE_LAPACK 1
- #define HAVE_LIMITS_H 1
- #define HAVE_LITTLE_ENDIAN 1
- #define HAVE_MEMORY_H 1
- #define HAVE_PTHREAD_H 1
- #define HAVE_STDDEF_H 1
- #define HAVE_STDINT_H 1
- #define HAVE_STDLIB_H 1
- #define HAVE_STRINGS_H 1
- #define HAVE_STRING_H 1
- #define HAVE_SYS_STAT_H 1

- #define HAVE_SYS_TIME_H 1
- #define HAVE_SYS_TYPES_H 1
- #define HAVE_UNISTD_H 1
- #define LT_OBJDIR ".libs/"
- #define OPENBLAS_NUM_THREADS 1
- #define PACKAGE "fflas-ffpack"
- #define PACKAGE_BUGREPORT "ffpack-devel@googlegroups.com"
- #define PACKAGE_NAME "FFLAS-FFPACK"
- #define PACKAGE_STRING "FFLAS-FFPACK 2.5.0"
- #define PACKAGE_TARNAME "fflas-ffpack"
- #define PACKAGE_URL "https://github.com/linbox-team/fflas-ffpack"
- #define PACKAGE_VERSION "2.5.0"
- #define SIZEOF_CHAR 1
- #define SIZEOF_INT 4
- #define SIZEOF_LONG 8
- #define SIZEOF_LONG_LONG 8
- #define SIZEOF_SHORT 2
- #define SIZEOF___INT64_T 8
- #define STDC_HEADERS 1
- #define USE_OPENMP 1
- #define VERSION "2.5.0"

17.59.1 Macro Definition Documentation

17.59.1.1 HAVE_BLAS

```
#define HAVE_BLAS 1
```

17.59.1.2 HAVE_CBLAS

```
#define HAVE_CBLAS 1
```

17.59.1.3 HAVE_CXX11

```
#define HAVE_CXX11 1
```

17.59.1.4 HAVE_DLFCN_H

```
#define HAVE_DLFCN_H 1
```

17.59.1.5 HAVE_FLOAT_H

```
#define HAVE_FLOAT_H 1
```

17.59.1.6 HAVE_INT128

```
#define HAVE_INT128 1
```

17.59.1.7 HAVE_INTTYPES_H

```
#define HAVE_INTTYPES_H 1
```

17.59.1.8 HAVE_LAPACK

```
#define HAVE_LAPACK 1
```

17.59.1.9 HAVE_LIMITS_H

```
#define HAVE_LIMITS_H 1
```

17.59.1.10 HAVE_LITTLE_ENDIAN

```
#define HAVE_LITTLE_ENDIAN 1
```

17.59.1.11 HAVE_MEMORY_H

```
#define HAVE_MEMORY_H 1
```

17.59.1.12 HAVE_PTHREAD_H

```
#define HAVE_PTHREAD_H 1
```

17.59.1.13 HAVE_STDDEF_H

```
#define HAVE_STDDEF_H 1
```

17.59.1.14 HAVE_STDINT_H

```
#define HAVE_STDINT_H 1
```

17.59.1.15 HAVE_STDLIB_H

```
#define HAVE_STDLIB_H 1
```

17.59.1.16 HAVE_STRINGS_H

```
#define HAVE_STRINGS_H 1
```

17.59.1.17 HAVE_STRING_H

```
#define HAVE_STRING_H 1
```

17.59.1.18 HAVE_SYS_STAT_H

```
#define HAVE_SYS_STAT_H 1
```

17.59.1.19 HAVE_SYS_TIME_H

```
#define HAVE_SYS_TIME_H 1
```

17.59.1.20 HAVE_SYS_TYPES_H

```
#define HAVE_SYS_TYPES_H 1
```

17.59.1.21 HAVE_UNISTD_H

```
#define HAVE_UNISTD_H 1
```

17.59.1.22 LT_OBJDIR

```
#define LT_OBJDIR ".libs/"
```

17.59.1.23 OPENBLAS_NUM_THREADS

```
#define OPENBLAS_NUM_THREADS 1
```

17.59.1.24 PACKAGE

```
#define PACKAGE "fflas-ffpack"
```

17.59.1.25 PACKAGE_BUGREPORT

```
#define PACKAGE_BUGREPORT "ffpack-devel@googlegroups.com"
```

17.59.1.26 PACKAGE_NAME

```
#define PACKAGE_NAME "FFLAS-FFPACK"
```

17.59.1.27 PACKAGE_STRING

```
#define PACKAGE_STRING "FFLAS-FFPACK 2.5.0"
```

17.59.1.28 PACKAGE_TARNAME

```
#define PACKAGE_TARNAME "fflas-ffpack"
```

17.59.1.29 PACKAGE_URL

```
#define PACKAGE_URL "https://github.com/linbox-team/fflas-ffpack"
```

17.59.1.30 PACKAGE_VERSION

```
#define PACKAGE_VERSION "2.5.0"
```

17.59.1.31 SIZEOF_CHAR

```
#define SIZEOF_CHAR 1
```

17.59.1.32 SIZEOF_INT

```
#define SIZEOF_INT 4
```

17.59.1.33 SIZEOF_LONG

```
#define SIZEOF_LONG 8
```

17.59.1.34 SIZEOF_LONG_LONG

```
#define SIZEOF_LONG_LONG 8
```

17.59.1.35 SIZEOF_SHORT

```
#define SIZEOF_SHORT 2
```

17.59.1.36 SIZEOF___INT64_T

```
#define SIZEOF___INT64_T 8
```

17.59.1.37 STDC_HEADERS

```
#define STDC_HEADERS 1
```

17.59.1.38 USE_OPENMP

```
#define USE_OPENMP 1
```

17.59.1.39 VERSION

```
#define VERSION "2.5.0"
```

17.60 config.h File Reference

Macros

- #define __FFLASFFPACK_HAVE_BLAS 1
- #define __FFLASFFPACK_HAVE_CBLAS 1
- #define __FFLASFFPACK_HAVE_CXX11 1
- #define __FFLASFFPACK_HAVE_DLFCN_H 1
- #define __FFLASFFPACK_HAVE_FLOAT_H 1
- #define __FFLASFFPACK_HAVE_INT128 1
- #define __FFLASFFPACK_HAVE_INTTYPES_H 1
- #define __FFLASFFPACK_HAVE_LAPACK 1
- #define __FFLASFFPACK_HAVE_LIMITS_H 1
- #define __FFLASFFPACK_HAVE_LITTLE_ENDIAN 1
- #define __FFLASFFPACK_HAVE_MEMORY_H 1

- #define __FFLASFFPACK_HAVE_PTHREAD_H 1
- #define __FFLASFFPACK_HAVE_STDDEF_H 1
- #define __FFLASFFPACK_HAVE_STDINT_H 1
- #define __FFLASFFPACK_HAVE_STDLIB_H 1
- #define __FFLASFFPACK_HAVE_STRINGS_H 1
- #define __FFLASFFPACK_HAVE_STRING_H 1
- #define __FFLASFFPACK_HAVE_SYS_STAT_H 1
- #define __FFLASFFPACK_HAVE_SYS_TIME_H 1
- #define __FFLASFFPACK_HAVE_SYS_TYPES_H 1
- #define __FFLASFFPACK_HAVE_UNISTD_H 1
- #define __FFLASFFPACK_LT_OBJDIR ".libs/"
- #define __FFLASFFPACK_OPENBLAS_NUM_THREADS 1
- #define __FFLASFFPACK_PACKAGE "fflas-ffpack"
- #define __FFLASFFPACK_PACKAGE_BUGREPORT "ffpack-devel@googlegroups.com"
- #define __FFLASFFPACK_PACKAGE_NAME "FFLAS-FFPACK"
- #define __FFLASFFPACK_PACKAGE_STRING "FFLAS-FFPACK 2.5.0"
- #define __FFLASFFPACK_PACKAGE_TARNAME "fflas-ffpack"
- #define __FFLASFFPACK_PACKAGE_URL "https://github.com/linbox-team/fflas-ffpack"
- #define __FFLASFFPACK_PACKAGE_VERSION "2.5.0"
- #define __FFLASFFPACK_SIZEOF_CHAR 1
- #define __FFLASFFPACK_SIZEOF_INT 4
- #define __FFLASFFPACK_SIZEOF_LONG 8
- #define __FFLASFFPACK_SIZEOF_LONG_LONG 8
- #define __FFLASFFPACK_SIZEOF_SHORT 2
- #define __FFLASFFPACK_SIZEOF___INT64_T 8
- #define __FFLASFFPACK_STDC_HEADERS 1
- #define __FFLASFFPACK_USE_OPENMP 1
- #define __FFLASFFPACK_VERSION "2.5.0"

17.60.1 Macro Definition Documentation

17.60.1.1 __FFLASFFPACK_HAVE_BLAS

```
#define __FFLASFFPACK_HAVE_BLAS 1
```

17.60.1.2 __FFLASFFPACK_HAVE_CBLAS

```
#define __FFLASFFPACK_HAVE_CBLAS 1
```

17.60.1.3 __FFLASFFPACK_HAVE_CXX11

```
#define __FFLASFFPACK_HAVE_CXX11 1
```

17.60.1.4 __FFLASFFPACK_HAVE_DLFCN_H

```
#define __FFLASFFPACK_HAVE_DLFCN_H 1
```

17.60.1.5 __FFLASFFPACK_HAVE_FLOAT_H

```
#define __FFLASFFPACK_HAVE_FLOAT_H 1
```

17.60.1.6 __FFLASFFPACK_HAVE_INT128

```
#define __FFLASFFPACK_HAVE_INT128 1
```

17.60.1.7 __FFLASFFPACK_HAVE_INTTYPES_H

```
#define __FFLASFFPACK_HAVE_INTTYPES_H 1
```

17.60.1.8 __FFLASFFPACK_HAVE_LAPACK

```
#define __FFLASFFPACK_HAVE_LAPACK 1
```

17.60.1.9 __FFLASFFPACK_HAVE_LIMITS_H

```
#define __FFLASFFPACK_HAVE_LIMITS_H 1
```

17.60.1.10 __FFLASFFPACK_HAVE_LITTLE_ENDIAN

```
#define __FFLASFFPACK_HAVE_LITTLE_ENDIAN 1
```

17.60.1.11 __FFLASFFPACK_HAVE_MEMORY_H

```
#define __FFLASFFPACK_HAVE_MEMORY_H 1
```

17.60.1.12 __FFLASFFPACK_HAVE_PTHREAD_H

```
#define __FFLASFFPACK_HAVE_PTHREAD_H 1
```

17.60.1.13 __FFLASFFPACK_HAVE_STDDEF_H

```
#define __FFLASFFPACK_HAVE_STDDEF_H 1
```

17.60.1.14 __FFLASFFPACK_HAVE_STDINT_H

```
#define __FFLASFFPACK_HAVE_STDINT_H 1
```

17.60.1.15 __FFLASFFPACK_HAVE_STDLIB_H

```
#define __FFLASFFPACK_HAVE_STDLIB_H 1
```

17.60.1.16 __FFLASFFPACK_HAVE_STRINGS_H

```
#define __FFLASFFPACK_HAVE_STRINGS_H 1
```

17.60.1.17 __FFLASFFPACK_HAVE_STRING_H

```
#define __FFLASFFPACK_HAVE_STRING_H 1
```

17.60.1.18 __FFLASFFPACK_HAVE_SYS_STAT_H

```
#define __FFLASFFPACK_HAVE_SYS_STAT_H 1
```

17.60.1.19 __FFLASFFPACK_HAVE_SYS_TIME_H

```
#define __FFLASFFPACK_HAVE_SYS_TIME_H 1
```

17.60.1.20 __FFLASFFPACK_HAVE_SYS_TYPES_H

```
#define __FFLASFFPACK_HAVE_SYS_TYPES_H 1
```

17.60.1.21 __FFLASFFPACK_HAVE_UNISTD_H

```
#define __FFLASFFPACK_HAVE_UNISTD_H 1
```

17.60.1.22 __FFLASFFPACK_LT_OBJDIR

```
#define __FFLASFFPACK_LT_OBJDIR ".libs/"
```

17.60.1.23 __FFLASFFPACK_OPENBLAS_NUM_THREADS

```
#define __FFLASFFPACK_OPENBLAS_NUM_THREADS 1
```

17.60.1.24 __FFLASFFPACK_PACKAGE

```
#define __FFLASFFPACK_PACKAGE "fflas-ffpack"
```

17.60.1.25 __FFLASFFPACK_PACKAGE_BUGREPORT

```
#define __FFLASFFPACK_PACKAGE_BUGREPORT "ffpack-devel@googlegroups.com"
```

17.60.1.26 __FFLASFFPACK_PACKAGE_NAME

```
#define __FFLASFFPACK_PACKAGE_NAME "FFLAS-FFPACK"
```

17.60.1.27 __FFLASFFPACK_PACKAGE_STRING

```
#define __FFLASFFPACK_PACKAGE_STRING "FFLAS-FFPACK 2.5.0"
```

17.60.1.28 __FFLASFFPACK_PACKAGE_TARNAME

```
#define __FFLASFFPACK_PACKAGE_TARNAME "fflas-ffpack"
```

17.60.1.29 __FFLASFFPACK_PACKAGE_URL

```
#define __FFLASFFPACK_PACKAGE_URL "https://github.com/linbox-team/fflas-ffpack"
```

17.60.1.30 __FFLASFFPACK_PACKAGE_VERSION

```
#define __FFLASFFPACK_PACKAGE_VERSION "2.5.0"
```

17.60.1.31 __FFLASFFPACK_SIZEOF_CHAR

```
#define __FFLASFFPACK_SIZEOF_CHAR 1
```

17.60.1.32 __FFLASFFPACK_SIZEOF_INT

```
#define __FFLASFFPACK_SIZEOF_INT 4
```

17.60.1.33 __FFLASFFPACK_SIZEOF_LONG

```
#define __FFLASFFPACK_SIZEOF_LONG 8
```

17.60.1.34 __FFLASFFPACK_SIZEOF_LONG_LONG

```
#define __FFLASFFPACK_SIZEOF_LONG_LONG 8
```

17.60.1.35 __FFLASFFPACK_SIZEOF_SHORT

```
#define __FFLASFFPACK_SIZEOF_SHORT 2
```

17.60.1.36 __FFLASFFPACK_SIZEOF___INT64_T

```
#define __FFLASFFPACK_SIZEOF___INT64_T 8
```

17.60.1.37 __FFLASFFPACK_STDC_HEADERS

```
#define __FFLASFFPACK_STDC_HEADERS 1
```

17.60.1.38 __FFLASFFPACK_USE_OPENMP

```
#define __FFLASFFPACK_USE_OPENMP 1
```

17.60.1.39 __FFLASFFPACK_VERSION

```
#define __FFLASFFPACK_VERSION "2.5.0"
```

17.61 coo.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/coo/coo_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/coo/coo_spmv.inl"
#include "fflas-ffpack/fflas/fflas_sparse/coo/coo_spmm.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::COO >
- struct Sparse< _Field, SparseMatrix_t::COO_ZO >

Namespaces

- FFLAS

Functions

- template<class Field , class IndexT >
void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO_ZO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
void sparse_delete (const Sparse< Field, SparseMatrix_t::COO > &A)
- template<class Field >
void sparse_delete (const Sparse< Field, SparseMatrix_t::COO_ZO > &A)

17.62 coo_spmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_coo_spmm_INL

Functions

- template<class Field >
void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::Unparametric↩Tag)
- template<class Field >
void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
void fspmm_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_t block↩Size, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
void fspmm_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, size_↩t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::↩GenericTag)
- template<class Field >
void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::↩GenericTag)

- template<class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)

17.62.1 Macro Definition Documentation

17.62.1.1 __FFLASFFPACK_fflas_sparse_coo_spmm_INL

```
#define __FFLASFFPACK_fflas_sparse_coo_spmm_INL
```

17.63 coo_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_coo_spmv_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::COO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::COO_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.63.1 Macro Definition Documentation

17.63.1.1 __FFLASFFPACK_fflas_sparse_coo_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_coo_spmv_INL
```

17.64 coo_utils.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_sparse_coo_utils_INL

Functions

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::COO > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::COO_ZO > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::COO_ZO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.64.1 Macro Definition Documentation

17.64.1.1 __FFLASFFPACK_fflas_sparse_coo_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_coo_utils_INL
```

17.65 csr.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/csr/csr_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/csr/csr_spmv.inl"
#include "fflas-ffpack/fflas/fflas_sparse/csr/csr_spmm.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::CSR >
- struct Sparse< _Field, SparseMatrix_t::CSR_ZO >

Namespaces

- FFLAS

Functions

- template< class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template< class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR > &A)
- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_ZO > &A)

17.66 csr_hyb.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/csr_hyb/csr_hyb_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/csr_hyb/csr_hyb_spmv.inl"
#include "fflas-ffpack/fflas/fflas_sparse/csr_hyb/csr_hyb_spmm.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::CSR_HYB >

Namespaces

- FFLAS

Functions

- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_HYB > &A)
- template< class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_HYB > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.67 csr_hyb_pspmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmm_INL

Functions

- template< class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)

- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::↩ UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, const int64_t kmax)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, const int64_t kmax)

17.67.1 Macro Definition Documentation

17.67.1.1 __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmm_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmm_INL
```

17.68 csr_hyb_pspmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)

17.68.1 Macro Definition Documentation

17.68.1.1 __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_HYB_pspmv_INL
```

17.69 csr_hyb_spmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_HYB_spmm_INL

Functions

- template< class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template< class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)

17.69.1 Macro Definition Documentation

17.69.1.1 __FFLASFFPACK_fflas_sparse_CSR_HYB_spmm_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_HYB_spmm_INL
```

17.70 csr_hyb_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_HYB_spmv_INL

Functions

- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_HYB > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)

17.70.1 Macro Definition Documentation

17.70.1.1 __FFLASFFPACK_fflas_sparse_CSR_HYB_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_HYB_spmv_INL
```

17.71 csr_hyb_utils.inl File Reference

Data Structures

- struct Info
- struct Coo< ValT, IdxT >

Namespaces

- FFLAS
- FFLAS::csr_hyb_details

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_HYB_utils_INL

Functions

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_HYB > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_HYB > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.71.1 Macro Definition Documentation

17.71.1.1 __FFLASFFPACK_fflas_sparse_CSR_HYB_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_HYB_utils_INL
```

17.72 csr_pspmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_pspmm_INL

Functions

- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)

- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void pfspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)

17.72.1 Macro Definition Documentation

17.72.1.1 __FFLASFFPACK_fflas_sparse_CSR_pspmm_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_pspmm_INL
```

17.73 csr_pspmv.inl File Reference

```
#include <thread>
```

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_task (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const index_t iStart, const index_t iStop, FieldCategories::UnparametricTag)

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.73.1 Macro Definition Documentation

17.73.1.1 __FFLASFFPACK_fflas_sparse_CSR_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_pspmv_INL
```

17.74 csr_spmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_spmm_INL

Functions

- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, index_t blockSize, typename Field::ConstElement_ptr x_, index_t ldx, typename Field::Element_ptr y_, index_t ldy, FieldCategories::↩
  UnparametricTag)
- template<class Field >
  void fspmm_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_↩
  t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, Field↩
  Categories::UnparametricTag)
- template<class Field >
  void fspmm_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_↩
  t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, Field↩
  Categories::UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)

- template<class Field >
  void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::↩ GenericTag)
- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::↩ GenericTag)
- template<class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size↩ _t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, Field↩ Categories::UnparametricTag)
- template<class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)

17.74.1 Macro Definition Documentation

17.74.1.1 __FFLASFFPACK_fflas_sparse_CSR_spmm_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_spmm_INL
```

17.75 csr_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_CSR_spmv_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::CSR > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)

- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::CSR_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.75.1 Macro Definition Documentation

17.75.1.1 __FFLASFFPACK_fflas_sparse_CSR_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_CSR_spmv_INL
```

17.76 csr_utils.inl File Reference

Namespaces

- FFLAS

Functions

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::CSR_ZO > &A)
- template<class Field >
  std::ostream & sparse_print (std::ostream &os, const Sparse< Field, SparseMatrix_t::CSR > &A)
- template<class IndexT >
  void sparse_init (const Givaro::Modular< Givaro::Integer > &F, Sparse< Givaro::Modular< Givaro::Integer >, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, Givaro::Integer ∗dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT >
  void sparse_init (const Givaro::ZRing< Givaro::Integer > &F, Sparse< Givaro::ZRing< Givaro::Integer >, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, Givaro::Integer ∗dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT , size_t RECINT_SIZE>
  void sparse_init (const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> &F, Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class IndexT , size_t RECINT_SIZE>
  void sparse_init (const Givaro::ZRing< RecInt::rmint< RECINT_SIZE >> &F, Sparse< Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, typename Givaro::ZRing< RecInt::rmint< RECINT_SIZE >>::Element_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::CSR_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.77 cuda.C File Reference

```
#include <stdio.h>
#include <cuda_runtime.h>
#include <cusparse.h>
```

Functions

- int main ()

17.77.1 Function Documentation

17.77.1.1 main()

```
int main (
            void )
```

17.78 debug.h File Reference

Various utilities for debugging.

```
#include <fflas-ffpack/fflas-ffpack-config.h>
#include <iostream>
#include <sstream>
#include <cmath>
#include <stdexcept>
```

Data Structures

- class Failure

  A precondtion failed.

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define FFLASFFPACK_check(check)
- #define FFLASFFPACK_abort(msg)

Functions

- Failure & failure ()
- template<class T >
  bool isOdd (const T &a)
- bool isOdd (const float &a)
- bool isOdd (const double &a)

17.78.1 Detailed Description

Various utilities for debugging.

Todo we should put vector printing elsewhere.

17.78.2 Macro Definition Documentation

17.78.2.1 FFLASFFPACK_check

```
#define FFLASFFPACK_check(
                check )
```

Value:

```
if (!(check)) {\
    FFPACK::failure()(__func__, __FILE__, __LINE__, #check); \
    throw std::runtime_error(#check); \
}
```

17.78.2.2 FFLASFFPACK_abort

```
#define FFLASFFPACK_abort(
                msg )
```

Value:

```
{\
    FFPACK::failure()(__func__, __FILE__, __LINE__, msg); \
    throw std::runtime_error(msg); \
}
```

17.79 det.C File Reference

```
#include <givaro/modular.h>
#include <iostream>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Functions

- int main (int argc, char **argv)

  This example computes the determinant of a matrix over a defined finite field.

17.79.1 Function Documentation

17.79.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

This example computes the determinant of a matrix over a defined finite field.

Outputs the determinant.

17.80 ell.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/ell/ell_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/ell/ell_spmv.inl"
#include "fflas-ffpack/fflas/fflas_sparse/ell/ell_spmm.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::ELL >
- struct Sparse< _Field, SparseMatrix_t::ELL_ZO >

Namespaces

- FFLAS

Functions

- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_ZO > &A)

17.81 ell_pspmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_pspmm_INL

Functions

- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, const int64_t kmax)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, const int64_t kmax)
- template<class Field , class Func >
  void pfspmm_zo (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, Func &&func)

- template<class Field , class Func >
  void pfspmm_zo (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, Func &&func)

17.81.1 Macro Definition Documentation

17.81.1.1 __FFLASFFPACK_fflas_sparse_ELL_pspmm_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_pspmm_INL
```

17.82 ell_pspmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.82.1 Macro Definition Documentation

17.82.1.1 __FFLASFFPACK_fflas_sparse_ELL_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_pspmv_INL
```

17.83 ell_simd.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/ell_simd/ell_simd_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/ell_simd/ell_simd_spmv.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::ELL_simd >
- struct Sparse< _Field, SparseMatrix_t::ELL_simd_ZO >

Namespaces

- FFLAS

Functions

- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A)

17.84 ell_simd_pspmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_simd_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)

- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.84.1 Macro Definition Documentation

17.84.1.1 __FFLASFFPACK_fflas_sparse_ELL_simd_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_simd_pspmv_INL
```

17.85 ell_simd_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_simd_spmv_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_one_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

- template<class Field >
  void fspmv_mone_simd (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.85.1 Macro Definition Documentation

17.85.1.1 __FFLASFFPACK_fflas_sparse_ELL_simd_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_simd_spmv_INL
```

17.86 ell_simd_utils.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_simd_utils_INL

Functions

- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A)
- template<class Field >
  void sparse_print (const Sparse< Field, SparseMatrix_t::ELL_simd > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > &A, const IndexT ∗row, const IndexT ∗col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.86.1 Macro Definition Documentation

17.86.1.1 __FFLASFFPACK_fflas_sparse_ELL_simd_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_simd_utils_INL
```

17.87 ell_spmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_spmm_INL

Functions

- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, const int64_t kmax)
- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_one_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_one_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_aligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmm_mone_simd_unaligned (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x_, int ldx, typename Field::Element_ptr y_, int ldy, FieldCategories::UnparametricTag)

17.87.1 Macro Definition Documentation

17.87.1.1 __FFLASFFPACK_fflas_sparse_ELL_spmm_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_spmm_INL
```

17.88 ell_spmv.inl File Reference

Namespaces

- FFLAS

- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_spmv_INL

Functions

- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::ELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template< class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template< class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template< class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::ELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.88.1 Macro Definition Documentation

17.88.1.1 __FFLASFFPACK_fflas_sparse_ELL_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_spmv_INL
```

17.89 ell_utils.inl File Reference

```
#include <vector>
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_sparse_ELL_utils_INL

Functions

- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL > &A)
- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::ELL_ZO > &A)

- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::ELL_ZO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.89.1 Macro Definition Documentation

17.89.1.1 __FFLASFFPACK_fflas_sparse_ELL_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_ELL_utils_INL
```

17.90 fblas.C File Reference

```
#include "fflas-ffpack/config-blas.h"
```

Macros

- #define __FFLASFFPACK_CONFIGURATION

Functions

- void dgemm_ (const char *, const char *, const int *, const int *, const int *, const double *, const double *, const int *, const double *, const int *, const double *, double *, const int *)
- int main ()

17.90.1 Macro Definition Documentation

17.90.1.1 __FFLASFFPACK_CONFIGURATION

```
#define __FFLASFFPACK_CONFIGURATION
```

17.90.2 Function Documentation

17.90.2.1 dgemm_()

```
void dgemm_ (
            const char * ,
            const char * ,
            const int * ,
            const int * ,
            const int * ,
            const double * ,
            const double * ,
            const int * ,
            const double * ,
            const int * ,
            const double * ,
            double * ,
            const int *  )
```

17.90.2.2 main()

```
int main (
            void  )
```

17.91 fflas-101_1.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/fflas_io.h"
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.91.1 Function Documentation

17.91.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.92 fflas-101_3.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.92.1 Function Documentation

17.92.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.93 fflas-ffpack-config.h File Reference

Defaults for optimised values.

```
#include "fflas-ffpack/config.h"
#include "fflas-ffpack/fflas-ffpack-thresholds.h"
#include "fflas-ffpack/fflas-ffpack-default-thresholds.h"
#include "givaro/givconfig.h"
```

Macros

- #define GCC_VERSION (__GNUC__ * 10000 + __GNUC_MINOR__ * 100 + __GNUC_PATCHLEVEL__)

17.93.1 Detailed Description

Defaults for optimised values.

While `fflas-ffpack-optimise.h` is created by `configure` script, (either left blank or filled by optimiser), this file produces the defaults for the optimised values. If `fflas-ffpack-optimise.h` is not empty, then its values preceeds the defaults here.

17.93.2 Macro Definition Documentation

17.93.2.1 GCC_VERSION

```
#define GCC_VERSION (__GNUC__ * 10000 + __GNUC_MINOR__ * 100 + __GNUC_PATCHLEVEL__)
```

17.94 fflas-ffpack-default-thresholds.h File Reference

Macros

- #define __FFLASFFPACK_WINOTHRESHOLD 1000
- #define __FFLASFFPACK_WINOTHRESHOLD_FLT 2000
- #define __FFLASFFPACK_WINOTHRESHOLD_BAL 1000
- #define __FFLASFFPACK_WINOTHRESHOLD_BAL_FLT 2000
- #define __FFLASFFPACK_PLUQ_THRESHOLD 256
- #define __FFLASFFPACK_CHARPOLY_LUKrylov_ArithProg_THRESHOLD 1000
- #define __FFLASFFPACK_CHARPOLY_Danilevskii_LUKrylov_THRESHOLD 16
- #define __FFLASFFPACK_ARITHPROG_THRESHOLD 30
- #define __FFLASFFPACK_FTRTRI_THRESHOLD 32
- #define __FFLASFFPACK_FSYTRF_THRESHOLD 64
- #define __FFLASFFPACK_FSYRK_THRESHOLD 3000

17.94.1 Macro Definition Documentation

17.94.1.1 __FFLASFFPACK_WINOTHRESHOLD

```
#define __FFLASFFPACK_WINOTHRESHOLD 1000
```

17.94.1.2 __FFLASFFPACK_WINOTHRESHOLD_FLT

```
#define __FFLASFFPACK_WINOTHRESHOLD_FLT 2000
```

17.94.1.3 __FFLASFFPACK_WINOTHRESHOLD_BAL

```
#define __FFLASFFPACK_WINOTHRESHOLD_BAL 1000
```

17.94.1.4 __FFLASFFPACK_WINOTHRESHOLD_BAL_FLT

```
#define __FFLASFFPACK_WINOTHRESHOLD_BAL_FLT 2000
```

17.94.1.5 __FFLASFFPACK_PLUQ_THRESHOLD

```
#define __FFLASFFPACK_PLUQ_THRESHOLD 256
```

17.94.1.6 __FFLASFFPACK_CHARPOLY_LUKrylov_ArithProg_THRESHOLD

```
#define __FFLASFFPACK_CHARPOLY_LUKrylov_ArithProg_THRESHOLD 1000
```

17.94.1.7 __FFLASFFPACK_CHARPOLY_Danilevskii_LUKrylov_THRESHOLD

```
#define __FFLASFFPACK_CHARPOLY_Danilevskii_LUKrylov_THRESHOLD 16
```

17.94.1.8 __FFLASFFPACK_ARITHPROG_THRESHOLD

```
#define __FFLASFFPACK_ARITHPROG_THRESHOLD 30
```

17.94.1.9 __FFLASFFPACK_FTRTRI_THRESHOLD

```
#define __FFLASFFPACK_FTRTRI_THRESHOLD 32
```

17.94.1.10 __FFLASFFPACK_FSYTRF_THRESHOLD

```
#define __FFLASFFPACK_FSYTRF_THRESHOLD 64
```

17.94.1.11 __FFLASFFPACK_FSYRK_THRESHOLD

```
#define __FFLASFFPACK_FSYRK_THRESHOLD 3000
```

17.95 fflas-ffpack-thresholds.h File Reference

17.96 fflas-ffpack.doxy File Reference

17.97 fflas-ffpack.h File Reference

Includes FFLAS and FFPACK.

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas/fflas.h"
#include "ffpack/ffpack.h"
```

17.97.1 Detailed Description

Includes FFLAS and FFPACK.

17.98 fflas.doxy File Reference

17.99 fflas.h File Reference

Finite **F**ield **L**inear **A**lgebra **S**ubroutines

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/config.h"
#include "fflas-ffpack/config-blas.h"
#include <cmath>
#include <cstring>
#include <float.h>
#include <algorithm>
#include "fflas_enum.h"
#include "fflas-ffpack/utils/fflas_memory.h"
#include "fflas-ffpack/paladin/parallel.h"
#include "fflas_level1.inl"
#include "fflas_level2.inl"
#include "fflas_level3.inl"
#include "fflas-ffpack/checkers/checkers_fflas.h"
#include "fflas_freduce.h"
#include "fflas_fadd.h"
#include "fflas_fscal.h"
#include "fflas_fassign.h"
#include "fflas_fgemm.inl"
#include "fflas_pfgemm.inl"
#include "fflas_fgemv.inl"
#include "fflas-ffpack/paladin/pfgemv.inl"
#include "fflas_freivalds.inl"
#include "fflas_fger.inl"
#include "fflas_fsyrk.inl"
#include "fflas_fsyrk_strassen.inl"
#include "fflas_fsyr2k.inl"
#include "fflas_ftrsm.inl"
#include "fflas_pftrsm.inl"
#include "fflas_ftrmm.inl"
#include "fflas_ftrsv.inl"
#include "fflas_faxpy.inl"
#include "fflas_fdot.inl"
#include "fflas-ffpack/field/rns.h"
#include "fflas_fscal_mp.inl"
#include "fflas_freduce_mp.inl"
#include "fflas-ffpack/fflas/fflas_fger_mp.inl"
#include "fflas_fgemm/fgemm_classical_mp.inl"
#include "fflas_ftrsm_mp.inl"
#include "fflas_fgemv_mp.inl"
#include "fflas-ffpack/field/rns.inl"
#include "fflas-ffpack/paladin/fflas_plevel1.h"
#include "fflas_sparse.h"
#include "fflas-ffpack/checkers/checkers_fflas.inl"
```

Macros

- #define WINOTHRESHOLD __FFLASFFPACK_WINOTHRESHOLD
- #define DOUBLE_TO_FLOAT_CROSSOVER 800

    Thresholds determining which floating point representation to use, depending on the cardinality of the finite field.

17.99.1 Detailed Description

Finite **F**ield **L**inear **A**lgebra **S**ubroutines

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17.99.2 Macro Definition Documentation

17.99.2.1 WINOTHRESHOLD

```
#define WINOTHRESHOLD __FFLASFFPACK_WINOTHRESHOLD
```

17.99.2.2 DOUBLE_TO_FLOAT_CROSSOVER

```
#define DOUBLE_TO_FLOAT_CROSSOVER 800
```

Thresholds determining which floating point representation to use, depending on the cardinality of the finite field. This is only used when the element representation is not a floating point type.

Bug to be benchmarked.

17.100 fflas_101.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.100.1 Function Documentation

17.100.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.101 fflas_101_lvl1.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <iostream>
#include "fflas-ffpack/utils/fflas_io.h"
```

Functions

- int main (int argc, char **argv)

17.101.1 Function Documentation

17.101.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.102 fflas_bounds.inl File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/flimits.h"
#include <givaro/udl.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_bounds_INL
- #define FFLAS_INT_TYPE uint64_t

Functions

- template<class Field >
  double computeFactorClassic (const Field &F)
- template<> double computeFactorClassic (const Givaro::ModularBalanced< double > &F)
- template<> double computeFactorClassic (const Givaro::ModularBalanced< float > &F)
- template<class Field >
  size_t DotProdBoundClassic (const Field &F, const typename Field::Element &beta)
- Givaro::Integer InfNorm (const size_t M, const size_t N, const Givaro::Integer ∗A, const size_t lda)
- template<class Field >
  size_t TRSMBound (const Field &)

  TRSMBound.
- template<class Element >
  size_t TRSMBound (const Givaro::Modular< Element > &F)

  Specialization for positive modular representation over float.
- template<class Element >
  size_t TRSMBound (const Givaro::ModularBalanced< Element > &F)

  Specialization for balanced modular representation over double.

17.102.1 Macro Definition Documentation

17.102.1.1 __FFLASFFPACK_fflas_bounds_INL

```
#define __FFLASFFPACK_fflas_bounds_INL
```

17.102.1.2 FFLAS_INT_TYPE

```
#define FFLAS_INT_TYPE uint64_t
```

17.103 fflas_c.h File Reference

```
#include <stdbool.h>
#include <stdlib.h>
#include <inttypes.h>
```

Macros

- #define FFLAS_COMPILED

Enumerations

- enum FFLAS_C_ORDER { FflasRowMajor =101 , FflasColMajor =102 , FflasRowMajor =101 , FflasColMajor =102 }

    Storage by row or col ?
- enum FFLAS_C_TRANSPOSE { FflasNoTrans = 111 , FflasTrans = 112 , FflasNoTrans = 111 , FflasTrans = 112 }

    Is matrix transposed ?
- enum FFLAS_C_UPLO { FflasUpper = 121 , FflasLower = 122 , FflasUpper = 121 , FflasLower = 122 }

    Is triangular matrix's shape upper ?
- enum FFLAS_C_DIAG { FflasNonUnit = 131 , FflasUnit = 132 , FflasNonUnit = 131 , FflasUnit = 132 }

    Is the triangular matrix implicitly unit diagonal ?
- enum FFLAS_C_SIDE { FflasLeft = 141 , FflasRight = 142 , FflasLeft = 141 , FflasRight = 142 }

    On what side ?
- enum FFLAS_C_BASE { FflasDouble = 151 , FflasFloat = 152 , FflasGeneric = 153 }

    FFLAS_C_BASE determines the type of the element representation for Matrix Mult kernel.

Functions

- void freducein_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, bool positive)
- void freduce_1_modular_double (const double F, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fnegin_1_modular_double (const double F, const size_t n, double ∗X, const size_t incX, bool positive)
- void fneg_1_modular_double (const double p, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fzero_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, bool positive)
- bool fiszero_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, bool positive)
- bool fequal_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, const double ∗Y, const size_t incY, bool positive)
- void fassign_1_modular_double (const double p, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fscalin_1_modular_double (const double p, const size_t n, const double alpha, double ∗X, const size_t incX, bool positive)
- void fscal_1_modular_double (const double p, const size_t n, const double alpha, const double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- void faxpy_1_modular_double (const double p, const size_t n, const double alpha, const double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- double fdot_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, const double ∗Y, const size_t incY, bool positive)

- void fswap_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- void fadd_1_modular_double (const double p, const size_t n, const double ∗A, const size_t incA, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void fsub_1_modular_double (const double p, const size_t n, const double ∗A, const size_t incA, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void faddin_1_modular_double (const double p, const size_t n, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void fsubin_1_modular_double (const double p, const size_t n, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void fassign_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size↵_t ldB, double ∗A, const size_t ldA, bool positive)
- void fzero_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t ldA, bool positive)
- bool fequal_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t ldA, const double ∗B, const size_t ldB, bool positive)
- bool fiszero_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size↵_t ldA, bool positive)
- void fidentity_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t ldA, const double d, bool positive)
- void freducein_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t ldA, bool positive)
- void freduce_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldB, double ∗A, const size_t ldA, bool positive)
- void fnegin_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t ldA, bool positive)
- void fneg_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldB, double ∗A, const size_t ldA, bool positive)
- void fscalin_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, double ∗A, const size_t ldA, bool positive)
- void fscal_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)
- void faxpy_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗X, const size_t ldX, double ∗Y, const size_t ldY, bool positive)
- void fmove_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)
- void fadd_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t ldA, const double ∗B, const size_t ldB, double ∗C, const size_t ldC, bool positive)
- void fsub_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t ldA, const double ∗B, const size_t ldB, double ∗C, const size_t ldC, bool positive)
- void fsubin_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldB, double ∗C, const size_t ldC, bool positive)
- void faddin_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldB, double ∗C, const size_t ldC, bool positive)
- double ∗ fgemv_2_modular_double (const double p, const enum FFLAS_C_TRANSPOSE TransA, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t ldA, const double ∗X, const size_t incX, const double betA, double ∗Y, const size_t incY, bool positive)
- void fger_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗x, const size_t incX, const double ∗y, const size_t incY, double ∗A, const size_t ldA, bool positive)
- void ftrsv_2_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE TransA, const enum FFLAS_C_DIAG Diag, const size_t n, const double ∗A, const size_t ldA, double ∗X, int incX, bool positive)
- void ftrsm_3_modular_double (const double p, const enum FFLAS_C_SIDE Side, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE TransA, const enum FFLAS_C_DIAG Diag, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)

- void ftrmm_3_modular_double (const double p, const enum FFLAS_C_SIDE Side, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE TransA, const enum FFLAS_C_DIAG Diag, const size_t m, const size_t n, const double alpha, double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)
- double ∗ fgemm_3_modular_double (const double p, const enum FFLAS_C_TRANSPOSE tA, const enum FFLAS_C_TRANSPOSE tB, const size_t m, const size_t n, const size_t k, const double alpha, const double ∗A, const size_t ldA, const double ∗B, const size_t ldB, const double betA, double ∗C, const size_t ldC, bool positive)
- double ∗ fsquare_3_modular_double (const double p, const enum FFLAS_C_TRANSPOSE tA, const size_t n, const double alpha, const double ∗A, const size_t ldA, const double betA, double ∗C, const size_t ldC, bool positive)

17.103.1 Macro Definition Documentation

17.103.1.1 FFLAS_COMPILED

```
#define FFLAS_COMPILED
```

17.103.2 Enumeration Type Documentation

17.103.2.1 FFLAS_C_ORDER

```
enum FFLAS_C_ORDER
```

Storage by row or col ?

Enumerator

FflasRowMajor	row major
FflasColMajor	col major
FflasRowMajor	
FflasColMajor	

17.103.2.2 FFLAS_C_TRANSPOSE

```
enum FFLAS_C_TRANSPOSE
```

Is matrix transposed ?

Enumerator

FflasNoTrans	Matrix is not transposed.
FflasTrans	Matrix is transposed.
FflasNoTrans	
FflasTrans	

17.103.2.3 FFLAS_C_UPLO

```
enum FFLAS_C_UPLO
```

Is triangular matrix's shape upper ?

Enumerator

FflasUpper	Triangular matrix is Upper triangular (if $i > j$ then $T_{i,j} = 0$)
FflasLower	Triangular matrix is Lower triangular (if $i < j$ then $T_{i,j} = 0$)
FflasUpper	
FflasLower	

17.103.2.4 FFLAS_C_DIAG

`enum FFLAS_C_DIAG`

Is the triangular matrix implicitly unit diagonal ?

Enumerator

FflasNonUnit	Triangular matrix has an explicit arbitrary diagonal.
FflasUnit	Triangular matrix has an implicit unit diagonal ($T_{i,i} = 1$)
FflasNonUnit	
FflasUnit	

17.103.2.5 FFLAS_C_SIDE

`enum FFLAS_C_SIDE`

On what side ?

Enumerator

FflasLeft	Operator applied on the left.
FflasRight	Operator applied on the rigth.
FflasLeft	
FflasRight	

17.103.2.6 FFLAS_C_BASE

`enum FFLAS_C_BASE`

`FFLAS_C_BASE` determines the type of the element representation for Matrix Mult kernel. (deprecated, should not be used)

Enumerator

FflasDouble	to use the double precision BLAS
FflasFloat	to use the single precison BLAS
FflasGeneric	for any other domain, that can not be converted to floating point integers

17.103.3 Function Documentation

17.103.3.1 freducein_1_modular_double()

```
void freducein_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.2 freduce_1_modular_double()

```
void freduce_1_modular_double (
            const double F,
            const size_t n,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.3 fnegin_1_modular_double()

```
void fnegin_1_modular_double (
            const double F,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.4 fneg_1_modular_double()

```
void fneg_1_modular_double (
            const double p,
            const size_t n,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.5 fzero_1_modular_double()

```
void fzero_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.6 fiszero_1_modular_double()

```
bool fiszero_1_modular_double (
            const double p,
            const size_t n,
```

```
const double * X,
const size_t incX,
bool positive )
```

17.103.3.7 fequal_1_modular_double()

```
bool fequal_1_modular_double (
            const double p,
            const size_t n,
            const double * X,
            const size_t incX,
            const double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.8 fassign_1_modular_double()

```
void fassign_1_modular_double (
            const double p,
            const size_t n,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.9 fscalin_1_modular_double()

```
void fscalin_1_modular_double (
            const double p,
            const size_t n,
            const double alpha,
            double * X,
            const size_t incX,
            bool positive )
```

17.103.3.10 fscal_1_modular_double()

```
void fscal_1_modular_double (
            const double p,
            const size_t n,
            const double alpha,
            const double * X,
            const size_t incX,
            double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.11 faxpy_1_modular_double()

```
void faxpy_1_modular_double (
            const double p,
            const size_t n,
            const double alpha,
```

```
            const double * X,
            const size_t incX,
            double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.12 fdot_1_modular_double()

```
double fdot_1_modular_double (
            const double p,
            const size_t n,
            const double * X,
            const size_t incX,
            const double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.13 fswap_1_modular_double()

```
void fswap_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.14 fadd_1_modular_double()

```
void fadd_1_modular_double (
            const double p,
            const size_t n,
            const double * A,
            const size_t incA,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.103.3.15 fsub_1_modular_double()

```
void fsub_1_modular_double (
            const double p,
            const size_t n,
            const double * A,
            const size_t incA,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.103.3.16 faddin_1_modular_double()

```
void faddin_1_modular_double (
            const double p,
            const size_t n,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.103.3.17 fsubin_1_modular_double()

```
void fsubin_1_modular_double (
            const double p,
            const size_t n,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.103.3.18 fassign_2_modular_double()

```
void fassign_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldB,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.19 fzero_2_modular_double()

```
void fzero_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.20 fequal_2_modular_double()

```
bool fequal_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t ldA,
            const double * B,
            const size_t ldB,
            bool positive )
```

17.103.3.21 fiszero_2_modular_double()

```
bool fiszero_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.22 fidentity_2_modular_double()

```
void fidentity_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t ldA,
            const double d,
            bool positive )
```

17.103.3.23 freducein_2_modular_double()

```
void freducein_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.24 freduce_2_modular_double()

```
void freduce_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldB,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.25 fnegin_2_modular_double()

```
void fnegin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.26 fneg_2_modular_double()

```
void fneg_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldB,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.27 fscalin_2_modular_double()

```
void fscalin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.28 fscal_2_modular_double()

```
void fscal_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t ldA,
            double * B,
            const size_t ldB,
            bool positive )
```

17.103.3.29 faxpy_2_modular_double()

```
void faxpy_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * X,
            const size_t ldX,
            double * Y,
            const size_t ldY,
            bool positive )
```

17.103.3.30 fmove_2_modular_double()

```
void fmove_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
```

```
            double * A,
            const size_t ldA,
            double * B,
            const size_t ldB,
            bool positive )
```

17.103.3.31 fadd_2_modular_double()

```
void fadd_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t ldA,
            const double * B,
            const size_t ldB,
            double * C,
            const size_t ldC,
            bool positive )
```

17.103.3.32 fsub_2_modular_double()

```
void fsub_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t ldA,
            const double * B,
            const size_t ldB,
            double * C,
            const size_t ldC,
            bool positive )
```

17.103.3.33 fsubin_2_modular_double()

```
void fsubin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldB,
            double * C,
            const size_t ldC,
            bool positive )
```

17.103.3.34 faddin_2_modular_double()

```
void faddin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldB,
            double * C,
```

```
            const size_t ldC,
            bool positive )
```

17.103.3.35 fgemv_2_modular_double()

```
double* fgemv_2_modular_double (
            const double p,
            const enum FFLAS_C_TRANSPOSE TransA,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t ldA,
            const double * X,
            const size_t incX,
            const double betA,
            double * Y,
            const size_t incY,
            bool positive )
```

17.103.3.36 fger_2_modular_double()

```
void fger_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * x,
            const size_t incX,
            const double * y,
            const size_t incY,
            double * A,
            const size_t ldA,
            bool positive )
```

17.103.3.37 ftrsv_2_modular_double()

```
void ftrsv_2_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_TRANSPOSE TransA,
            const enum FFLAS_C_DIAG Diag,
            const size_t n,
            const double * A,
            const size_t ldA,
            double * X,
            int incX,
            bool positive )
```

17.103.3.38 ftrsm_3_modular_double()

```
void ftrsm_3_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const enum FFLAS_C_UPLO Uplo,
```

```
              const enum FFLAS_C_TRANSPOSE TransA,
              const enum FFLAS_C_DIAG Diag,
              const size_t m,
              const size_t n,
              const double alpha,
              const double * A,
              const size_t ldA,
              double * B,
              const size_t ldB,
              bool positive )
```

17.103.3.39 ftrmm_3_modular_double()

```
void ftrmm_3_modular_double (
              const double p,
              const enum FFLAS_C_SIDE Side,
              const enum FFLAS_C_UPLO Uplo,
              const enum FFLAS_C_TRANSPOSE TransA,
              const enum FFLAS_C_DIAG Diag,
              const size_t m,
              const size_t n,
              const double alpha,
              double * A,
              const size_t ldA,
              double * B,
              const size_t ldB,
              bool positive )
```

17.103.3.40 fgemm_3_modular_double()

```
double* fgemm_3_modular_double (
              const double p,
              const enum FFLAS_C_TRANSPOSE tA,
              const enum FFLAS_C_TRANSPOSE tB,
              const size_t m,
              const size_t n,
              const size_t k,
              const double alpha,
              const double * A,
              const size_t ldA,
              const double * B,
              const size_t ldB,
              const double betA,
              double * C,
              const size_t ldC,
              bool positive )
```

17.103.3.41 fsquare_3_modular_double()

```
double* fsquare_3_modular_double (
              const double p,
              const enum FFLAS_C_TRANSPOSE tA,
              const size_t n,
              const double alpha,
              const double * A,
              const size_t ldA,
```

```
const double betA,
double * C,
const size_t ldC,
bool positive )
```

17.104 fflas_enum.h File Reference

`#include <algorithm>`

Data Structures

- class AreEqual< X, Y >
- class AreEqual< X, X >

Namespaces

- FFLAS
- FFLAS::Protected

Enumerations

- enum FFLAS_ORDER { FflasRowMajor =101 , FflasColMajor =102 }

  Storage by row or col ?
- enum FFLAS_TRANSPOSE { FflasNoTrans = 111 , FflasTrans = 112 }

  Is matrix transposed ?
- enum FFLAS_UPLO { FflasUpper = 121 , FflasLower = 122 , FflasLeftTri = 123 , FflasRightTri = 124 }

  Is triangular matrix's shape upper ?
- enum FFLAS_DIAG { FflasNonUnit = 131 , FflasUnit = 132 }

  Is the triangular matrix implicitly unit diagonal ?
- enum FFLAS_SIDE { FflasLeft = 141 , FflasRight = 142 }

  On what side ?
- enum FFLAS_BASE { FflasDouble = 151 , FflasFloat = 152 , FflasGeneric = 153 }

  `FFLAS_BASE` *determines the type of the element representation for Matrix Mult kernel.*

Functions

- template<class T >
  const T & min3 (const T &m, const T &n, const T &k)
- template<class T >
  const T & max3 (const T &m, const T &n, const T &k)
- template<class T >
  const T & min4 (const T &m, const T &n, const T &k, const T &l)
- template<class T >
  const T & max4 (const T &m, const T &n, const T &k, const T &l)

17.105 fflas_fadd.h File Reference

```
#include "fflas-ffpack/fflas/fflas_simd.h"
#include "fflas_fadd.inl"
```

Data Structures

- struct support_simd_add< T >

Namespaces

- FFLAS

Functions

- template<class Field >
  void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void faddin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void fsub (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void fsubin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void pfadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
  void pfsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
  void pfaddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
  void pfsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
  void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadd : matrix addition.
- template<class Field >
  void fsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsub : matrix subtraction.
- template<class Field >
  void faddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size↩
  _t ldb, typename Field::Element_ptr C, const size_t ldc)

  faddin
- template<class Field >
  void faddin (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadding for symmetric matrices
- template<class Field >
  void fsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsubin C = C - B

- template<class Field >
void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

    fadd : matrix addition with scaling.

17.106 fflas_fadd.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_simd.h"
```

Namespaces

- FFLAS
- FFLAS::vectorised
- FFLAS::details

Macros

- #define __FFLASFFPACK_fadd_INL

Functions

- template<class SimdT , class Element , bool positive>
std::enable_if< is_simd< SimdT >::value, void >::type VEC_ADD (SimdT &C, SimdT &A, SimdT &B, SimdT &Q, SimdT &T, SimdT &P, SimdT &NEGP, SimdT &MIN, SimdT &MAX)
- template<bool positive, class Element , class T1 , class T2 >
std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type addp (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n, Element p, T1 min_, T2 max_)
- template<class SimdT , class Element , bool positive>
std::enable_if< is_simd< SimdT >::value, void >::type VEC_SUB (SimdT &C, SimdT &A, SimdT &B, SimdT &Q, SimdT &T, SimdT &P, SimdT &NEGP, SimdT &MIN, SimdT &MAX)
- template<bool positive, class Element , class T1 , class T2 >
std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type subp (Element ∗T, const Element ∗TA, const Element ∗TB, const size_t n, const Element p, const T1 min_, const T2 max_)
- template<class Element >
std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type add (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n)
- template<class Element >
std::enable_if< FFLAS::support_simd_add< Element >::value, void >::type sub (Element ∗T, const Element ∗TA, const Element ∗TB, size_t n)
- template<class Field , bool ADD>
std::enable_if< FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, Field↩ Categories::ModularTag)
- template<class Field , bool ADD>
std::enable_if<!FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, Field↩ Categories::ModularTag)
- template<class Field , bool ADD>
void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, Field↩ Categories::GenericTag)

- template<class Field , bool ADD>
  std::enable_if<!FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::UnparametricTag)
- template<class Field , bool ADD>
  std::enable_if< FFLAS::support_simd_add< typename Field::Element >::value, void >::type fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc, FieldCategories::UnparametricTag)

17.106.1 Macro Definition Documentation

17.106.1.1 __FFLASFFPACK_fadd_INL

```
#define __FFLASFFPACK_fadd_INL
```

17.107 fflas_fassign.h File Reference

```
#include "fflas_fassign.inl"
```

17.108 fflas_fassign.inl File Reference

```
#include <string.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <givaro/zring.h>
#include "fflas-ffpack/utils/debug.h"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fassign_INL

Functions

- template<class Field >
  void fassign (const Field &F, const size_t N, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  fassign : $x \leftarrow y$.
- template<> void fassign (const Givaro::Modular< float > &F, const size_t N, const float ∗Y, const size_t incY, float ∗X, const size_t incX)
- template<> void fassign (const Givaro::ModularBalanced< float > &F, const size_t N, const float ∗Y, const size_t incY, float ∗X, const size_t incX)
- template<> void fassign (const Givaro::ZRing< float > &F, const size_t N, const float ∗Y, const size_t incY, float ∗X, const size_t incX)
- template<> void fassign (const Givaro::Modular< double > &F, const size_t N, const double ∗Y, const size_t incY, double ∗X, const size_t incX)

- template<> void fassign (const Givaro::ModularBalanced< double > &F, const size_t N, const double ∗Y, const size_t incY, double ∗X, const size_t incX)
- template<> void fassign (const Givaro::ZRing< double > &F, const size_t N, const double ∗Y, const size_t incY, double ∗X, const size_t incX)
- template<class Field >
  void fassign (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  fassign : $A \leftarrow B$.

17.108.1 Macro Definition Documentation

17.108.1.1 __FFLASFFPACK_fassign_INL

```
#define __FFLASFFPACK_fassign_INL
```

17.109 fflas_faxpy.inl File Reference

Namespaces

- FFLAS
- FFLAS::vectorised
- FFLAS::vectorised::unswitch
- FFLAS::details

Macros

- #define __FFLASFFPACK_faxpy_INL

Functions

- template<class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, const size_t incX, const size_t incY, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type axpyp (const Field &F, const typename Field::Element a, typename Field::ConstElement_ptr X, typename Field::Element_ptr Y, const size_t n, const size_t incX, const size_t incY)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type faxpy (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size←
  _t incX, typename Field::Element_ptr Y, const size_t incY, FieldCategories::ModularTag)
- template<class Field , class FC >
  void faxpy (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FC)

- template<class Field >
  void faxpy (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template<> void faxpy (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::↩ Element a, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void faxpy (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, Givaro::FloatDomain::Element_ptr y, const size_t incy)
- template<class Field >
  void faxpy (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t ldx, typename Field::Element_ptr Y, const size_t ldy)

  faxpy : $y \leftarrow \alpha \cdot x + y$.

17.109.1 Macro Definition Documentation

17.109.1.1 __FFLASFFPACK_faxpy_INL

```
#define __FFLASFFPACK_faxpy_INL
```

17.110 fflas_fdot.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_helpers.inl"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fdot_INL

Functions

- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DelayedTag &MT)
- template<> Givaro::DoubleDomain::Element fdot (const Givaro::DoubleDomain &, const size_t N, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<> Givaro::FloatDomain::Element fdot (const Givaro::FloatDomain &, const size_t N, Givaro::FloatDomain::ConstElem x, const size_t incx, Givaro::FloatDomain::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultTag &MT)
- template<class Field , class T >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::ConvertTo< T > &MT)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, ModeCategories::DefaultBoundedTag &dbt)

- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, const ParSeqHelper::Sequential seq)
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fdot: dot product $x^T y$.

17.110.1 Macro Definition Documentation

17.110.1.1 __FFLASFFPACK_fdot_INL

```
#define __FFLASFFPACK_fdot_INL
```

17.111 fflas_fgemm.inl File Reference

```
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/debug.h"
#include "fflas_fgemm/fgemm_classical.inl"
#include "fflas_fgemm/fgemm_winograd.inl"
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fgemm_INL

Functions

- template<class NewField , class Field , class FieldMode >
  Field::Element_ptr fgemm_convert (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H)
- template<class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedPreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedPreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedPreSubReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedPreSubReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)

- template<class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedDoublePreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, Element beta, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template<class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedDoublePreAddReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, Element beta, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template<class Field , class AlgoT , class ParSeqTrait >
  void ScalAndReduce (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr X, const size_t incX, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field , class AlgoT , class ParSeqTrait >
  void ScalAndReduce (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag >, ParSeqHelper::Sequential > &H)
- template<typename Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template<typename Field , class Cut , class Param >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par)
- template<typename Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *fgemm: Field **GE**neral **M**atrix **M**ultiply.*
- template<typename Field , class ModeT , class ParSeq >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Auto, ModeT, ParSeq > &H)
- template<class Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential > &H)
- template<class Field >
  Field::Element_ptr fsquare (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

fsquare: Squares a matrix.

- template<class Field >
  Field::Element_ptr fsquareCommon (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)
- template<> double ∗ fsquare (const Givaro::ModularBalanced< double > &F, const FFLAS_TRANSPOSE ta, const size_t n, const double alpha, const double ∗A, const size_t lda, const double beta, double ∗C, const size_t ldc)
- template<> float ∗ fsquare (const Givaro::ModularBalanced< float > &F, const FFLAS_TRANSPOSE ta, const size_t n, const float alpha, const float ∗A, const size_t lda, const float beta, float ∗C, const size_t ldc)
- template<> double ∗ fsquare (const Givaro::Modular< double > &F, const FFLAS_TRANSPOSE ta, const size_t n, const double alpha, const double ∗A, const size_t lda, const double beta, double ∗C, const size_t ldc)
- template<> float ∗ fsquare (const Givaro::Modular< float > &F, const FFLAS_TRANSPOSE ta, const size_t n, const float alpha, const float ∗A, const size_t lda, const float beta, float ∗C, const size_t ldc)

17.111.1 Macro Definition Documentation

17.111.1.1 __FFLASFFPACK_fgemm_INL

```
#define __FFLASFFPACK_fgemm_INL
```

17.112 fflas_fgemv.inl File Reference

```
#include <givaro/zring.h>
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fgemv_INL

Functions

- template<typename FloatElement , class Field >
  Field::Element_ptr fgemv_convert (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)

- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE TransA, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)

  finite prime Field GEneral Matrix Vector multiplication.
- Givaro::ZRing< int64_t >::Element_ptr fgemv (const Givaro::ZRing< int64_t > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const int64_t alpha, const int64_t *A, const size_t lda, const int64_t *X, const size_t incX, const int64_t beta, int64_t *Y, const size_t incY, MMHelper< Givaro::ZRing< int64_t >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- Givaro::DoubleDomain::Element_ptr fgemv (const Givaro::DoubleDomain &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const Givaro::DoubleDomain::Element alpha, const Givaro::DoubleDomain::ConstElement_ptr A, const size_t lda, const Givaro::DoubleDomain::ConstElement_ptr X, const size_t incX, const Givaro::DoubleDomain::Element beta, Givaro::DoubleDomain::Element_ptr Y, const size_t incY, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- Givaro::FloatDomain::Element_ptr fgemv (const Givaro::FloatDomain &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const Givaro::FloatDomain::Element alpha, const Givaro::FloatDomain::ConstElement_ptr A, const size_t lda, const Givaro::FloatDomain::ConstElement_ptr X, const size_t incX, const Givaro::FloatDomain::Element beta, Givaro::FloatDomain::Element_ptr Y, const size_t incY, MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field , class Cut , class Param >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, ParSeqHelper::Parallel< Cut, Param > &parH)
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, ParSeqHelper::Sequential &seqH)

17.112.1 Macro Definition Documentation

17.112.1.1 __FFLASFFPACK_fgemv_INL

```
#define __FFLASFFPACK_fgemv_INL
```

17.113 fflas_fgemv_mp.inl File Reference

```
#include "fflas-ffpack/field/rns-integer-mod.h"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fgemv_mp_INL

Functions

- FFPACK::rns_double::Element_ptr fgemv (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::ConstElement_ptr X, const size_t incX, const FFPACK::rns_double::Element beta, FFPACK::rns_double::Element_ptr Y, const size_t incY, MMHelper< FFPACK::RNSInteger< FFPACK::rns_double >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- FFPACK::rns_double::Element_ptr fgemv (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const FFLAS_TRANSPOSE ta, const size_t M, const size_t N, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t lda, FFPACK::rns_double::ConstElement_ptr X, const size_t incX, const FFPACK::rns_double::Element beta, FFPACK::rns_double::Element_ptr Y, const size_t incY, MMHelper< FFPACK::RNSIntegerMod< FFPACK::rns_double >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- Givaro::Integer ∗ fgemv (const Givaro::ZRing< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const Givaro::Integer alpha, Givaro::Integer ∗A, const size_t lda, Givaro::Integer ∗X, const size_t ldx, Givaro::Integer beta, Givaro::Integer ∗Y, const size_t ldy, MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- Givaro::Integer ∗ fgemv (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const Givaro::Integer alpha, Givaro::Integer ∗A, const size_t lda, Givaro::Integer ∗X, const size_t ldx, Givaro::Integer beta, Givaro::Integer ∗Y, const size_t ldy, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- template<size_t K1, size_t K2, class ParSeq >
  RecInt::ruint< K1 > ∗ fgemv (const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const RecInt::ruint< K1 > alpha, const RecInt::ruint< K1 > ∗A, const size_t lda, const RecInt::ruint< K1 > ∗X, const size_t incx, RecInt::ruint< K1 > beta, RecInt::ruint< K1 > ∗Y, const size_t incy, MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)

17.113.1 Macro Definition Documentation

17.113.1.1 __FFLASFFPACK_fgemv_mp_INL

```
#define __FFLASFFPACK_fgemv_mp_INL
```

17.114 fflas_fger.inl File Reference

Namespaces

- FFLAS

- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fger_INL

Functions

- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda)

  fger: rank one update of a general matrix
- template< class FloatElement , class Field >
  void fger_convert (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda)
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::MachineFloatTag > > &H)
- template< class Field , class AnyTag >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, AnyTag > &H)
- void fger (const Givaro::DoubleDomain &F, const size_t M, const size_t N, const Givaro::DoubleDomain::Element alpha, const Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, const Givaro::DoubleDomain::ConstElement_ptr y, const size_t incy, Givaro::DoubleDomain::Element_ptr A, const size_t lda, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, const typename Field::ConstElement_ptr x, const size_t incx, const typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- void fger (const Givaro::FloatDomain &F, const size_t M, const size_t N, const Givaro::FloatDomain::Element alpha, const Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, const Givaro::FloatDomain::ConstElement_ptr y, const size_t incy, Givaro::FloatDomain::Element_ptr A, const size_t lda, MMHelper< Givaro::FloatDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template< class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)

17.114.1 Macro Definition Documentation

17.114.1.1 __FFLASFFPACK_fger_INL

```
#define __FFLASFFPACK_fger_INL
```

17.115 fflas_fger_mp.inl File Reference

```
#include <givaro/modular-integer.h>
#include <givaro/zring.h>
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas-ffpack/fflas/fflas_fgemm/fgemm_classical_mp.inl"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/field/rns-integer-mod.h"
```

Namespaces

- FFLAS

Macros

- #define __FFPACK_fger_mp_INL

Functions

- void fger (const Givaro::Modular< Givaro::Integer > &F, const size_t M, const size_t N, const typename Givaro::Integer alpha, typename Givaro::Integer *x, const size_t incx, typename Givaro::Integer *y, const size_t incy, typename Givaro::Integer *A, const size_t lda, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- template<typename RNS >
  void fger (const FFPACK::RNSInteger< RNS > &F, const size_t M, const size_t N, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::Element_ptr x, const size_t incx, typename FFPACK::RNSInteger< RNS >::Element_ptr y, const size_t incy, typename FFPACK::RNSInteger< RNS >::Element_ptr A, const size_t lda, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<typename RNS >
  void fger (const FFPACK::RNSIntegerMod< RNS > &F, const size_t M, const size_t N, const typename FFPACK::RNSIntegerMod< RNS >::Element alpha, typename FFPACK::RNSIntegerMod< RNS >↩
  ::Element_ptr x, const size_t incx, typename FFPACK::RNSIntegerMod< RNS >::Element_ptr y, const size_t incy, typename FFPACK::RNSIntegerMod< RNS >::Element_ptr A, const size_t lda, MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Classic > &H)

17.115.1 Macro Definition Documentation

17.115.1.1 __FFPACK_fger_mp_INL

```
#define __FFPACK_fger_mp_INL
```

17.116 fflas_freduce.h File Reference

```
#include "fflas-ffpack/fflas/fflas_simd.h"
#include "fflas-ffpack/field/field-traits.h"
#include "fflas-ffpack/utils/cast.h"
#include "fflas-ffpack/fflas/fflas_freduce.inl"
```

Data Structures

- struct support_simd_mod< T >
- struct support_fast_mod< T >

- struct support_fast_mod< float >
- struct support_fast_mod< double >
- struct support_fast_mod< int64_t >

Namespaces

- FFLAS

Functions

- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow y mod F$.
- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow x mod F$.
- template<class Field >
  void freduce_constoverride (const Field &F, const size_t m, typename Field::ConstElement_ptr A, const size_t incX)
- template<class Field , class ConstOtherElement_ptr >
  void finit (const Field &F, const size_t n, ConstOtherElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)
- template<class Field >
  void finit (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  finit Initializes X *in* $F\$$.
- template<class Field >
  void freduce (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow A mod F$.
- template<class Field >
  void freduce (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::Element_ptr A, const size_t lda)

  freduce for square symmetric matrices
- template<class Field >
  void pfreduce (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, const size_t numths)
- template<class Field >
  void freduce (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow B mod F$.
- template<class Field >
  void freduce_constoverride (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda)
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t m, const size_t n, const OtherElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  finit $A \leftarrow B mod F$.
- template<class Field >
  void finit (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  finit Initializes A *in* $F\$$.

17.117 fflas_freduce.inl File Reference

```
#include <givaro/udl.h>
#include "fflas-ffpack/fflas/fflas_fassign.h"
```

Data Structures

- struct HelperMod< Field, ElementCategories::MachineIntTag >
- struct HelperMod< Field, FFLAS::ElementCategories::MachineFloatTag >
- struct HelperMod< Field, FFLAS::ElementCategories::ArbitraryPrecIntTag >
- struct HelperMod< Field, FFLAS::ElementCategories::FixedPrecIntTag >

Namespaces

- FFLAS
- FFLAS::vectorised
- FFLAS::vectorised::unswitch
- FFLAS::details

Macros

- #define __FFLASFFPACK_fflas_freduce_INL
- #define FFLASFFPACK_COPY_REDUCE 32 /∗ TODO TO BENCMARK LATER ∗/

Functions

- template<class T >
  std::enable_if< ! std::is_integral< T >::value, T >::type reduce (T A, T B)
- template<class T >
  std::enable_if< std::is_integral< T >::value, T >::type reduce (T A, T B)
- template<> Givaro::Integer reduce (Givaro::Integer A, Givaro::Integer B)
- float reduce (float A, float B, float invB, float min, float max)
- double reduce (double A, double B, double invB, double min, double max)
- int64_t reduce (int64_t A, int64_t p, double invp, double min, double max, int64_t pow50rem)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::MachineIntTag > &H)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::MachineFloat←Tag > &H)
- template<class Field >
  Field::Element reduce (typename Field::Element A, HelperMod< Field, ElementCategories::ArbitraryPrec←IntTag > &H)
- template<class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, typename Field::Element_ptr T, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, const size_t &incX, typename Field::Element_ptr T, HelperMod< Field > &H)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, typename Field::Element_ptr T)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type modp (const Field &F, typename Field::ConstElement_ptr U, const size_t &n, const size_t &incX, typename Field::Element_ptr T)
- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type freduce (const Field &F, const size_t m, typename Field::Element_ptr A, const size_t incX, FieldCategories::ModularTag)

- template<class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type freduce (const Field &F, const size_t m, typename Field::ConstElement_ptr B, const size_t incY, typename Field::Element_ptr A, const size_t incX, FieldCategories::ModularTag)
- template<class Field , class FC >
  void freduce (const Field &F, const size_t m, typename Field::Element_ptr A, const size_t incX, FC)
- template<class Field , class FC >
  void freduce (const Field &F, const size_t m, typename Field::ConstElement_ptr B, const size_t incY, typename Field::Element_ptr A, const size_t incX, FC)

17.117.1 Macro Definition Documentation

17.117.1.1 __FFLASFFPACK_fflas_freduce_INL

```
#define __FFLASFFPACK_fflas_freduce_INL
```

17.117.1.2 FFLASFFPACK_COPY_REDUCE

```
#define FFLASFFPACK_COPY_REDUCE 32 /* TODO TO BENCMARK LATER */
```

17.118 fflas_freduce_mp.inl File Reference

```
#include "fflas-ffpack/field/rns-integer-mod.h"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_freduce_mp_INL

Functions

- template<> void freduce (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t n, FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A, size_t inc)
- template<> void freduce (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, FFPACK::rns_double::Element_ptr A, size_t lda)

17.118.1 Macro Definition Documentation

17.118.1.1 __FFLASFFPACK_fflas_freduce_mp_INL

```
#define __FFLASFFPACK_fflas_freduce_mp_INL
```

17.119 fflas_freivalds.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_freivalds_INL

Functions

- template< class Field >
  bool freivalds (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::ConstElement_ptr C, const size_t ldc)

    *freivalds: Freivalds **GE**neral **M**atrix **M**ultiply **R**andom **C**heck.*

17.119.1 Macro Definition Documentation

17.119.1.1 __FFLASFFPACK_freivalds_INL

```
#define __FFLASFFPACK_freivalds_INL
```

17.120 fflas_fscal.h File Reference

```
#include "fflas_fscal.inl"
```

17.121 fflas_fscal.inl File Reference

Namespaces

- FFLAS
- FFLAS::vectorised
- FFLAS::vectorised::unswitch
- FFLAS::details

Macros

- #define __FFLASFFPACK_fscal_INL

Functions

- template< class Field >
  std::enable_if<!FFLAS::support_simd_mod< typename Field::Element >::value &&FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, HelperMod< Field > &H)
- template< class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, HelperMod< Field > &H)
- template< class Field >
  std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, const size_t &incY, HelperMod< Field > &H)

- template<class Field >
std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n)
- template<class Field >
std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX)
- template<class Field >
std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type scalp (const Field &F, typename Field::Element_ptr T, const typename Field::Element alpha, typename Field::ConstElement_ptr U, const size_t n, const size_t &incX, const size_t &incY)
- template<class Field >
std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type fscalin (const Field &F, const size_t N, const typename Field::Element a, typename Field::Element_ptr X, const size_t incX, FieldCategories::ModularTag)
- template<class Field >
std::enable_if< FFLAS::support_fast_mod< typename Field::Element >::value, void >::type fscal (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size←_t incX, typename Field::Element_ptr Y, const size_t incY, FieldCategories::ModularTag)
- template<class Field , class FC >
void fscalin (const Field &F, const size_t n, const typename Field::Element a, typename Field::Element_ptr X, const size_t incX, FC)
- template<class Field , class FC >
void fscal (const Field &F, const size_t N, const typename Field::Element a, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, FC)
- template<class Field >
void fscalin (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr X, const size_t incX)

  fscalin $x \leftarrow \alpha \cdot x.$
- template<class Field >
void fscal (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)

  fscal $y \leftarrow \alpha \cdot x.$
- template<> void fscal (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::←Element a, Givaro::DoubleDomain::ConstElement_ptr x, const size_t incx, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void fscal (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::ConstElement_ptr x, const size_t incx, Givaro::FloatDomain::Element_ptr y, const size_t incy)
- template<> void fscalin (const Givaro::DoubleDomain &, const size_t N, const Givaro::DoubleDomain::←Element a, Givaro::DoubleDomain::Element_ptr y, const size_t incy)
- template<> void fscalin (const Givaro::FloatDomain &, const size_t N, const Givaro::FloatDomain::Element a, Givaro::FloatDomain::Element_ptr y, const size_t incy)
- template<class Field >
void fscalin (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda)

  fscalin $A \leftarrow a \cdot A.$
- template<class Field >
void fscal (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  fscal $B \leftarrow a \cdot A.$

17.121.1 Macro Definition Documentation

17.121.1.1 __FFLASFFPACK_fscal_INL

```
#define __FFLASFFPACK_fscal_INL
```

17.122 fflas_fscal_mp.inl File Reference

```
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas_fscal.h"
#include "fflas_fgemm.inl"
#include "fflas-ffpack/fflas/fflas_freduce_mp.inl"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fscal_mp_INL

Functions

- template<> void fscalin (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t inc)
- template<> void fscal (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t Ainc, FFPACK::rns_double::Element_ptr B, const size_t Binc)
- template<> void fscalin (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t lda)
- template<> void fscal (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size↩_t lda, FFPACK::rns_double::Element_ptr B, const size_t ldb)
- template<> void fscalin (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size↩_t n, const typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element alpha, typename FFPACK::RNSIntegerMod< FFPACK::rns_double >::Element_ptr A, const size_t inc)
- template<> void fscal (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size_t Ainc, FFPACK::rns_double::Element_ptr B, const size_t Binc)
- template<> void fscalin (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::Element_ptr A, const size_t lda)
- template<> void fscal (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const FFPACK::rns_double::Element alpha, FFPACK::rns_double::ConstElement_ptr A, const size↩_t lda, FFPACK::rns_double::Element_ptr B, const size_t ldb)

17.122.1 Macro Definition Documentation

17.122.1.1 __FFLASFFPACK_fscal_mp_INL

```
#define __FFLASFFPACK_fscal_mp_INL
```

17.123 fflas_fsyr2k.inl File Reference

```
#include <fflas-ffpack/utils/fflas_io.h>
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_fsyr2k_INL

Functions

- template< class Field >
  Field::Element_ptr fsyr2k (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyr2k: Symmetric Rank 2K update

17.123.1 Macro Definition Documentation

17.123.1.1 __FFLASFFPACK_fflas_fsyr2k_INL

```
#define __FFLASFFPACK_fflas_fsyr2k_INL
```

17.124 fflas_fsyrk.inl File Reference

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_fsyrk_INL

Functions

- template< class NewField , class Field , class FieldMode >
  Field::Element_ptr fsyrk_convert (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, FieldMode > &H)
- template< class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyrk: Symmetric Rank K update
- template< class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const Par↩
  SeqHelper::Sequential seq)
- template< class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)

- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::Machine↩ FloatTag >, ParSeqHelper::Sequential > &H)
- template<class Field , class AlgoT , class ParSeqTrait >
void ScalAndReduce (const Field &F, const FFLAS_UPLO UpLo, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &H)
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DelayedTag > &H)
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::LazyTag > &H)
- template<class Field , typename Mode >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::DivideAndConquer, Mode > &H)
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Classic, ModeCategories::DefaultBoundedTag > &H)
- Givaro::FloatDomain::Element_ptr fsyrk (const Givaro::FloatDomain &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const Givaro::FloatDomain::Element alpha, Givaro::FloatDomain::ConstElement_ptr A, const size_t lda, const Givaro::FloatDomain::Element beta, Givaro::FloatDomain::Element_ptr C, const size_t ldc, MMHelper< Givaro::FloatDomain, MMHelperAlgo::↩ Classic, ModeCategories::DefaultTag > &H)
- Givaro::DoubleDomain::Element_ptr fsyrk (const Givaro::DoubleDomain &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const Givaro::DoubleDomain::Element alpha, Givaro::DoubleDomain::ConstElement_ptr A, const size_t lda, const Givaro::DoubleDomain::↩ Element beta, Givaro::DoubleDomain::Element_ptr C, const size_t ldc, MMHelper< Givaro::DoubleDomain, MMHelperAlgo::Classic, ModeCategories::DefaultTag > &H)
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

    fsyrk: Symmetric Rank K update with diagonal scaling
- template<class Field >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq, const size_t threshold)
- template<class Field , class Cut , class Param >
Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold)

- template< class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const std::vector< bool > &two↩ Block, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

  fsyrk: Symmetric Rank K update with diagonal scaling

17.124.1 Macro Definition Documentation

17.124.1.1 __FFLASFFPACK_fflas_fsyrk_INL

```
#define __FFLASFFPACK_fflas_fsyrk_INL
```

17.125 fflas_fsyrk_strassen.inl File Reference

```
#include <givaro/givintsqrootmod.h>
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_fsyrk_strassen_INL

Functions

- template< class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedPreScalReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, const Element &x, MMHelper< Field, AlgoT, ModeCategories::LazyTag, ParSeqTrait > &WH)
- template< class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedPreScalReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, const Element &x, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template< class Field , class Element , class AlgoT , class ParSeqTrait >
  bool NeedPreAxpyReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, const Element &x, MMHelper< Field, AlgoT, ModeCategories::↩ LazyTag, ParSeqTrait > &WH)
- template< class Field , class Element , class AlgoT , class ModeT , class ParSeqTrait >
  bool NeedPreAxpyReduction (Element &Outmin, Element &Outmax, Element &Op1min, Element &Op1max, Element &Op2min, Element &Op2max, const Element &x, MMHelper< Field, AlgoT, ModeT, ParSeqTrait > &WH)
- template< class Field , class FieldTrait >
  void computeS1S2 (const Field &F, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element x, const typename Field::Element y, typename Field::Element_ptr A, const size↩ _t lda, typename Field::Element_ptr S, const size_t lds, typename Field::Element_ptr T, const size_t ldt, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template< class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeCategories::DelayedTag, ParSeqHelper::Sequential > &H)

- template<class Field , class Mode >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, Mode > &H)
- template<class Field , class FieldTrait >
  Field::Element_ptr fsyrk_strassen (const Field &F, const FFLAS_UPLO uplo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element y1, const typename Field::Element y2, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::↩ Winograd, FieldTrait > &WH)

17.125.1 Macro Definition Documentation

17.125.1.1 __FFLASFFPACK_fflas_fsyrk_strassen_INL

```
#define __FFLASFFPACK_fflas_fsyrk_strassen_INL
```

17.126 fflas_ftrmm.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_ftrmm_INL

Functions

- template<class Field >
  void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply.*
- template<class Field >
  void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply with 3 operands Computes* $C \leftarrow \alpha \mathrm{op}(A)B + betaC$ *or* $C \leftarrow \alpha B \mathrm{op}(A) + betaC$.

17.126.1 Macro Definition Documentation

17.126.1.1 __FFLASFFPACK_ftrmm_INL

```
#define __FFLASFFPACK_ftrmm_INL
```

17.127 fflas_ftrsm.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_ftrsm_INL

Functions

- template<class Field >
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)
- template<class Field >
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const ParSeqHelper::Sequential &PSH)
- template<class Field , class Cut , class Param >
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const ParSeqHelper::Parallel< Cut, Param > &PSH)
- template<class Field , class ParSeqTrait = ParSeqHelper::Sequential>
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Recursive, ParSeqTrait > &H)

17.127.1 Macro Definition Documentation

17.127.1.1 __FFLASFFPACK_ftrsm_INL

```
#define __FFLASFFPACK_ftrsm_INL
```

17.128 fflas_ftrsm_mp.inl File Reference

triangular system with matrix right hand side over multiprecision domain (either over Z or over Z/pZ)

```
#include <cmath>
#include <givaro/modular-integer.h>
#include <givaro/givinteger.h>
#include "fflas-ffpack/fflas/fflas_bounds.inl"
#include "fflas-ffpack/fflas/fflas_level3.inl"
#include "fflas-ffpack/field/rns-integer-mod.h"
#include "fflas-ffpack/field/rns-integer.h"
```

Namespaces

- FFLAS

Macros

- #define __FFPACK_ftrsm_mp_INL

Functions

- void ftrsm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, Givaro::Integer *B, const size_t ldb)
- void cblas_imptrsm (const enum FFLAS_ORDER Order, const enum FFLAS_SIDE Side, const enum FFLAS_UPLO Uplo, const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_DIAG Diag, const int M, const int N, const FFPACK::rns_double_elt alpha, FFPACK::rns_double_elt_cstptr A, const int lda, FFPACK::rns_double_elt_ptr B, const int ldb)

17.128.1 Detailed Description

triangular system with matrix right hand side over multiprecision domain (either over Z or over Z/pZ)

17.128.2 Macro Definition Documentation

17.128.2.1 __FFPACK_ftrsm_mp_INL

```
#define __FFPACK_ftrsm_mp_INL
```

17.129 fflas_ftrsv.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_ftrsv_INL

Functions

- template<class Field >
  void ftrsv (const Field &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, int incX)

  ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$

17.129.1 Macro Definition Documentation

17.129.1.1 __FFLASFFPACK_ftrsv_INL

```
#define __FFLASFFPACK_ftrsv_INL
```

17.130 fflas_helpers.inl File Reference

```
#include "fflas-ffpack/field/field-traits.h"
#include "fflas-ffpack/paladin/parallel.h"
#include "fflas-ffpack/utils/flimits.h"
#include <algorithm>
```

Data Structures

- struct Auto
- struct Classic
- struct DivideAndConquer
- struct Winograd
- struct WinogradPar
- struct Bini
- struct AlgoChooser< ModeT, ParSeq >
- struct AlgoChooser< ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq >
- struct MMHelper< Field, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >

  FGEMM Helper for Default and ConvertTo modes of operation.
- struct MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< Dest >, ParSeqTrait >
- struct MMHelper< Field, AlgoTrait, ModeTrait, ParSeqTrait >
- struct Recursive
- struct Iterative
- struct Hybrid
- struct TRSMHelper< RecIterTrait, ParSeqTrait >

  TRSM Helper.

Namespaces

- FFLAS
- FFLAS::Protected
- FFLAS::MMHelperAlgo
- FFLAS::StructureHelper

  StructureHelper for ftrsm.

Macros

- #define __FFLASFFPACK_fflas_fflas_mmhelper_INL

Functions

- template<class Field >
  int WinogradSteps (const Field &F, const size_t &m)

  Computes the number of recursive levels to perform.
- template<class DFE >
  size_t min_types (const DFE &k)
- template<> size_t min_types (const RecInt::rint< 6 > &k)
- template<> size_t min_types (const RecInt::rint< 7 > &k)
- template<> size_t min_types (const RecInt::rint< 8 > &k)
- template<> size_t min_types (const RecInt::rint< 9 > &k)
- template<> size_t min_types (const RecInt::rint< 10 > &k)
- template<> size_t min_types (const Givaro::Integer &k)
- template<class T >
  bool unfit (T x)
- template<> bool unfit (int64_t x)
- template<size_t K>
  bool unfit (RecInt::rint< K > x)
- template<> bool unfit (RecInt::rint< 6 > x)

17.130.1 Macro Definition Documentation

17.130.1.1 __FFLASFFPACK_fflas_fflas_mmhelper_INL

```
#define __FFLASFFPACK_fflas_fflas_mmhelper_INL
```

17.131 fflas_intrinsic.h File Reference

17.132 fflas_io.h File Reference

```
#include <cstring>
#include <stdio.h>
#include <stdlib.h>
#include <fstream>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas_memory.h"
```

Namespaces

- FFLAS

Enumerations

- enum FFLAS_FORMAT {
  FflasAuto = 0 , FflasDense = 1 , FflasSMS = 2 , FflasBinary = 3 ,
  FflasMath = 4 , FflasMaple = 5 , FflasSageMath = 6 }

Functions

- template<class Field >
  std::ostream & WriteMatrix (std::ostream &c, const Field &F, size_t m, size_t n, typename Field::ConstElement_ptr A, size_t lda, FFLAS_FORMAT format, bool column_major)

  WriteMatrix: write a matrix to an output stream.
- void preamble (std::ifstream &ifs, FFLAS_FORMAT &format)
- template<class Field >
  Field::Element_ptr ReadMatrix (std::ifstream &ifs, Field &F, size_t &m, size_t &n, typename Field::Element_ptr &A, FFLAS_FORMAT format=FflasAuto)

  ReadMatrix: read a matrix from an input stream.
- template<class Field >
  Field::Element_ptr ReadMatrix (const std::string &matrix_file, Field &F, size_t &m, size_t &n, typename Field::Element_ptr &A, FFLAS_FORMAT format=FflasAuto)

  ReadMatrix: read a matrix from a file.
- template<class Field >
  void WriteMatrix (std::string &matrix_file, const Field &F, int m, int n, typename Field::ConstElement_ptr A, size_t lda, FFLAS_FORMAT format=FflasDense, bool column_major=false)

  WriteMatrix: write a matrix to a file.
- std::ostream & WritePermutation (std::ostream &c, const size_t *P, size_t N)

  WritePermutation: write a permutation matrix to an output stream.

17.133 fflas_L1_inst.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
```

```
#include "fflas_L1_inst_implem.inl"
```

Macros

- #define __FFLAS_L1_INST_C
- #define INST_OR_DECL
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.133.1 Macro Definition Documentation

17.133.1.1 __FFLAS_L1_INST_C

```
#define __FFLAS_L1_INST_C
```

17.133.1.2 INST_OR_DECL

```
#define INST_OR_DECL
```

17.133.1.3 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.133.1.4 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.133.1.5 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.133.1.6 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.133.1.7 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.133.1.8 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.133.1.9 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.133.1.10 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.134 fflas_L1_inst.h File Reference

```
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas_L1_inst_implem.inl"
```

Macros

- #define INST_OR_DECL <>
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.134.1 Macro Definition Documentation

17.134.1.1 INST_OR_DECL

```
#define INST_OR_DECL <>
```

17.134.1.2 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.134.1.3 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.134.1.4 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.134.1.5 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.134.1.6 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.134.1.7 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.134.1.8 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.134.1.9 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.135 fflas_L1_inst_implem.inl File Reference

Namespaces

- FFLAS

Functions

- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  freduce $x \leftarrow x mod F$.
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  freduce $x \leftarrow y mod F$.
- template INST_OR_DECL void finit (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  finit $x \leftarrow y mod F$.
- template INST_OR_DECL void fconvert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX, const FFLAS_ELT ∗Y, const size_t incY)

  fconvert $x \leftarrow y mod F$.
- template INST_OR_DECL void fnegin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  fnegin $x \leftarrow -x$.
- template INST_OR_DECL void fneg (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

  fneg $x \leftarrow -y$.
- template INST_OR_DECL void fzero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, FFLAS_ELT ∗X, const size_t incX)

  fzero : $A \leftarrow 0$.
- template INST_OR_DECL bool fiszero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗X, const size_t incX)

  fiszero : test $X = 0$.
- template INST_OR_DECL bool fequal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT ∗X, const size_t incX, const FFLAS_ELT ∗Y, const size_t incY)

  fequal : test $X = Y$.
- template INST_OR_DECL void fassign (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗Y, const size_t incY, FFLAS_ELT ∗X, const size_t incX)

fassign : $x \leftarrow y$.

- template INST_OR_DECL void fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, FFLAS_ELT *X, const size_t incX)

  fscalin $x \leftarrow \alpha \cdot x$.
- template INST_OR_DECL void fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT *X, const size_t incX, FFLAS_ELT *Y, const size_t incY)

  fscal $y \leftarrow \alpha \cdot x$.
- template INST_OR_DECL void faxpy (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *X, const size_t incX, FFLAS_ELT *Y, const size_t incY)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template INST_OR_DECL FFLAS_ELT fdot (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *X, const size_t incX, const FFLAS_ELT *Y, const size_t incY)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.
- template INST_OR_DECL void fswap (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, FFLAS_ELT *X, const size_t incX, FFLAS_ELT *Y, const size_t incY)

  fswap: $X \leftrightarrow Y$.
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *A, const size_t inca, const FFLAS_ELT *B, const size_t incb, FFLAS_ELT *C, const size_t incc)
- template INST_OR_DECL void fsub (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *A, const size_t inca, const FFLAS_ELT *B, const size_t incb, FFLAS_ELT *C, const size_t incc)
- template INST_OR_DECL void faddin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *B, const size_t incb, FFLAS_ELT *C, const size_t incc)
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT *A, const size_t inca, const FFLAS_ELT alpha, const FFLAS_ELT *B, const size_t incb, FFLAS_ELT *C, const size_t incc)

17.136 fflas_L2_inst.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas_L2_inst_implem.inl"
```

Macros

- #define __FFLAS_L2_INST_C
- #define INST_OR_DECL
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.136.1 Macro Definition Documentation

17.136.1.1 __FFLAS_L2_INST_C

```
#define __FFLAS_L2_INST_C
```

17.136.1.2 INST_OR_DECL

```
#define INST_OR_DECL
```

17.136.1.3 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.136.1.4 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.136.1.5 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.136.1.6 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.136.1.7 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.136.1.8 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.136.1.9 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.136.1.10 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.137 fflas_L2_inst.h File Reference

```
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas_L2_inst_implem.inl"
```

Macros

- #define INST_OR_DECL <>
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.137.1 Macro Definition Documentation

17.137.1.1 INST_OR_DECL

```
#define INST_OR_DECL <>
```

17.137.1.2 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.137.1.3 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.137.1.4 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.137.1.5 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.137.1.6 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.137.1.7 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.137.1.8 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.137.1.9 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.138 fflas_L2_inst_implem.inl File Reference

Namespaces

- FFLAS

Functions

- template INST_OR_DECL void fassign (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗B, const size_t ldb, FFLAS_ELT ∗A, const size_t lda)

  fassign : $A \leftarrow B$.
- template INST_OR_DECL void fzero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT ∗A, const size_t lda)

  fzero : $A \leftarrow 0$.
- template INST_OR_DECL bool fequal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb)

  fequal : test $A = B$.
- template INST_OR_DECL bool fiszero (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗A, const size_t lda)

  fiszero : test $A = 0$.
- template INST_OR_DECL void fidentity (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT &d)

  creates a diagonal matrix
- template INST_OR_DECL void fidentity (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT ∗A, const size_t lda)

  creates a diagonal matrix
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, FFLAS_ELT ∗A, const size_t lda)

  freduce $A \leftarrow AmodF$.
- template INST_OR_DECL void freduce (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗B, const size_t ldb, FFLAS_ELT ∗A, const size_t lda)

  freduce $A \leftarrow BmodF$.
- template INST_OR_DECL void finit (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗B, const size_t ldb, FFLAS_ELT ∗A, const size_t lda)

  finit $A \leftarrow BmodF$.
- template INST_OR_DECL void fnegin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, FFLAS_ELT ∗A, const size_t lda)

  fnegin $A \leftarrow -A$.
- template INST_OR_DECL void fneg (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT ∗B, const size_t ldb, FFLAS_ELT ∗A, const size_t lda)

  fneg $A \leftarrow -B$.
- template INST_OR_DECL void fscalin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, const FFLAS_ELT alpha, FFLAS_ELT ∗A, const size_t lda)

  fscalin $A \leftarrow a \cdot A$.
- template INST_OR_DECL void fscal (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗B, const size_t ldb)

  fscal $B \leftarrow a \cdot A$.
- template INST_OR_DECL void faxpy (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, const FFLAS_ELT alpha, const FFLAS_ELT ∗X, const size_t ldx, FFLAS_ELT ∗Y, const size_t ldy)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template INST_OR_DECL void fmove (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t m, const size←_t n, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗B, const size_t ldb)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.

- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

    fadd : matrix addition.
- template INST_OR_DECL void fsub (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

    fsub : matrix subtraction.
- template INST_OR_DECL void fsubin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size←↩ _t N, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

    fsubin C = C - B
- template INST_OR_DECL void fadd (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT alpha, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

    fadd : matrix addition with scaling.
- template INST_OR_DECL void faddin (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size←↩ _t N, const FFLAS_ELT *B, const size_t ldb, FFLAS_ELT *C, const size_t ldc)

    faddin
- template INST_OR_DECL FFLAS_ELT * fgemv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_←↩ TRANSPOSE TransA, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *A, const size_t lda, const FFLAS_ELT *X, const size_t incX, const FFLAS_ELT beta, FFLAS_ELT *Y, const size_t incY)

    finite prime FFLAS_FIELD<FFLAS_ELT> GEneral Matrix Vector multiplication.
- template INST_OR_DECL void fger (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT *x, const size_t incx, const FFLAS_ELT *y, const size_t incy, FFLAS_ELT *A, const size_t lda)

    fger: rank one update of a general matrix
- template INST_OR_DECL void ftrsv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, const FFLAS_ELT *A, const size_t lda, FFLAS_ELT *X, int incX)

    ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$

17.139 fflas_L3_inst.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas_L3_inst_implem.inl"
```

Macros

- #define __FFLAS_L3_INST_C
- #define INST_OR_DECL
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.139.1 Macro Definition Documentation

17.139.1.1 __FFLAS_L3_INST_C

```
#define __FFLAS_L3_INST_C
```

17.139.1.2 INST_OR_DECL

```
#define INST_OR_DECL
```

17.139.1.3 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.139.1.4 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.139.1.5 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.139.1.6 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.139.1.7 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.139.1.8 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.139.1.9 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.139.1.10 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.140 fflas_L3_inst.h File Reference

```
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
```

```
#include "fflas_L3_inst_implem.inl"
```

Macros

- #define INST_OR_DECL <>
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.140.1 Macro Definition Documentation

17.140.1.1 INST_OR_DECL

```
#define INST_OR_DECL <>
```

17.140.1.2 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.140.1.3 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.140.1.4 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.140.1.5 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.140.1.6 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.140.1.7 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.140.1.8 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.140.1.9 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.141 fflas_L3_inst_implem.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLAS__TRSM_READONLY

Functions

- template INST_OR_DECL void ftrsm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗B, const size_t ldb)

  *ftrsm: **TR**iangular **S**ystem solve with **M**atrix.*
- template INST_OR_DECL void ftrmm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗B, const size_t ldb)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply.*
- template INST_OR_DECL FFLAS_ELT ∗ fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS↩_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT ∗C, const size_t ldc)

  *fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.*
- template INST_OR_DECL FFLAS_ELT ∗ fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS↩_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT ∗C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template INST_OR_DECL FFLAS_ELT ∗ fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS↩_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT ∗C, const size_t ldc, const ParSeqHelper::Parallel< CuttingStrategy::↩Recursive, StrategyParameter::TwoDAdaptive > par)
- template INST_OR_DECL FFLAS_ELT ∗ fgemm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS↩_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗B, const size_t ldb, const FFLAS_ELT beta, FFLAS_ELT ∗C, const size_t ldc, const ParSeqHelper::Parallel< CuttingStrategy::Block, StrategyParameter::Threads > par)
- template INST_OR_DECL FFLAS_ELT ∗ fsquare (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS↩_TRANSPOSE ta, const size_t n, const FFLAS_ELT alpha, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT beta, FFLAS_ELT ∗C, const size_t ldc)

  fsquare: Squares a matrix.

17.141.1 Macro Definition Documentation

17.141.1.1 __FFLAS__TRSM_READONLY

```
#define __FFLAS__TRSM_READONLY
```

17.142 fflas_level1.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_fflas_level1_INL

Functions

- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow xmodF$.
- template<class Field >
  void freduce (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  freduce $x \leftarrow ymodF$.
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t n, const OtherElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  finit $x \leftarrow ymodF$.
- template<class Field >
  void finit (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  finit Initializes X *in* $F\$$.
- template<class Field , class OtherElement_ptr >
  void fconvert (const Field &F, const size_t n, OtherElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fconvert $x \leftarrow ymodF$.
- template<class Field >
  void fnegin (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  fnegin $x \leftarrow -x$.
- template<class Field >
  void fneg (const Field &F, const size_t n, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  fneg $x \leftarrow -y$.
- template<class Field >
  void fzero (const Field &F, const size_t n, typename Field::Element_ptr X, const size_t incX)

  fzero : $A \leftarrow 0$.
- template<class Field , class RandIter >
  void frand (const Field &F, RandIter &G, const size_t n, typename Field::Element_ptr X, const size_t incX)

  frand : $A \leftarrow random$.
- template<class Field >
  bool fiszero (const Field &F, const size_t n, typename Field::ConstElement_ptr X, const size_t incX)

  fiszero : test $X = 0$.
- template<class Field >
  bool fequal (const Field &F, const size_t n, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)

  fequal : test $X = Y$.
- template<class Field >
  void fassign (const Field &F, const size_t N, typename Field::ConstElement_ptr Y, const size_t incY, typename Field::Element_ptr X, const size_t incX)

  fassign : $x \leftarrow y$.

- template<class Field >
  void fscalin (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr X, const size_t incX)
  fscalin $x \leftarrow \alpha \cdot x$.
- template<class Field >
  void fscal (const Field &F, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)
  fscal $y \leftarrow \alpha \cdot x$.
- template<class Field >
  void faxpy (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)
  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template<class Field >
  void faxpby (const Field &F, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)
  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY)
  fdot: dot product $x^T y$.
- template<class Field >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, const ParSeqHelper::Sequential seq)
- template<typename Field , class Cut , class Param >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY, const ParSeqHelper::Parallel< Cut, Param > par)
- template<class Field >
  void fswap (const Field &F, const size_t N, typename Field::Element_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY)
  fswap: $X \leftrightarrow Y$.
- template<class Field >
  void pfadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
  void pfsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, const size_t numths)
- template<class Field >
  void pfaddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
  void pfsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc, size_t numths)
- template<class Field >
  void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void fsub (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void faddin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)
- template<class Field >
  void fsubin (const Field &F, const size_t N, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)

- template<class Field >
void fadd (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t inca, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t incb, typename Field::Element_ptr C, const size_t incc)

17.142.1 Macro Definition Documentation

17.142.1.1 __FFLASFFPACK_fflas_fflas_level1_INL

```
#define __FFLASFFPACK_fflas_fflas_level1_INL
```

17.143 fflas_level2.inl File Reference

```
#include "givaro/zring.h"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_fflas_level2_INL

Functions

- template<class Field >
void fassign (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  fassign : $A \leftarrow B$.
- template<class Field >
void fzero (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fzero : $A \leftarrow 0$.
- template<class Field >
void fzero (const Field &F, const FFLAS_UPLO shape, const FFLAS_DIAG diag, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fzero : $A \leftarrow 0$ *for a triangular matrix.*
- template<class Field , class RandIter >
void frand (const Field &F, RandIter &G, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  frand : $A \leftarrow random$.
- template<class Field >
bool fequal (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb)

  fequal : test $A = B$.
- template<class Field >
bool fiszero (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda)

  fiszero : test $A = 0$.
- template<class Field >
void fidentity (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, const typename Field::Element &d)

  creates a diagonal matrix

- template<class Field >
  void fidentity (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  creates a diagonal matrix
- template<class Field >
  void freduce (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow AmodF$.
- template<class Field >
  void freduce (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::Element_ptr A, const size_t lda)

  freduce for square symmetric matrices
- template<class Field >
  void freduce (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  freduce $A \leftarrow BmodF$.
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t m, const size_t n, const OtherElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  finit $A \leftarrow BmodF$.
- template<class Field , class OtherElement_ptr >
  void finit (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  finit Initializes $\mathtt{A}$ *in* $F\$$.
- template<class Field , class OtherElement_ptr >
  void fconvert (const Field &F, const size_t m, const size_t n, OtherElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb)

  fconvert $A \leftarrow BmodF$.
- template<class Field >
  void fnegin (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda)

  fnegin $A \leftarrow -A$.
- template<class Field >
  void fneg (const Field &F, const size_t m, const size_t n, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr A, const size_t lda)

  fneg $A \leftarrow -B$.
- template<class Field >
  void fscalin (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda)

  fscalin $A \leftarrow a \cdot A$.
- template<class Field >
  void fscal (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  fscal $B \leftarrow a \cdot A$.
- template<class Field >
  void faxpy (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t ldx, typename Field::Element_ptr Y, const size_t ldy)

  faxpy : $y \leftarrow \alpha \cdot x + y$.
- template<class Field >
  void faxpby (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr X, const size_t ldx, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t ldy)

  faxpby : $y \leftarrow \alpha \cdot x + \beta \cdot y$.
- template<class Field >
  void fmove (const Field &F, const size_t m, const size_t n, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  fmove : $A \leftarrow B$ *and* $B \leftarrow 0$.

- template<class Field >
  void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadd : matrix addition.
- template<class Field >
  void fsub (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsub : matrix subtraction.
- template<class Field >
  void fsubin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fsubin C = C - B
- template<class Field >
  void fadd (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element alpha, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadd : matrix addition with scaling.
- template<class Field >
  void faddin (const Field &F, const size_t M, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  faddin
- template<class Field >
  void faddin (const Field &F, const FFLAS_UPLO uplo, const size_t N, typename Field::ConstElement_ptr B, const size_t ldb, typename Field::Element_ptr C, const size_t ldc)

  fadding for symmetric matrices
- template<class Field >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE TransA, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY)

  finite prime Field GEneral Matrix Vector multiplication.
- template<class Field >
  void fger (const Field &F, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element_ptr A, const size_t lda)

  fger: rank one update of a general matrix
- template<class Field >
  void ftrsv (const Field &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, int incX)

  ftrsv: TRiangular System solve with Vector Computes $X \leftarrow \mathrm{op}(A^{-1})X$
- template<class Field >
  size_t bitsize (const Field &F, size_t M, size_t N, const typename Field::ConstElement_ptr A, size_t lda)

  bitsize: Computes the largest bitsize of the matrix' coefficients.
- template<> size_t bitsize< Givaro::ZRing< Givaro::Integer > > (const Givaro::ZRing< Givaro::Integer > &F, size_t M, size_t N, const Givaro::Integer ∗A, size_t lda)
- template<class Field >
  void ftrmv (const Field &F, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, int incX)

  ftrsm: TRiangular Matrix Vector prodcut Computes $X \leftarrow \mathrm{op}(A)X$

17.143.1 Macro Definition Documentation

17.143.1.1 __FFLASFFPACK_fflas_fflas_level2_INL

```
#define __FFLASFFPACK_fflas_fflas_level2_INL
```

17.144 fflas_level3.inl File Reference

```
#include "fflas_bounds.inl"
#include "fflas_helpers.inl"
#include "fflas-ffpack/paladin/parallel.h"
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_fflas_level3_INL
- #define __FFLAS__TRSM_READONLY

Functions

- template<class Field >
  void MatF2MatD_Triangular (const Field &F, Givaro::DoubleDomain::Element_ptr S, const size_t lds, typename Field::ConstElement_ptr const E, const size_t lde, const size_t m, const size_t n)
- template<class Field >
  void MatF2MatFl_Triangular (const Field &F, Givaro::FloatDomain::Element_ptr S, const size_t lds, typename Field::ConstElement_ptr const E, const size_t lde, const size_t m, const size_t n)
- template<class Field >
  void ftrsm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  *ftrsm: **TR**iangular **S**ystem solve with **M**atrix.*
- template<class Field >
  void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply.*
- template<class Field >
  void ftrmm (const Field &F, const FFLAS_SIDE Side, const FFLAS_UPLO Uplo, const FFLAS_TRANSPOSE TransA, const FFLAS_DIAG Diag, const size_t M, const size_t N, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *ftrmm: **TR**iangular **M**atrix **M**ultiply with 3 operands Computes $C \leftarrow \alpha \mathrm{op}(A)B + betaC$ or $C \leftarrow \alpha B\mathrm{op}(A) + betaC$.*
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyrk: Symmetric Rank K update
- template<class Field , typename FieldTrait >
  Field::Element_ptr fsyrk_strassen (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element y1, const typename Field::Element y2, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::↩
  Winograd, FieldTrait > &H)

- template<class Field >
  Field::Element_ptr fsyr2k (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsyr2k: Symmetric Rank 2K update
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

  fsyrk: Symmetric Rank K update with diagonal scaling
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq, const size_t threshold)
- template<class Field , class Cut , class Param >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t N, const size_t K, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold)
- template<class Field >
  Field::Element_ptr fsyrk (const Field &F, const FFLAS_UPLO UpLo, const FFLAS_TRANSPOSE trans, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::ConstElement_ptr D, const size_t incD, const std::vector< bool > &twoBlock, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t threshold=__FFLASFFPACK_FSYRK_THRESHOLD)

  fsyrk: Symmetric Rank K update with diagonal scaling
- template<typename Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  *fgemm: **F**ield **GE**neral **M**atrix **M**ultiply.*
- template<typename Field >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Sequential seq)
- template<typename Field , class Cut , class Param >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const ParSeqHelper::Parallel< Cut, Param > par)
- template<typename Field >
  Field::Element_ptr pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t numthreads=0)
- template<class Field >
  Field::Element * pfgemm_1D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha,

const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element ∗C, const size_t ldc, size_t seuil)
- template<class Field >
  Field::Element ∗ pfgemm_2D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_↩ TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element ∗C, const size_t ldc, size_t seuil)
- template<class Field >
  Field::Element ∗ pfgemm_3D_rec (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_↩ TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t seuil, size_t ∗x)
- template<class Field >
  Field::Element_ptr pfgemm_3D_rec2 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_↩ TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, size_t seuil, size_t ∗x)
- template<class Field >
  Field::Element_ptr fsquare (const Field &F, const FFLAS_TRANSPOSE ta, const size_t n, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc)

  fsquare: Squares a matrix.

17.144.1 Macro Definition Documentation

17.144.1.1 __FFLASFFPACK_fflas_fflas_level3_INL

```
#define __FFLASFFPACK_fflas_fflas_level3_INL
```

17.144.1.2 __FFLAS__TRSM_READONLY

```
#define __FFLAS__TRSM_READONLY
```

17.145 fflas_lvl1.C File Reference

C functions calls for level 1 FFLAS in fflas-c.h.

```
#include "fflas-ffpack/interfaces/libs/fflas_c.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "givaro//modular-balanced.h"
#include "givaro//modular.h"
```

Functions

- void freducein_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, bool positive)
- void freduce_1_modular_double (const double p, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fnegin_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, bool positive)
- void fneg_1_modular_double (const double p, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fzero_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, bool positive)
- bool fiszero_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, bool positive)

- bool fequal_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, const double ∗Y, const size_t incY, bool positive)
- void fassign_1_modular_double (const double p, const size_t n, const double ∗Y, const size_t incY, double ∗X, const size_t incX, bool positive)
- void fscalin_1_modular_double (const double p, const size_t n, const double alpha, double ∗X, const size_t incX, bool positive)
- void fscal_1_modular_double (const double p, const size_t n, const double alpha, const double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- void faxpy_1_modular_double (const double p, const size_t n, const double alpha, const double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- double fdot_1_modular_double (const double p, const size_t n, const double ∗X, const size_t incX, const double ∗Y, const size_t incY, bool positive)
- void fswap_1_modular_double (const double p, const size_t n, double ∗X, const size_t incX, double ∗Y, const size_t incY, bool positive)
- void fadd_1_modular_double (const double p, const size_t n, const double ∗A, const size_t incA, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void fsub_1_modular_double (const double p, const size_t n, const double ∗A, const size_t incA, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void faddin_1_modular_double (const double p, const size_t n, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)
- void fsubin_1_modular_double (const double p, const size_t n, const double ∗B, const size_t incB, double ∗C, const size_t incC, bool positive)

17.145.1 Detailed Description

C functions calls for level 1 FFLAS in fflas-c.h.

Author

Brice Boyer

See also

fflas/fflas_level1.inl

17.145.2 Function Documentation

17.145.2.1 freducein_1_modular_double()

```
void freducein_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.145.2.2 freduce_1_modular_double()

```
void freduce_1_modular_double (
            const double p,
            const size_t n,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX,
            bool positive )
```

17.145.2.3 fnegin_1_modular_double()

```
void fnegin_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.145.2.4 fneg_1_modular_double()

```
void fneg_1_modular_double (
            const double p,
            const size_t n,
            const double * Y,
            const size_t incY,
            double * X,
            const size_t incX,
            bool positive )
```

17.145.2.5 fzero_1_modular_double()

```
void fzero_1_modular_double (
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            bool positive )
```

17.145.2.6 fiszero_1_modular_double()

```
bool fiszero_1_modular_double (
            const double p,
            const size_t n,
            const double * X,
            const size_t incX,
            bool positive )
```

17.145.2.7 fequal_1_modular_double()

```
bool fequal_1_modular_double (
            const double p,
            const size_t n,
            const double * X,
            const size_t incX,
            const double * Y,
            const size_t incY,
            bool positive )
```

17.145.2.8 fassign_1_modular_double()

```
void fassign_1_modular_double (
            const double p,
            const size_t n,
```

```
             const double * Y,
             const size_t incY,
             double * X,
             const size_t incX,
             bool positive )
```

17.145.2.9 fscalin_1_modular_double()

```
void fscalin_1_modular_double (
             const double p,
             const size_t n,
             const double alpha,
             double * X,
             const size_t incX,
             bool positive )
```

17.145.2.10 fscal_1_modular_double()

```
void fscal_1_modular_double (
             const double p,
             const size_t n,
             const double alpha,
             const double * X,
             const size_t incX,
             double * Y,
             const size_t incY,
             bool positive )
```

17.145.2.11 faxpy_1_modular_double()

```
void faxpy_1_modular_double (
             const double p,
             const size_t n,
             const double alpha,
             const double * X,
             const size_t incX,
             double * Y,
             const size_t incY,
             bool positive )
```

17.145.2.12 fdot_1_modular_double()

```
double fdot_1_modular_double (
             const double p,
             const size_t n,
             const double * X,
             const size_t incX,
             const double * Y,
             const size_t incY,
             bool positive )
```

17.145.2.13 fswap_1_modular_double()

```
void fswap_1_modular_double (
```

```
            const double p,
            const size_t n,
            double * X,
            const size_t incX,
            double * Y,
            const size_t incY,
            bool positive )
```

17.145.2.14 fadd_1_modular_double()

```
void fadd_1_modular_double (
            const double p,
            const size_t n,
            const double * A,
            const size_t incA,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.145.2.15 fsub_1_modular_double()

```
void fsub_1_modular_double (
            const double p,
            const size_t n,
            const double * A,
            const size_t incA,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.145.2.16 faddin_1_modular_double()

```
void faddin_1_modular_double (
            const double p,
            const size_t n,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.145.2.17 fsubin_1_modular_double()

```
void fsubin_1_modular_double (
            const double p,
            const size_t n,
            const double * B,
            const size_t incB,
            double * C,
            const size_t incC,
            bool positive )
```

17.146 fflas_lvl2.C File Reference

C functions calls for level 2 FFLAS in fflas-c.h.

```
#include "fflas-ffpack/interfaces/libs/fflas_c.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "givaro//modular-balanced.h"
#include "givaro//modular.h"
```

Functions

- void fassign_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void fzero_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t lda, bool positive)
- bool fequal_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, const double ∗B, const size_t ldb, bool positive)
- bool fiszero_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, bool positive)
- void fidentity_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t lda, const double d, bool positive)
- void freducein_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t lda, bool positive)
- void freduce_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void fnegin_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t lda, bool positive)
- void fneg_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void fscalin_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, double ∗A, const size_t lda, bool positive)
- void fscal_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void faxpy_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void fmove_2_modular_double (const double p, const size_t m, const size_t n, double ∗A, const size_t lda, double ∗B, const size_t ldb, bool positive)
- void fadd_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, const double ∗B, const size_t ldb, double ∗C, const size_t ldc, bool positive)
- void fsub_2_modular_double (const double p, const size_t m, const size_t n, const double ∗A, const size_t lda, const double ∗B, const size_t ldb, double ∗C, const size_t ldc, bool positive)
- void fsubin_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldb, double ∗C, const size_t ldc, bool positive)
- void faddin_2_modular_double (const double p, const size_t m, const size_t n, const double ∗B, const size_t ldb, double ∗C, const size_t ldc, bool positive)
- double ∗ fgemv_2_modular_double (const double p, const enum FFLAS_C_TRANSPOSE TransA, const size_t m, const size_t n, const double alpha, const double ∗A, const size_t lda, const double ∗X, const size_t incX, const double beta, double ∗Y, const size_t incY, bool positive)
- void fger_2_modular_double (const double p, const size_t m, const size_t n, const double alpha, const double ∗X, const size_t incX, const double ∗Y, const size_t incY, double ∗A, const size_t lda, bool positive)
- void ftrsv_2_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE TransA, const enum FFLAS_C_DIAG Diag, const size_t n, const double ∗A, const size_t lda, double ∗X, int incX, bool positive)

17.146.1 Detailed Description

C functions calls for level 2 FFLAS in fflas-c.h.

Author

Brice Boyer

See also

fflas/fflas_level2.inl

17.146.2 Function Documentation

17.146.2.1 fassign_2_modular_double()

```
void fassign_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.2 fzero_2_modular_double()

```
void fzero_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t lda,
            bool positive )
```

17.146.2.3 fequal_2_modular_double()

```
bool fequal_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
            const double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.4 fiszero_2_modular_double()

```
bool fiszero_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
```

```
const size_t lda,
bool positive )
```

17.146.2.5 fidentity_2_modular_double()

```
void fidentity_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t lda,
            const double d,
            bool positive )
```

17.146.2.6 freducein_2_modular_double()

```
void freducein_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t lda,
            bool positive )
```

17.146.2.7 freduce_2_modular_double()

```
void freduce_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.8 fnegin_2_modular_double()

```
void fnegin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t lda,
            bool positive )
```

17.146.2.9 fneg_2_modular_double()

```
void fneg_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
```

```
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.10 fscalin_2_modular_double()

```
void fscalin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            double * A,
            const size_t lda,
            bool positive )
```

17.146.2.11 fscal_2_modular_double()

```
void fscal_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.12 faxpy_2_modular_double()

```
void faxpy_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.13 fmove_2_modular_double()

```
void fmove_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            bool positive )
```

17.146.2.14 fadd_2_modular_double()

```
void fadd_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
            const double * B,
            const size_t ldb,
            double * C,
            const size_t ldc,
            bool positive )
```

17.146.2.15 fsub_2_modular_double()

```
void fsub_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * A,
            const size_t lda,
            const double * B,
            const size_t ldb,
            double * C,
            const size_t ldc,
            bool positive )
```

17.146.2.16 fsubin_2_modular_double()

```
void fsubin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldb,
            double * C,
            const size_t ldc,
            bool positive )
```

17.146.2.17 faddin_2_modular_double()

```
void faddin_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double * B,
            const size_t ldb,
            double * C,
            const size_t ldc,
            bool positive )
```

17.146.2.18 fgemv_2_modular_double()

```
double* fgemv_2_modular_double (
            const double p,
```

```
            const enum FFLAS_C_TRANSPOSE TransA,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t lda,
            const double * X,
            const size_t incX,
            const double beta,
            double * Y,
            const size_t incY,
            bool positive )
```

17.146.2.19 fger_2_modular_double()

```
void fger_2_modular_double (
            const double p,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * X,
            const size_t incX,
            const double * Y,
            const size_t incY,
            double * A,
            const size_t lda,
            bool positive )
```

17.146.2.20 ftrsv_2_modular_double()

```
void ftrsv_2_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_TRANSPOSE TransA,
            const enum FFLAS_C_DIAG Diag,
            const size_t n,
            const double * A,
            const size_t lda,
            double * X,
            int incX,
            bool positive )
```

17.147 fflas_lvl3.C File Reference

C functions calls for level 3 FFLAS in fflas-c.h.

```
#include "fflas-ffpack/interfaces/libs/fflas_c.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "givaro//modular-balanced.h"
#include "givaro//modular.h"
```

Functions

- void ftrsm_3_modular_double (const double p, const enum FFLAS_C_SIDE Side, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE tA, const enum FFLAS_C_DIAG Diag, const

size_t m, const size_t n, const double alpha, const double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)
- void ftrmm_3_modular_double (const double p, const enum FFLAS_C_SIDE Side, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_TRANSPOSE tA, const enum FFLAS_C_DIAG Diag, const size_t m, const size_t n, const double alpha, double ∗A, const size_t ldA, double ∗B, const size_t ldB, bool positive)
- double ∗ fgemm_3_modular_double (const double p, const enum FFLAS_C_TRANSPOSE tA, const enum FFLAS_C_TRANSPOSE tB, const size_t m, const size_t n, const size_t k, const double alpha, const double ∗A, const size_t ldA, const double ∗B, const size_t ldB, const double betA, double ∗C, const size_t ldC, bool positive)
- double ∗ fsquare_3_modular_double (const double p, const enum FFLAS_C_TRANSPOSE tA, const size_t n, const double alpha, const double ∗A, const size_t ldA, const double betA, double ∗C, const size_t ldC, bool positive)

17.147.1 Detailed Description

C functions calls for level 3 FFLAS in fflas-c.h.

Author

Brice Boyer

See also

fflas/fflas_level3.inl

17.147.2 Function Documentation

17.147.2.1 ftrsm_3_modular_double()

```
void ftrsm_3_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_TRANSPOSE tA,
            const enum FFLAS_C_DIAG Diag,
            const size_t m,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t ldA,
            double * B,
            const size_t ldB,
            bool positive )
```

17.147.2.2 ftrmm_3_modular_double()

```
void ftrmm_3_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_TRANSPOSE tA,
            const enum FFLAS_C_DIAG Diag,
            const size_t m,
            const size_t n,
            const double alpha,
            double * A,
```

```
            const size_t ldA,
            double * B,
            const size_t ldB,
            bool positive )
```

17.147.2.3 fgemm_3_modular_double()

```
double* fgemm_3_modular_double (
            const double p,
            const enum FFLAS_C_TRANSPOSE tA,
            const enum FFLAS_C_TRANSPOSE tB,
            const size_t m,
            const size_t n,
            const size_t k,
            const double alpha,
            const double * A,
            const size_t ldA,
            const double * B,
            const size_t ldB,
            const double betA,
            double * C,
            const size_t ldC,
            bool positive )
```

17.147.2.4 fsquare_3_modular_double()

```
double* fsquare_3_modular_double (
            const double p,
            const enum FFLAS_C_TRANSPOSE tA,
            const size_t n,
            const double alpha,
            const double * A,
            const size_t ldA,
            const double betA,
            double * C,
            const size_t ldC,
            bool positive )
```

17.148 fflas_memory.h File Reference

```
#include "fflas-ffpack/utils/align-allocator.h"
#include <givaro/givinteger.h>
```

Namespaces

- FFLAS

Functions

- template<class Element >
  bool alignable ()
- template<> bool alignable< Givaro::Integer * > ()
- template<class Field >
  Field::Element_ptr fflas_new (const Field &F, const size_t m, const Alignment align=Alignment::DEFAULT)

- template<class Field >
  Field::Element_ptr fflas_new (const Field &F, const size_t m, const size_t n, const Alignment align=Alignment::DEFAULT)
- template<class Element >
  Element * fflas_new (const size_t m, const Alignment align=Alignment::DEFAULT)
- template<> void fflas_delete (FFPACK::rns_double_elt_ptr A)
- template<class Ptr , class ... Args>
  void fflas_delete (Ptr p, Args ... args)
- void prefetch (const int64_t *)
- void getTLBSize (int &tlb)
- void queryCacheSizes (int &l1, int &l2, int &l3)
- int queryL1CacheSize ()
- int queryTopLevelCacheSize ()

17.149 fflas_pfgemm.inl File Reference

```
#include "fflas-ffpack/paladin/blockcuts.inl"
#include "fflas-ffpack/paladin/parallel.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/paladin/pfgemm_variants.inl"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_pfgemm_INL
- #define __FFLASFFPACK_SEQPARTHRESHOLD 220
- #define __FFLASFFPACK_DIMKPENALTY 1

Functions

- template<class Field , class ModeTrait , class Strat , class Param >
  std::enable_if<!std::is_same< ModeTrait, ModeCategories::ConvertTo< ElementCategories::RNSElement↩Tag > >::value, typename Field::Element_ptr >::type fgemm (const Field &F, const FFLAS::FFLAS_TRANSPOSE ta, const FFLAS::FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeTrait, ParSeqHelper::Parallel< Strat, Param > > &H)

17.149.1 Macro Definition Documentation

17.149.1.1 __FFLASFFPACK_fflas_pfgemm_INL

```
#define __FFLASFFPACK_fflas_pfgemm_INL
```

17.149.1.2 __FFLASFFPACK_SEQPARTHRESHOLD

```
#define __FFLASFFPACK_SEQPARTHRESHOLD 220
```

17.149.1.3 __FFLASFFPACK_DIMKPENALTY

```
#define __FFLASFFPACK_DIMKPENALTY 1
```

17.150 fflas_pftrsm.inl File Reference

```
#include "fflas-ffpack/paladin/parallel.h"
```

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_pftrsm_INL
- #define PTRSM_HYBRID_THRESHOLD 256

Functions

- template<class Field , class Cut , class Param >
  Field::Element_ptr ftrsm (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_TRANSPOSE TA, const FFLAS::FFLAS_DIAG Diag, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Iterative, ParSeqHelper::Parallel< Cut, Param > > &H)
- template<class Field , class Cut , class Param >
  Field::Element_ptr ftrsm (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_TRANSPOSE TA, const FFLAS::FFLAS_DIAG Diag, const size_t m, const size_t n, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, TRSMHelper< StructureHelper::Hybrid, ParSeqHelper::Parallel< Cut, Param > > &H)

17.150.1 Macro Definition Documentation

17.150.1.1 __FFLASFFPACK_fflas_pftrsm_INL

```
#define __FFLASFFPACK_fflas_pftrsm_INL
```

17.150.1.2 PTRSM_HYBRID_THRESHOLD

```
#define PTRSM_HYBRID_THRESHOLD 256
```

17.151 fflas_plevel1.h File Reference

```
#include "fflas-ffpack/paladin/parallel.h"
```

Namespaces

- FFLAS

Functions

- template<class Field >
  void pfzero (const Field &F, size_t m, size_t n, typename Field::Element_ptr C, size_t BS=0)
- template<class Field , class RandIter >
  void pfrand (const Field &F, RandIter &G, size_t m, size_t n, typename Field::Element_ptr C, size_t BS=0)
- template<class Field , class Cut , class Param >
  Field::Element & fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr x, const size_t incx, typename Field::ConstElement_ptr y, const size_t incy, typename Field::Element &d, const ParSeqHelper↩ ::Parallel< Cut, Param > par)
- template<typename Field , class Cut , class Param >
  Field::Element fdot (const Field &F, const size_t N, typename Field::ConstElement_ptr X, const size_t incX, typename Field::ConstElement_ptr Y, const size_t incY, const ParSeqHelper::Parallel< Cut, Param > par)

17.152 fflas_randommatrix.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/debug.h"
#include "fflas-ffpack/fflas/fflas.h"
#include <givaro/givinteger.h>
#include <givaro/givintprime.h>
#include <givaro/givranditer.h>
#include "fflas-ffpack/ffpack/ffpack.h"
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Functions

- template<class Field , class RandIter >
  Field::Element_ptr NonZeroRandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random non-zero Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr NonZeroRandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda)

  Random non-zero Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix.
- template<class Field >
  Field::Element_ptr RandomMatrix (const Field &F, size_t m, size_t n, typename Field::Element_ptr A, size_t lda)

  Random Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomTriangularMatrix (const Field &F, size_t m, size_t n, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_DIAG Diag, bool nonsingular, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Triangular Matrix.
- template<class Field >
  Field::Element_ptr RandomTriangularMatrix (const Field &F, size_t m, size_t n, const FFLAS::FFLAS_UPLO UpLo, const FFLAS::FFLAS_DIAG Diag, bool nonsingular, typename Field::Element_ptr A, size_t lda)

Random Triangular Matrix.

- size_t RandInt (size_t a, size_t b)
- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrix (const Field &F, size_t n, bool nonsingular, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Symmetric Matrix.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRank (const Field &F, size_t m, size_t n, size_t r, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed rank.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRank (const Field &F, size_t m, size_t n, size_t r, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed rank.
- size_t ∗ RandomIndexSubset (size_t N, size_t R, size_t ∗P)

  Pick uniformly at random a sequence of R distinct elements from the set $\{0, \ldots, N-1\}$ using Knuth's shuffle.
- size_t ∗ RandomPermutation (size_t N, size_t ∗P)

  Pick uniformly at random a permutation of size N stored in LAPACK format using Knuth's shuffle.
- void RandomRankProfileMatrix (size_t M, size_t N, size_t R, size_t ∗rows, size_t ∗cols)

  Pick uniformly at random an R-subpermutation of dimension M x N : a matrix with only R non-zeros equal to one, in a random rook placement.
- void swapval (size_t k, size_t N, size_t ∗P, size_t val)
- void RandomSymmetricRankProfileMatrix (size_t N, size_t R, size_t ∗rows, size_t ∗cols)

  Pick uniformly at random a symmetric R-subpermutation of dimension N x N : a symmetric matrix with only R non-zeros, all equal to one, in a random rook placement.
- void RandomLTQSRankProfileMatrix (size_t n, size_t r, size_t t, size_t ∗rows, size_t ∗cols)
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP, RandIter &G)

  Random Matrix with prescribed rank and rank profile matrix Creates an m x n matrix with random entries and rank r.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP)

  Random Matrix with prescribed rank and rank profile matrix Creates an m x n matrix with random entries and rank r.
- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP, RandIter &G)

  Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an n x n symmetric matrix with random entries and rank r.
- template<class Field >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, const size_t ∗RRP, const size_t ∗CRP)

  Random Symmetric Matrix with prescribed rank and rank profile matrix Creates an n x n symmetric matrix with random entries and rank r.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithRankandRandomRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomMatrixWithRankandRandomRPM (const Field &F, size_t M, size_t N, size_t R, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed rank, with random rank profile matrix Creates an m x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.

- template<class Field , class RandIter >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRandomRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an n x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomSymmetricMatrixWithRankandRandomRPM (const Field &F, size_t N, size_t R, typename Field::Element_ptr A, size_t lda)

  Random Symmetric Matrix with prescribed rank, with random rank profile matrix Creates an n x n matrix with random entries, rank r and with a rank profile matrix chosen uniformly at random.
- template<class Field >
  Field::Element_ptr RandomMatrixWithDet (const Field &F, size_t n, const typename Field::Element d, typename Field::Element_ptr A, size_t lda)

  Random Matrix with prescribed det.
- template<class Field , class RandIter >
  Field::Element_ptr RandomMatrixWithDet (const Field &F, size_t n, const typename Field::Element d, typename Field::Element_ptr A, size_t lda, RandIter &G)

  Random Matrix with prescribed det.
- template<class Field , class RandIter >
  Field::Element_ptr RandomLTQSMatrixWithRankandQSorder (Field &F, size_t n, size_t r, size_t t, typename Field::Element_ptr A, size_t lda, RandIter &G)

17.153 fflas_simd.h File Reference

```
#include "fflas-ffpack/utils/fflas_intrinsic.h"
#include <iostream>
#include <type_traits>
#include <limits>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/debug.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include "givaro/givtypestring.h"
#include <fflas-ffpack/fflas/fflas_simd/simd_modular.inl>
```

Data Structures

- struct support_simd< T >
- struct is_simd< T >
- struct NoSimd< T >
- struct SimdChooser< T, bool, bool >
- struct SimdChooser< T, false, b >
- struct SimdChooser< T, true, false >
- struct SimdChooser< T, true, true >

Namespaces

- FFLAS

Macros

- #define SIMD_INT 1
- #define INLINE inline
- #define CONST
- #define PURE

- #define NORML_MOD(C, P, NEGP, MIN, MAX, Q, T)
- #define FLOAT_MOD(C, P, INVP, Q)

Typedefs

- template< class T >
  using Simd = typename SimdChooser< T >::value

17.153.1 Macro Definition Documentation

17.153.1.1 SIMD_INT

```
#define SIMD_INT 1
```

17.153.1.2 INLINE

```
#define INLINE inline
```

17.153.1.3 CONST

```
#define CONST
```

17.153.1.4 PURE

```
#define PURE
```

17.153.1.5 NORML_MOD

```
#define NORML_MOD(
                C,
                P,
                NEGP,
                MIN,
                MAX,
                Q,
                T )
```

Value:

```
{
                    \
    Q = greater(C, MAX);
                    \
    T = lesser(C, MIN);
                    \
    Q = vand(Q, NEGP);
                    \
    T = vand(T, P);
                    \
    Q = vor(Q, T);
                    \
    C = add(C, Q);
                    \
}
```

17.153.1.6 FLOAT_MOD

```
#define FLOAT_MOD(
                C,
```

P,
INVP,
Q)

Value:

```
{                 \
    Q = mul(C, INVP);  \
    Q = floor(Q);      \
    C = fnmadd(C, Q, P);  \
}
```

17.153.2 Typedef Documentation

17.153.2.1 Simd

```
using Simd = typename SimdChooser<T>::value
```

17.154 fflas_sparse.C File Reference

C functions calls for level 1.5 and 2.5 FFLAS in fflas-c.h.

17.154.1 Detailed Description

C functions calls for level 1.5 and 2.5 FFLAS in fflas-c.h.

Author

Brice Boyer

See also

fflas/fflas_sparse.h

17.155 fflas_sparse.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/config.h"
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/paladin/parallel.h"
#include <recint/recint.h>
#include <givaro/udl.h>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/field/field-traits.h"
#include "fflas-ffpack/fflas/fflas_bounds.inl"
#include "fflas-ffpack/utils/fflas_memory.h"
#include <type_traits>
#include <vector>
#include <iostream>
#include "fflas-ffpack/fflas/fflas_sparse/sparse_matrix_traits.h"
#include "fflas-ffpack/fflas/fflas_sparse/utils.h"
#include "fflas-ffpack/fflas/fflas_sparse/csr.h"
#include "fflas-ffpack/fflas/fflas_sparse/coo.h"
#include "fflas-ffpack/fflas/fflas_sparse/ell.h"
#include "fflas-ffpack/fflas/fflas_sparse/sell.h"
#include "fflas-ffpack/fflas/fflas_sparse/csr_hyb.h"
#include "fflas-ffpack/fflas/fflas_sparse/ell_simd.h"
```

```
#include "fflas-ffpack/fflas/fflas_sparse/hyb_zo.h"
#include "fflas-ffpack/fflas/fflas_sparse.inl"
#include "fflas-ffpack/fflas/fflas_sparse/read_sparse.h"
```

Data Structures

- struct HelperFlag
- struct CsrMat< Field >
- struct CooMat< Field >
- struct EllMat< Field >
- struct SpMat< Field, flag >

Namespaces

- MKL_CONFIG
- FFLAS
- FFLAS::sparse_details

Macros

- #define index_t uint32_t
- #define ROUND_DOWN(x, s) ((x) & ∼((s)-1))
- #define __FFLASFFPACK_CACHE_LINE_SIZE 64
- #define assume_aligned(pout, pin, v) decltype(pin) pout = pin;
- #define DENSE_THRESHOLD 0.5

Enumerations

- enum class SparseMatrix_t {
  CSR , CSR_ZO , CSC , CSC_ZO ,
  COO , COO_ZO , ELL , ELL_ZO ,
  SELL , SELL_ZO , ELL_simd , ELL_simd_ZO ,
  CSR_HYB , HYB_ZO }

Functions

- template<class Field >
  void init_y (const Field &F, const size_t m, const typename Field::Element b, typename Field::Element_ptr y)
- template<class Field >
  void init_y (const Field &F, const size_t m, const size_t n, const typename Field::Element b, typename Field::Element_ptr y, const int ldy)
- template<class Field , class SM , class FC , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, Element←Categories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)
- template<class Field , class SM , class FC , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, Element←Categories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)
- template<class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, NotZOSparseMatrix)

- template<class Field , class SM >
std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, ZOSparseMatrix)
- template<class Field , class SM >
std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::true_type)
- template<class Field , class SM , class FCat , class MZO >
std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM , class FCat , class MZO >
std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM >
void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)

- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, ZOSparseMatrix)
- template<class Field , class SM , class FCat , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type pfspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM , class FCat , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type pfspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)

- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  void pfspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, ZOSparseMatrix)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::false_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, std::true_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, std::true_type)
- template<class Field , class SM >
  void pfspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::true_type)
- template<class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, const typename Field::Element &beta, typename Field::Element_ptr y)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, const typename Field::Element &beta, typename Field::Element_ptr y, int ldy)

17.155.1 Macro Definition Documentation

17.155.1.1 index_t

```
#define index_t uint32_t
```

17.155.1.2 ROUND_DOWN

```
#define ROUND_DOWN(
              x,
              s ) ((x) & ~((s)-1))
```

17.155.1.3 __FFLASFFPACK_CACHE_LINE_SIZE

```
#define __FFLASFFPACK_CACHE_LINE_SIZE 64
```

17.155.1.4 assume_aligned

```
#define assume_aligned(
              pout,
```

```
pin,
v ) decltype(pin) pout = pin;
```

17.155.1.5 DENSE_THRESHOLD

```
#define DENSE_THRESHOLD 0.5
```

17.156 fflas_sparse.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details

Macros

- #define __FFLASFFPACK_fflas_fflas_sparse_INL

Functions

- template< class Field >
  void init_y (const Field &F, const size_t m, const typename Field::Element b, typename Field::Element_ptr y)
- template< class Field >
  void init_y (const Field &F, const size_t m, const size_t n, const typename Field::Element b, typename Field::Element_ptr y, const int ldy)
- template< class Field , class SM , class FC , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)
- template< class Field , class SM , class FC , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmv_dispatch (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FC fc, MZO mzo)
- template< class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, NotZOSparseMatrix)
- template< class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag, ZOSparseMatrix)

- template<class Field , class SM >
  std::enable_if<!isSparseMatrixSimdFormat< Field, SM >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< isSparseMatrixSimdFormat< Field, SM >::value &&support_simd< typename Field::Element >::value >::type fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag, std::true_type)
- template<class Field , class SM , class FCat , class MZO >
  std::enable_if< !(std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value)>::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM , class FCat , class MZO >
  std::enable_if< std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineFloatTag >::value||std::is_same< typename ElementTraits< typename Field::Element >::value, ElementCategories::MachineIntTag >::value >::type fspmm_dispatch (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FCat, MZO)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, NotZOSparseMatrix)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if< support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  std::enable_if<!support_simd< typename Field::Element >::value >::type fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::UnparametricTag, ZOSparseMatrix)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::ModularTag, ZOSparseMatrix)

- template<class Field , class SM >
  void fspmv (const Field &F, const SM &A, typename Field::ConstElement_ptr x, const typename Field::Element &beta, typename Field::Element_ptr y)
- template<class Field , class SM >
  void fspmm (const Field &F, const SM &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, const typename Field::Element &beta, typename Field::Element_ptr y, int ldy)

17.156.1 Macro Definition Documentation

17.156.1.1 __FFLASFFPACK_fflas_fflas_sparse_INL

```
#define __FFLASFFPACK_fflas_fflas_sparse_INL
```

17.157 fflas_transpose.h File Reference

transpose the storage of the matrix (switch between row and col major mode)

```
#include "fflas-ffpack/utils/debug.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/fflas_memory.h"
#include "fflas-ffpack/fflas/fflas_simd.h"
```

Data Structures

- struct BlockTransposeSIMD< Field, Simd, >

Namespaces

- FFLAS
- FFLAS::_ftranspose_impl

Macros

- #define FFLAS_TRANSPOSE_BLOCKSIZE 32
- #define LD(i) R##i=Simd::loadu(A+lda∗i)
- #define ST(i) Simd::storeu(B+ldb∗i,R##i)

Functions

- template<size_t bs, typename Field , typename BTSimd >
  void not_inplace (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb)
- template<size_t bs, typename Field , typename BTSimd >
  void square_inplace (const Field &F, const BTSimd &BTS, const size_t m, typename Field::Element_ptr A, const size_t lda)
- template<size_t bs, typename Field , typename BTSimd >
  void nonsquare_inplace_v1 (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::Element_ptr A)
- template<size_t bs, typename Field , typename BTSimd >
  void nonsquare_inplace_v2 (const Field &F, const BTSimd &BTS, const size_t m, const size_t n, typename Field::Element_ptr A)

17.157.1 Detailed Description

transpose the storage of the matrix (switch between row and col major mode)

17.157.2 Macro Definition Documentation

17.157.2.1 FFLAS_TRANSPOSE_BLOCKSIZE

```
#define FFLAS_TRANSPOSE_BLOCKSIZE 32
```

17.157.2.2 LD

```
#define LD(
              i ) R##i=Simd::loadu(A+lda*i)
```

17.157.2.3 ST

```
#define ST(
              i ) Simd::storeu(B+ldb*i,R##i)
```

17.158 ffpack-fgesv.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/fflas_io.h"
#include <fflas-ffpack/ffpack/ffpack.h>
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.158.1 Function Documentation

17.158.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.159 ffpack-solve.C File Reference

```
#include <fflas-ffpack/fflas/fflas.h>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/fflas_io.h"
#include <fflas-ffpack/ffpack/ffpack.h>
#include <iostream>
```

Functions

- int main (int argc, char **argv)

17.159.1 Function Documentation

17.159.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

PS: the function Solve will modify the matrix A so here we used a duplicate matrix A2 otherwise A∗x will not be equal to b for the later verification stage

17.160 ffpack.C File Reference

C functions calls for FFPACK in ffpack-c.h.

```
#include "fflas-ffpack/interfaces/libs/ffpack_c.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "givaro//modular-balanced.h"
#include "givaro//modular.h"
```

Functions

- void LAPACKPerm2MathPerm (size_t ∗MathP, const size_t ∗LapackP, const size_t N)
- void MathPerm2LAPACKPerm (size_t ∗LapackP, const size_t ∗MathP, const size_t N)
- void MatrixApplyS_modular_double (const double p, double ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, bool positive)
- void PermApplyS_double (double ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void MatrixApplyT_modular_double (const double p, double ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, bool positive)
- void PermApplyT_double (double ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void composePermutationsLLM (size_t ∗MathP, const size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)
- void composePermutationsLLL (size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)
- void composePermutationsMLM (size_t ∗MathP1, const size_t ∗P2, const size_t R, const size_t N)
- void cyclic_shift_mathPerm (size_t ∗P, const size_t s)
- void cyclic_shift_row_modular_double (const double p, double ∗A, size_t m, size_t n, size_t lda, bool positive)
- void cyclic_shift_col_modular_double (const double p, double ∗A, size_t m, size_t n, size_t lda, bool positive)
- void applyP_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const enum FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, double ∗A, const size_t lda, const size_t ∗P, bool positive)
- void fgetrsin_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, double ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, double ∗B, const size_t ldb, int ∗info, bool positive)
- double ∗ fgetrsv_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, const size_t R, double ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, double ∗X, const size_t ldx, const double ∗B, const size_t ldb, int ∗info, bool positive)
- size_t fgesvin_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗B, const size_t ldb, int ∗info, bool positive)
- size_t fgesv_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, double ∗A, const size_t lda, double ∗X, const size_t ldx, const double ∗B, const size_t ldb, int ∗info, bool positive)
- void ftrtri_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t N, double ∗A, const size_t lda, bool positive)

- void trinv_left_modular_double (const double p, const size_t N, const double ∗L, const size_t ldl, double ∗X, const size_t ldx, bool positive)
- void ftrtrm_modular_double (const double p, const FFLAS::FFLAS_SIDE side, const enum FFLAS::FFLAS_DIAG Diag, const size_t N, double ∗A, const size_t lda, bool positive)
- size_t PLUQ_modular_double (const double p, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, bool positive)
- size_t LUdivine_modular_double (const double p, const enum FFLAS::FFLAS_DIAG Diag, const enum FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const enum FFPACK_C_LU_TAG LuTag, const size_t cutoff, bool positive)
- size_t ColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pRowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedRowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pRowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedRowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)

- size_t pColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pRowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t pReducedRowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- double ∗ Invertin_modular_double (const double p, const size_t M, double ∗A, const size_t lda, int ∗nullity, bool positive)
- double ∗ Invert_modular_double (const double p, const size_t M, const double ∗A, const size_t lda, double ∗X, const size_t ldx, int ∗nullity, bool positive)
- double ∗ Invert2_modular_double (const double p, const size_t M, double ∗A, const size_t lda, double ∗X, const size_t ldx, int ∗nullity, bool positive)
- size_t KrylovElim_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const size_t deg, size_t ∗iterates, size_t ∗inviterates, const size_t maxit, size_t virt, bool positive)
- size_t SpecRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, const size_t deg, size_t ∗rankProfile, bool positive)
- size_t Rank_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, bool positive)
- bool IsSingular_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, bool positive)
- double Det_modular_double (const double p, const size_t N, double ∗A, const size_t lda, bool positive)
- double ∗ Solve_modular_double (const double p, const size_t M, double ∗A, const size_t lda, double ∗x, const int incx, const double ∗b, const int incb, bool positive)
- void solveLB_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, double ∗L, const size_t ldl, const size_t ∗Q, double ∗B, const size_t ldb, bool positive)
- void solveLB2_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, double ∗L, const size_t ldl, const size_t ∗Q, double ∗B, const size_t ldb, bool positive)
- void RandomNullSpaceVector_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗X, const size_t incX, bool positive)
- size_t NullSpaceBasis_modular_double (const double p, const enum FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗NS, size_t ∗ldn, size_t ∗NSdim, bool positive)
- size_t RowRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rkprofile, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rkprofile, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const enum FFPACK_C_LU_TAG LuTag)
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)
- size_t RowRankProfileSubmatrixIndices_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rowindices, size_t ∗∗colindices, size_t ∗R, bool positive)
- size_t ColRankProfileSubmatrixIndices_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rowindices, size_t ∗∗colindices, size_t ∗R, bool positive)
- size_t RowRankProfileSubmatrix_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗X, size_t ∗R, bool positive)
- size_t ColRankProfileSubmatrix_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗X, size_t ∗R, bool positive)
- void getTriangular_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, const size_t R, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, bool positive)

- void getTriangularin_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, const size_t R, double ∗A, const size_t lda, bool positive)
- void getEchelonForm_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getEchelonFormin_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, double ∗A, const size_t lda, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getEchelonTransform_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const enum FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size←
_t ∗Q, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonForm_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonFormin_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, double ∗A, const size_t lda, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonTransform_modular_double (const double p, const enum FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

17.160.1 Detailed Description

C functions calls for FFPACK in ffpack-c.h.

Author

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See also

ffpack/ffpack.h

17.160.2 Function Documentation

17.160.2.1 LAPACKPerm2MathPerm()

```
void LAPACKPerm2MathPerm (
            size_t * MathP,
            const size_t * LapackP,
            const size_t N )
```

17.160.2.2 MathPerm2LAPACKPerm()

```
void MathPerm2LAPACKPerm (
            size_t * LapackP,
            const size_t * MathP,
            const size_t N )
```

17.160.2.3 MatrixApplyS_modular_double()

```
void MatrixApplyS_modular_double (
            const double p,
            double * A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            bool positive )
```

17.160.2.4 PermApplyS_double()

```
void PermApplyS_double (
            double * A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )
```

17.160.2.5 MatrixApplyT_modular_double()

```
void MatrixApplyT_modular_double (
            const double p,
            double * A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            bool positive )
```

17.160.2.6 PermApplyT_double()

```
void PermApplyT_double (
            double * A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )
```

17.160.2.7 composePermutationsLLM()

```
void composePermutationsLLM (
            size_t * MathP,
```

```
            const size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.160.2.8 composePermutationsLLL()

```
void composePermutationsLLL (
            size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.160.2.9 composePermutationsMLM()

```
void composePermutationsMLM (
            size_t * MathP1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.160.2.10 cyclic_shift_mathPerm()

```
void cyclic_shift_mathPerm (
            size_t * P,
            const size_t s )
```

17.160.2.11 cyclic_shift_row_modular_double()

```
void cyclic_shift_row_modular_double (
            const double p,
            double * A,
            size_t m,
            size_t n,
            size_t lda,
            bool positive )
```

17.160.2.12 cyclic_shift_col_modular_double()

```
void cyclic_shift_col_modular_double (
            const double p,
            double * A,
            size_t m,
            size_t n,
            size_t lda,
            bool positive )
```

17.160.2.13 applyP_modular_double()

```
void applyP_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const enum FFLAS::FFLAS_TRANSPOSE Trans,
```

```
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            double * A,
            const size_t lda,
            const size_t * P,
            bool positive )
```

17.160.2.14 fgetrsin_modular_double()

```
void fgetrsin_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            double * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.160.2.15 fgetrsv_modular_double()

```
double* fgetrsv_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            const size_t R,
            double * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            double * X,
            const size_t ldx,
            const double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.160.2.16 fgesvin_modular_double()

```
size_t fgesvin_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
```

```
int * info,
bool positive )
```

17.160.2.17 fgesv_modular_double()

```
size_t fgesv_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
            const double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.160.2.18 ftrtri_modular_double()

```
void ftrtri_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.19 trinv_left_modular_double()

```
void trinv_left_modular_double (
            const double p,
            const size_t N,
            const double * L,
            const size_t ldl,
            double * X,
            const size_t ldx,
            bool positive )
```

17.160.2.20 ftrtrm_modular_double()

```
void ftrtrm_modular_double (
            const double p,
            const FFLAS::FFLAS_SIDE side,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.21 PLUQ_modular_double()

```
size_t PLUQ_modular_double (
            const double p,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            bool positive )
```

17.160.2.22 LUdivine_modular_double()

```
size_t LUdivine_modular_double (
            const double p,
            const enum FFLAS::FFLAS_DIAG Diag,
            const enum FFLAS::FFLAS_TRANSPOSE Trans,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const enum FFPACK_C_LU_TAG LuTag,
            const size_t cutoff,
            bool positive )
```

17.160.2.23 ColumnEchelonForm_modular_double()

```
size_t ColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.24 RowEchelonForm_modular_double()

```
size_t RowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.25 ReducedColumnEchelonForm_modular_double()

```
size_t ReducedColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.26 ReducedRowEchelonForm_modular_double()

```
size_t ReducedRowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.27 ColumnEchelonForm_modular_float()

```
size_t ColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.28 RowEchelonForm_modular_float()

```
size_t RowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
```

```
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.29 ReducedColumnEchelonForm_modular_float()

```
size_t ReducedColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.30 ReducedRowEchelonForm_modular_float()

```
size_t ReducedRowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.31 ColumnEchelonForm_modular_int32_t()

```
size_t ColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.32 RowEchelonForm_modular_int32_t()

```
size_t RowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
```

```
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.33 ReducedColumnEchelonForm_modular_int32_t()

```
size_t ReducedColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.34 ReducedRowEchelonForm_modular_int32_t()

```
size_t ReducedRowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.35 pColumnEchelonForm_modular_double()

```
size_t pColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.36 pRowEchelonForm_modular_double()

```
size_t pRowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
```

```
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.37 pReducedColumnEchelonForm_modular_double()

```
size_t pReducedColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.38 pReducedRowEchelonForm_modular_double()

```
size_t pReducedRowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.39 pColumnEchelonForm_modular_float()

```
size_t pColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.40 pRowEchelonForm_modular_float()

```
size_t pRowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
```

```
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.41 pReducedColumnEchelonForm_modular_float()

```
size_t pReducedColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.42 pReducedRowEchelonForm_modular_float()

```
size_t pReducedRowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.43 pColumnEchelonForm_modular_int32_t()

```
size_t pColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.44 pRowEchelonForm_modular_int32_t()

```
size_t pRowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
```

```
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.45 pReducedColumnEchelonForm_modular_int32_t()

```
size_t pReducedColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.46 pReducedRowEchelonForm_modular_int32_t()

```
size_t pReducedRowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.47 Invertin_modular_double()

```
double* Invertin_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            int * nullity,
            bool positive )
```

17.160.2.48 Invert_modular_double()

```
double* Invert_modular_double (
            const double p,
            const size_t M,
            const double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
```

```
            int * nullity,
            bool positive )
```

17.160.2.49 Invert2_modular_double()

```
double* Invert2_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
            int * nullity,
            bool positive )
```

17.160.2.50 KrylovElim_modular_double()

```
size_t KrylovElim_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const size_t deg,
            size_t * iterates,
            size_t * inviterates,
            const size_t maxit,
            size_t virt,
            bool positive )
```

17.160.2.51 SpecRankProfile_modular_double()

```
size_t SpecRankProfile_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            const size_t deg,
            size_t * rankProfile,
            bool positive )
```

17.160.2.52 Rank_modular_double()

```
size_t Rank_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.53 IsSingular_modular_double()

```
bool IsSingular_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.54 Det_modular_double()

```
double Det_modular_double (
            const double p,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.55 Solve_modular_double()

```
double* Solve_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            double * x,
            const int incx,
            const double * b,
            const int incb,
            bool positive )
```

17.160.2.56 solveLB_modular_double()

```
void solveLB_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            double * L,
            const size_t ldl,
            const size_t * Q,
            double * B,
            const size_t ldb,
            bool positive )
```

17.160.2.57 solveLB2_modular_double()

```
void solveLB2_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
```

```
double * L,
const size_t ldl,
const size_t * Q,
double * B,
const size_t ldb,
bool positive )
```

17.160.2.58 RandomNullSpaceVector_modular_double()

```
void RandomNullSpaceVector_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double * X,
            const size_t incX,
            bool positive )
```

17.160.2.59 NullSpaceBasis_modular_double()

```
size_t NullSpaceBasis_modular_double (
            const double p,
            const enum FFLAS::FFLAS_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** NS,
            size_t * ldn,
            size_t * NSdim,
            bool positive )
```

17.160.2.60 RowRankProfile_modular_double()

```
size_t RowRankProfile_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rkprofile,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.61 ColumnRankProfile_modular_double()

```
size_t ColumnRankProfile_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rkprofile,
```

```
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.62 RankProfileFromLU()

```
void RankProfileFromLU (
            const size_t * P,
            const size_t N,
            const size_t R,
            size_t * rkprofile,
            const enum FFPACK_C_LU_TAG LuTag )
```

17.160.2.63 LeadingSubmatrixRankProfiles()

```
size_t LeadingSubmatrixRankProfiles (
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t LSm,
            const size_t LSn,
            const size_t * P,
            const size_t * Q,
            size_t * RRP,
            size_t * CRP )
```

17.160.2.64 RowRankProfileSubmatrixIndices_modular_double()

```
size_t RowRankProfileSubmatrixIndices_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rowindices,
            size_t ** colindices,
            size_t * R,
            bool positive )
```

17.160.2.65 ColRankProfileSubmatrixIndices_modular_double()

```
size_t ColRankProfileSubmatrixIndices_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rowindices,
            size_t ** colindices,
            size_t * R,
            bool positive )
```

17.160.2.66 RowRankProfileSubmatrix_modular_double()

```
size_t RowRankProfileSubmatrix_modular_double (
```

```
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** X,
            size_t * R,
            bool positive )
```

17.160.2.67 ColRankProfileSubmatrix_modular_double()

```
size_t ColRankProfileSubmatrix_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** X,
            size_t * R,
            bool positive )
```

17.160.2.68 getTriangular_modular_double()

```
void getTriangular_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            bool positive )
```

17.160.2.69 getTriangularin_modular_double()

```
void getTriangularin_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const size_t R,
            double * A,
            const size_t lda,
            bool positive )
```

17.160.2.70 getEchelonForm_modular_double()

```
void getEchelonForm_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
```

```
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.71 getEchelonFormin_modular_double()

```
void getEchelonFormin_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            double * A,
            const size_t lda,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.72 getEchelonTransform_modular_double()

```
void getEchelonTransform_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const enum FFLAS::FFLAS_DIAG Diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.73 getReducedEchelonForm_modular_double()

```
void getReducedEchelonForm_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const double * A,
```

```
            const size_t lda,
            double * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.74 getReducedEchelonFormin_modular_double()

```
void getReducedEchelonFormin_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            double * A,
            const size_t lda,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.75 getReducedEchelonTransform_modular_double()

```
void getReducedEchelonTransform_modular_double (
            const double p,
            const enum FFLAS::FFLAS_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.160.2.76 PLUQtoEchelonPermutation()

```
void PLUQtoEchelonPermutation (
            const size_t N,
            const size_t R,
            const size_t * P,
            size_t * outPerm )
```

17.161 ffpack.doxy File Reference

17.162 ffpack.h File Reference

Set of elimination based routines for dense linear algebra.

```
#include "givaro/givpoly1.h"
#include <fflas-ffpack/fflas-ffpack-config.h>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
```

```
#include <list>
#include <vector>
#include <iostream>
#include <algorithm>
#include "fflas-ffpack/checkers/checkers_ffpack.h"
#include "ffpack_fgesv.inl"
#include "ffpack_fgetrs.inl"
#include "fflas-ffpack/checkers/checkers_ffpack.inl"
#include "ffpack_pluq.inl"
#include "ffpack_pluq_mp.inl"
#include "ffpack_ppluq.inl"
#include "ffpack_ludivine.inl"
#include "ffpack_ludivine_mp.inl"
#include "ffpack_echelonforms.inl"
#include "ffpack_fsytrf.inl"
#include "ffpack_invert.inl"
#include "ffpack_ftrtr.inl"
#include "ffpack_ftrstr.inl"
#include "ffpack_ftrssyr2k.inl"
#include "ffpack_charpoly_kglu.inl"
#include "ffpack_charpoly_kgfast.inl"
#include "ffpack_charpoly_kgfastgeneralized.inl"
#include "ffpack_charpoly_danilevski.inl"
#include "ffpack_charpoly.inl"
#include "ffpack_frobenius.inl"
#include "ffpack_minpoly.inl"
#include "ffpack_krylovelim.inl"
#include "ffpack_permutation.inl"
#include "ffpack_rankprofiles.inl"
#include "ffpack_det_mp.inl"
#include "ffpack_bruhatgen.inl"
#include "ffpack.inl"
```

Data Structures

- class CharpolyFailed

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_FTRSTR_THRESHOLD 64
- #define __FFLASFFPACK_FTRSSYR2K_THRESHOLD 64

Functions

- void LAPACKPerm2MathPerm (size_t ∗MathP, const size_t ∗LapackP, const size_t N)

  Conversion of a permutation from LAPACK format to Math format.
- void MathPerm2LAPACKPerm (size_t ∗LapackP, const size_t ∗MathP, const size_t N)

  Conversion of a permutation from Maths format to LAPACK format.
- template<class Field >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans,

const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P)

Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.

- template<class Field >
void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field , class Cut , class Param >
void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class Field >
void MonotonicApplyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t R)

  Apply a R-monotonically increasing permutation P, to the matrix A.
- template<class Field >
void fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t *Q, typename Field::Element_ptr B, const size_t ldb, int *info)

  Solve the system $AX = B$ *or* $XA = B$.
- template<class Field >
Field::Element_ptr fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size↩_t N, const size_t NRHS, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t *P, const size_t *Q, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int *info)

  Solve the system A X = B or X A = B.
- template<class Field >
size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, int *info)

  Square system solver.
- template<class Field >
size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int *info)

  Rectangular system solver.
- template<class Field >
void ftrtri (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG Diag, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FTRTRI_THRESHOLD)

  Compute the inverse of a triangular matrix.
- template<class Field >
void trinv_left (const Field &F, const size_t N, typename Field::ConstElement_ptr L, const size_t ldl, typename Field::Element_ptr X, const size_t ldx)
- template<class Field >
void ftrtrm (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Compute the product of two triangular matrices of opposite shape.
- template<class Field >
void ftrstr (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const FFLAS::FFLAS_DIAG diagB, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const size_t threshold=__FFLASFFPACK_FTRSTR_THRESHOLD)

  Solve a triangular system with a triangular right hand side of the same shape.

- template<class Field >
  void ftrssyr2k (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size↩_t ldb, const size_t threshold=__FFLASFFPACK_FTRSSYR2K_THRESHOLD)

  Solve a triangular system in a symmetric sum: find B upper/lower triangular such that A^ T B + B^ T A = C where C is symmetric.
- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOLD)

  Triangular factorization of symmetric matrices.
- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Sequential seq, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOL
- template<class Field , class Cut , class Param >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold=__FFLASFFPACK_FSYTRF_
- template<class Field >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr D, const size_t incD, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOLD)

  Triangular factorization of symmetric matrices.
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)

  Compute a PLUQ factorization of the given matrix.
- template<class Field >
  size_t pPLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q, const FFLAS::ParSeqHelper::Sequential &PSHelper, size_t BCThreshold=__FFLASFFPACK_PLUQ_THRESHOLD)
- template<class Field , class Cut , class Param >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q, const FFLAS::ParSeqHelper::Parallel< Cut, Param > &PSHelper)
- template<class Field >
  size_t LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Qt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive, const size_t cutoff=__FFLASFFPACK_LUDIVINE↩_THRESHOLD)

  Compute the CUP or PLE factorization of the given matrix.
- template<class Field >
  size_t LUdivine_construct (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::Element_ptr u, const size_t incu, size_t ∗P, bool computeX, const FFPACK_MINPOLY_TAG MinTag=FfpackDense, const size_t kg_mc=0, const size_t kg_mb=0, const size_t kg_j=0)
- template<class Field >
  size_t ColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform=false, const FFPACK_LU_TAG Lu↩Tag=FfpackSlabRecursive)

  Compute the Column Echelon form of the input matrix in-place.
- template<class Field >
  size_t pColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)

- template<class Field , class PSHelper >
size_t ColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
size_t RowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Compute the Row Echelon form of the input matrix in-place.
- template<class Field >
size_t pRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t RowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
size_t ReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Compute the Reduced Column Echelon form of the input matrix in-place.
- template<class Field >
size_t pReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t ReducedColumnEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
size_t ReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Compute the Reduced Row Echelon form of the input matrix in-place.
- template<class Field >
size_t pReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform=false, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t ReducedRowEchelonForm (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Qt, const bool transform, const FFPACK_LU_TAG LuTag, const PSHelper &psH)
- template<class Field >
size_t GaussJordan (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t colbeg, const size_t rowbeg, const size_t colsize, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)

    Gauss-Jordan algorithm computing the Reduced Row echelon form and its transform matrix.
- template<class Field >
Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, int &nullity)

    Invert the given matrix in place or computes its nullity if it is singular.
- template<class Field >
Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

    Invert the given matrix or computes its nullity if it is singular.

- template<class Field >
  Field::Element_ptr Invert2 (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

  Invert the given matrix or computes its nullity if it is singular.
- template<class PolRing >
  std::list< typename PolRing::Element > & CharPoly (const PolRing &R, std::list< typename PolRing::Element > &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template<class PolRing >
  PolRing::Element & CharPoly (const PolRing &R, typename PolRing::Element &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template<class PolRing >
  PolRing::Element & CharPoly (const PolRing &R, typename PolRing::Element &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template<class Field , class Polynomial >
  std::list< Polynomial > & KellerGehrig (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)
- template<class Field , class Polynomial >
  int KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *kg_mc, size_t *kg_mb, size_t *kg_j)
- template<class Field , class Polynomial >
  std::list< Polynomial > & KGFast_generalized (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)
- template<class Field >
  void fgemv_kgf (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, const size_t kg_mc, const size_t kg_mb, const size_t kg_j)
- template<class Field , class Polynomial , class RandIter >
  std::list< Polynomial > & LUKrylov (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr U, const size_t ldu, RandIter &G)
- template<class Field , class Polynomial >
  std::list< Polynomial > & Danilevski (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)
- template<class PolRing >
  void RandomKrylovPrecond (const PolRing &PR, std::list< typename PolRing::Element > &completedFactors, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, size_t &Nb, typename PolRing::Domain_t::Element_ptr &B, size_t &ldb, typename PolRing::Domain_t::RandIter &g, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)
- template<class PolRing >
  std::list< typename PolRing::Element > & ArithProg (const PolRing &PR, std::list< typename PolRing::Element > &frobeniusForm, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, const size_t degree)
- template<class Field , class Polynomial >
  std::list< Polynomial > & LUKrylov_KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx)
- template<class Field , class Polynomial >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)

  Compute the minimal polynomial of the matrix A.

- template<class Field , class Polynomial , class RandIter >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, RandIter &G)

  Compute the minimal polynomial of the matrix A.
- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr v, const size_t incv)

  Compute the minimal polynomial of the matrix A and a vector v, namely the first linear dependency relation in the Krylov basis $(v, Av, ..., A^N v)$.
- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr v, const size_t incv, typename Field::Element_ptr K, const size_t ldk, size_t ∗P)
- template<class Field , class Polynomial >
  Polynomial & Hybrid_KGF_LUK_MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, size_t ∗P, const FFPACK_MINPOLY_TAG MinTag=FFPACK::FfpackDense, const size_t kg_mc=0, const size_t kg_←mb=0, const size_t kg_j=0)
- template<class Field >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Computes the rank of the given matrix using a PLUQ factorization.
- template<class Field >
  size_t pRank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0)
- template<class Field , class PSHelper >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH)
- template<class Field >
  bool IsSingular (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Returns true if the given matrix is singular.
- template<class Field >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P=NULL, size_t ∗Q=NULL)

  Returns the determinant of the given square matrix.
- template<class Field >
  Field::Element & pDet (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0, size_t ∗P=NULL, size_t ∗Q=NULL)
- template<class Field , class PSHelper >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH, size_t ∗P=NULL, size_t ∗Q=NULL)
- template<class Field >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb)

  Solves a linear system AX = b using PLUQ factorization.
- template<class Field , class PSHelper >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, PSHelper &psH)
- template<class Field >
  Field::Element_ptr pSolve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, size_t numthreads=0)
- template<class Field >
  ∗void RandomNullSpaceVector (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t incX)

Solve L X = B or X L = B in place.

- template<class Field >
size_t NullSpaceBasis (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &NS, size_t &ldn, size_t &NSdim)

  Computes a basis of the Left/Right nullspace of the matrix A.
- template<class Field >
size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the row rank profile of A.
- template<class Field >
size_t pRowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- template<class Field >
size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the column rank profile of A.
- template<class Field >
size_t pColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const FFPACK_LU_TAG LuTag)

  Recovers the column/row rank profile from the permutation of an LU decomposition.
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)

  Recovers the row and column rank profiles of any leading submatrix from the PLUQ decomposition.
- template<class Field >
size_t RowRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  RowRankProfileSubmatrixIndices.
- template<class Field >
size_t ColRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  Computes the indices of the submatrix r∗r X of A whose columns correspond to the column rank profile of A.
- template<class Field >
size_t RowRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Computes the r∗r submatrix X of A, by picking the row rank profile rows of A.
- template<class Field >
size_t ColRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Compute the $r \times r$ submatrix X of A, by picking the row rank profile rows of A.
- template<class Field >
void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false)

  Extracts a triangular matrix from a compact storage A=L\U of rank R.

- template<class Field >
void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda)

    Cleans up a compact storage A=L\U to reveal a triangular matrix of rank R.
- template<class Field >
void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or ColumnEchelonForm.
- template<class Field >
void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Cleans up a compact storage A=L\U obtained by RowEchelonForm or ColumnEchelonForm to reveal an echelon form of rank R.
- template<class Field >
void getEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or ColumnEchelonForm.
- template<class Field >
void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.
- template<class Field >
void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Cleans up a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.
- template<class Field >
void getReducedEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

    Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or ColumnEchelonForm.
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

    Auxiliary routine: determines the permutation that changes a PLUQ decomposition into a echelon form revealing PLUQ decomposition.
- template<class Field >
size_t LTBruhatGen (const Field &Fi, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)

    LTBruhatGen Suppose A is Left Triangular Matrix This procedure computes the Bruhat Representation of A and return the rank of A.
- template<class Field >
void getLTBruhatGen (const Field &Fi, const size_t N, const size_t r, const size_t ∗P, const size_t ∗Q, typename Field::Element_ptr R, const size_t ldr)

    GetLTBruhatGen This procedure Computes the Rank Revealing Matrix based on the Bruhta representation of a Matrix.

- template<class Field >
  void getLTBruhatGen (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t N, const size_t r, const size_t *P, const size_t *Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt)

  GetLTBruhatGen This procedure computes the matrix L or U f the Bruhat Representation Suppose that A is the bruhat representation of a matrix.
- size_t LTQSorder (const size_t N, const size_t r, const size_t *P, const size_t *Q)

  LTQSorder This procedure computes the order of quasiseparability of a matrix.
- template<class Field >
  size_t CompressToBlockBiDiagonal (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size↩_t s, size_t r, const size_t *P, const size_t *Q, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t *K, size_t *M, size_t *T)

  CompressToBlockBiDiagonal This procedure compress a compact representation of a row echelon form or column echelon form.
- template<class Field >
  void ExpandBlockBiDiagonalToBruhat (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size↩_t s, size_t r, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t NbBlocks, size_t *K, size_t *M, size_t *T)

  ExpandBlockBiDiagonal This procedure expand a compact representation of a row echelon form or column echelon form.
- void Bruhat2EchelonPermutation (size_t N, size_t R, const size_t *P, const size_t *Q, size_t *M)

  Bruhat2EchelonPermutation (N,R,P,Q) Compute M such that LM or MU is in echelon form where L or U are factors of the Bruhat Rpresentation.
- size_t * TInverter (size_t *T, size_t r)
- template<class Field >
  void ComputeRPermutation (const Field &Fi, size_t N, size_t r, const size_t *P, const size_t *Q, size_t *R, size_t *MU, size_t *ML)
- template<class Field >
  void productBruhatxTS (const Field &Fi, size_t N, size_t s, size_t r, const size_t *P, const size_t *Q, const typename Field::Element_ptr Xu, size_t ldu, size_t NbBlocksU, size_t *Ku, size_t *Tu, size_t *MU, const typename Field::Element_ptr Xl, size_t ldl, size_t NbBlocksL, size_t *Kl, size_t *Tl, size_t *ML, typename Field::Element_ptr B, size_t t, size_t ldb, typename Field::Element_ptr C, size_t ldc)

  productBruhatxTS Comput the product between the CRE compact representation of a matrix A and B a tall matrix
- template<class Field >
  Field::Element_ptr LQUPtoInverseOfFullRankMinor (const Field &F, const size_t rank, typename Field::Element_ptr A_factors, const size_t lda, const size_t *QtPointer, typename Field::Element_ptr X, const size_t ldx)

  LQUPtoInverseOfFullRankMinor.

17.162.1 Detailed Description

Set of elimination based routines for dense linear algebra.
Matrices are supposed over finite prime field of characteristic less than 2^26.

17.162.2 Macro Definition Documentation

17.162.2.1 __FFLASFFPACK_FTRSTR_THRESHOLD

```
#define __FFLASFFPACK_FTRSTR_THRESHOLD 64
```

17.162.2.2 __FFLASFFPACK_FTRSSYR2K_THRESHOLD

```
#define __FFLASFFPACK_FTRSSYR2K_THRESHOLD 64
```

17.163 ffpack.inl File Reference

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_INL

Functions

- template<class Field >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Computes the rank of the given matrix using a PLUQ factorization.
- template<class Field >
  size_t pRank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0)
- template<class Field , class PSHelper >
  size_t Rank (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH)
- template<class Field >
  bool IsSingular (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda)

  Returns true if the given matrix is singular.
- template<class Field >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P=NULL, size_t *Q=NULL)

  Returns the determinant of the given square matrix.
- template<class Field >
  Field::Element & pDet (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t numthreads=0, size_t *P=NULL, size_t *Q=NULL)
- template<class Field , class PSHelper >
  Field::Element & Det (const Field &F, typename Field::Element &det, const size_t N, typename Field::Element_ptr A, const size_t lda, const PSHelper &psH, size_t *P=NULL, size_t *Q=NULL)
- template<class Field >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb)

  Solves a linear system AX = b using PLUQ factorization.
- template<class Field , class PSHelper >
  Field::Element_ptr Solve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, PSHelper &psH)
- template<class Field >
  Field::Element_ptr pSolve (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr x, const int incx, typename Field::ConstElement_ptr b, const int incb, size_t numthreads=0)
- template<class Field >
  void RandomNullSpaceVector (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t incX)

  Solve L X = B or X L = B in place.
- template<class Field >
  size_t NullSpaceBasis (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &NS, size_t &ldn, size_t &NSdim)

Computes a basis of the Left/Right nullspace of the matrix A.

- template<class Field >
  void solveLB (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr L, const size_t ldl, const size_t *Q, typename Field::Element_ptr B, const size_t ldb)
- template<class Field >
  void solveLB2 (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr L, const size_t ldl, const size_t *Q, typename Field::Element_ptr B, const size_t ldb)

17.163.1 Macro Definition Documentation

17.163.1.1 __FFLASFFPACK_ffpack_INL

```
#define __FFLASFFPACK_ffpack_INL
```

17.164 ffpack_bruhatgen.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_bruhatgen_inl

Functions

- template<class Field >
  size_t LTBruhatGen (const Field &Fi, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)

  LTBruhatGen Suppose A is Left Triangular Matrix This procedure computes the Bruhat Representation of A and return the rank of A.
- template<class Field >
  void getLTBruhatGen (const Field &Fi, const size_t N, const size_t r, const size_t *P, const size_t *Q, typename Field::Element_ptr R, const size_t ldr)

  GetLTBruhatGen This procedure Computes the Rank Revealing Matrix based on the Bruhta representation of a Matrix.
- template<class Field >
  void getLTBruhatGen (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t N, const size_t r, const size_t *P, const size_t *Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt)

  GetLTBruhatGen This procedure computes the matrix L or U f the Bruhat Representation Suppose that A is the bruhat representation of a matrix.
- size_t LTQSorder (const size_t N, const size_t r, const size_t *P, const size_t *Q)

  LTQSorder This procedure computes the order of quasiseparability of a matrix.
- template<class Field >
  size_t CompressToBlockBiDiagonal (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size_t s, size_t r, const size_t *P, const size_t *Q, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t *K, size_t *M, size_t *T)

  CompressToBlockBiDiagonal This procedure compress a compact representation of a row echelon form or column echelon form.

- template<class Field >
  void ExpandBlockBiDiagonalToBruhat (const Field &Fi, const FFLAS::FFLAS_UPLO Uplo, size_t N, size_t s, size_t r, typename Field::Element_ptr A, size_t lda, typename Field::Element_ptr X, size_t ldx, size_t NbBlocks, size_t *K, size_t *M, size_t *T)

  ExpandBlockBiDiagonal This procedure expand a compact representation of a row echelon form or column echelon form.
- void Bruhat2EchelonPermutation (size_t N, size_t R, const size_t *P, const size_t *Q, size_t *M)

  Bruhat2EchelonPermutation (N,R,P,Q) Compute M such that LM or MU is in echelon form where L or U are factors of the Bruhat Rpresentation.
- size_t * TInverter (const size_t *T, size_t r)
- template<class Field >
  void ComputeRPermutation (const Field &Fi, size_t N, size_t r, const size_t *P, const size_t *Q, size_t *R, const size_t *MU, const size_t *ML)
- template<class Field >
  Field::Element_ptr expandLCRE (const Field &Fi, size_t N, size_t s, size_t r, size_t *R, size_t i, typename Field::ConstElement_ptr Xu, size_t ldu, size_t NbBlocksU, const size_t *Ku, const size_t *Tuinv, typename Field::ConstElement_ptr Xl, size_t ldl, size_t NbBlocksL, const size_t *Kl, const size_t *Tlinv, typename Field::Element_ptr CRE, size_t ldcre)

  Expands an anti-diagonal block of a left triangular matrix from its compact Bruhat representation.
- template<class Field >
  void productBruhatxTS (const Field &Fi, size_t N, size_t s, size_t r, size_t t, const size_t *P, const size_t *Q, typename Field::ConstElement_ptr Xu, size_t ldu, size_t NbBlocksU, const size_t *Ku, const size_t *Tu, const size_t *MU, typename Field::ConstElement_ptr Xl, size_t ldl, size_t NbBlocksL, const size_t *Kl, const size_t *Tl, const size_t *ML, typename Field::Element_ptr B, size_t ldb, const typename Field::Element beta, typename Field::Element_ptr D, size_t ldd)

  Compute the product of a left-triangular quasi-separable matrix A, represented by a compact Bruhat generator, with a dense rectangular matrix B: $C \leftarrow A \times B + betaC$.

17.164.1 Macro Definition Documentation

17.164.1.1 __FFLASFFPACK_ffpack_bruhatgen_inl

```
#define __FFLASFFPACK_ffpack_bruhatgen_inl
```

17.165 ffpack_c.h File Reference

```
#include <stdbool.h>
#include <stdlib.h>
#include <inttypes.h>
```

Macros

- #define FFPACK_COMPILED

Enumerations

- enum FFLAS_C_ORDER { FflasRowMajor =101 , FflasColMajor =102 , FflasRowMajor =101 , FflasColMajor =102 }
- enum FFLAS_C_TRANSPOSE { FflasNoTrans = 111 , FflasTrans = 112 , FflasNoTrans = 111 , FflasTrans = 112 }
- enum FFLAS_C_UPLO { FflasUpper = 121 , FflasLower = 122 , FflasUpper = 121 , FflasLower = 122 }
- enum FFLAS_C_DIAG { FflasNonUnit = 131 , FflasUnit = 132 , FflasNonUnit = 131 , FflasUnit = 132 }
- enum FFLAS_C_SIDE { FflasLeft = 141 , FflasRight = 142 , FflasLeft = 141 , FflasRight = 142 }

- enum FFPACK_C_LU_TAG { FfpackSlabRecursive = 1 , FfpackTileRecursive = 2 , FfpackSingular = 3 }
- enum FFPACK_C_CHARPOLY_TAG {
FfpackLUK =1 , FfpackKG =2 , FfpackHybrid =3 , FfpackKGFast =4 ,
FfpackDanilevski =5 , FfpackArithProg =6 , FfpackKGFastG =7 }
- enum FFPACK_C_MINPOLY_TAG { FfpackDense =1 , FfpackKGF =2 }

Functions

- void LAPACKPerm2MathPerm (size_t ∗MathP, const size_t ∗LapackP, const size_t N)
- void MathPerm2LAPACKPerm (size_t ∗LapackP, const size_t ∗MathP, const size_t N)
- void MatrixApplyS_modular_double (const double p, double ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, bool positive)
- void PermApplyS_double (double ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void MatrixApplyT_modular_double (const double p, double ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, bool positive)
- void PermApplyT_double (double ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void composePermutationsLLM (size_t ∗MathP, const size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)
- void composePermutationsLLL (size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)
- void composePermutationsMLM (size_t ∗MathP1, const size_t ∗P2, const size_t R, const size_t N)
- void cyclic_shift_mathPerm (size_t ∗P, const size_t s)
- void cyclic_shift_row_modular_double (const double p, double ∗A, size_t m, size_t n, size_t lda, bool positive)
- void cyclic_shift_col_modular_double (const double p, double ∗A, size_t m, size_t n, size_t lda, bool positive)
- void applyP_modular_double (const double p, const enum FFLAS_C_SIDE Side, const enum FFLAS_C_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, double ∗A, const size_t lda, const size_t ∗P, bool positive)
- void fgetrsin_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size←_t N, const size_t R, double ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, double ∗B, const size_t ldb, int ∗info, bool positive)
- double ∗ fgetrs_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, const size_t NRHS, const size_t R, double ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, double ∗X, const size_t ldx, const double ∗B, const size_t ldb, int ∗info, bool positive)
- size_t fgesvin_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗B, const size_t ldb, int ∗info, bool positive)
- size_t fgesv_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size←_t N, const size_t NRHS, double ∗A, const size_t lda, double ∗X, const size_t ldx, const double ∗B, const size_t ldb, int ∗info)
- void ftrtri_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG Diag, const size_t N, double ∗A, const size_t lda, bool positive)
- void trinv_left_modular_double (const double p, const size_t N, const double ∗L, const size_t ldl, double ∗X, const size_t ldx, bool positive)
- void ftrtrm_modular_double (const double p, const enum FFLAS_C_DIAG diag, const size_t N, double ∗A, const size_t lda, bool positive)
- size_t PLUQ_modular_double (const double p, const enum FFLAS_C_DIAG Diag, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, bool positive)
- size_t LUdivine_modular_double (const double p, const enum FFLAS_C_DIAG Diag, const enum FFLAS_C_TRANSPOSE trans, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const enum FFPACK_C_LU_TAG LuTag, const size_t cutoff, bool positive)
- size_t LUdivine_small_modular_double (const double p, const enum FFLAS_C_DIAG Diag, const enum FFLAS_C_TRANSPOSE trans, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t LUdivine_gauss_modular_double (const double p, const enum FFLAS_C_DIAG Diag, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const enum FFPACK_C_LU_TAG LuTag, bool positive)

- size_t ColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size↩ _t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t RowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_float (const float p, const size_t M, const size_t N, float ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedColumnEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm_modular_int32_t (const int32_t p, const size_t M, const size_t N, int32_t ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ReducedRowEchelonForm2_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, bool positive)
- size_t REF_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, const size_t colbeg, const size_t rowbeg, const size_t colsize, size_t ∗Qt, size_t ∗P, bool positive)
- double ∗ Invertin_modular_double (const double p, const size_t M, double ∗A, const size_t lda, int ∗nullity, bool positive)
- double ∗ Invert_modular_double (const double p, const size_t M, const double ∗A, const size_t lda, double ∗X, const size_t ldx, int ∗nullity, bool positive)
- double ∗ Invert2_modular_double (const double p, const size_t M, double ∗A, const size_t lda, double ∗X, const size_t ldx, int ∗nullity, bool positive)
- size_t KrylovElim_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const size_t deg, size_t ∗iterates, size_t ∗inviterates, const size_t maxit, size_t virt, bool positive)
- size_t SpecRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, const size_t deg, size_t ∗rankProfile, bool positive)
- size_t Rank_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, bool positive)
- bool IsSingular_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, bool positive)
- double Det_modular_double (const double p, const size_t N, double ∗A, const size_t lda, bool positive)
- double ∗ Solve_modular_double (const double p, const size_t M, double ∗A, const size_t lda, double ∗x, const int incx, const double ∗b, const int incb, bool positive)
- void solveLB_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, const size_t R, double ∗L, const size_t ldl, const size_t ∗Q, double ∗B, const size_t ldb)
- void solveLB2_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, const size_t R, double ∗L, const size_t ldl, const size_t ∗Q, double ∗B, const size_t ldb, bool positive)
- void RandomNullSpaceVector_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗X, const size_t incX, bool positive)

- size_t NullSpaceBasis_modular_double (const double p, const enum FFLAS_C_SIDE Side, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗NS, size_t ∗ldn, size_t ∗NSdim, bool positive)
- size_t RowRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rkprofile, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- size_t ColumnRankProfile_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rkprofile, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const enum FFPACK_C_LU_TAG LuTag)
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)
- size_t RowRankProfileSubmatrixIndices_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rowindices, size_t ∗∗colindices, size_t ∗R, bool positive)
- size_t ColRankProfileSubmatrixIndices_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, size_t ∗∗rowindices, size_t ∗∗colindices, size_t ∗R, bool positive)
- size_t RowRankProfileSubmatrix_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗X, size_t ∗R, bool positive)
- size_t ColRankProfileSubmatrix_modular_double (const double p, const size_t M, const size_t N, double ∗A, const size_t lda, double ∗∗X, size_t ∗R, bool positive)
- void getTriangular_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG diag, const size_t M, const size_t N, const size_t R, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, bool positive)
- void getTriangularin_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG diag, const size_t M, const size_t N, const size_t R, double ∗A, const size_t lda, bool positive)
- void getEchelonForm_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getEchelonFormin_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, double ∗A, const size_t lda, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getEchelonTransform_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const enum FFLAS_C_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonForm_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonFormin_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, double ∗A, const size_t lda, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void getReducedEchelonTransform_modular_double (const double p, const enum FFLAS_C_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const double ∗A, const size_t lda, double ∗T, const size_t ldt, const enum FFPACK_C_LU_TAG LuTag, bool positive)
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

17.165.1 Macro Definition Documentation

17.165.1.1 FFPACK_COMPILED

```
#define FFPACK_COMPILED
```

17.165.2 Enumeration Type Documentation

17.165.2.1 FFLAS_C_ORDER

`enum FFLAS_C_ORDER`

Enumerator

FflasRowMajor	row major
FflasColMajor	col major
FflasRowMajor	
FflasColMajor	

17.165.2.2 FFLAS_C_TRANSPOSE

`enum FFLAS_C_TRANSPOSE`

Enumerator

FflasNoTrans	Matrix is not transposed.
FflasTrans	Matrix is transposed.
FflasNoTrans	
FflasTrans	

17.165.2.3 FFLAS_C_UPLO

`enum FFLAS_C_UPLO`

Enumerator

FflasUpper	Triangular matrix is Upper triangular (if $i > j$ then $T_{i,j} = 0$)
FflasLower	Triangular matrix is Lower triangular (if $i < j$ then $T_{i,j} = 0$)
FflasUpper	
FflasLower	

17.165.2.4 FFLAS_C_DIAG

`enum FFLAS_C_DIAG`

Enumerator

FflasNonUnit	Triangular matrix has an explicit arbitrary diagonal.
FflasUnit	Triangular matrix has an implicit unit diagonal ($T_{i,i} = 1$)
FflasNonUnit	
FflasUnit	

17.165.2.5 FFLAS_C_SIDE

`enum FFLAS_C_SIDE`

Enumerator

FflasLeft	Operator applied on the left.
FflasRight	Operator applied on the rigth.
FflasLeft	
FflasRight	

17.165.2.6 FFPACK_C_LU_TAG

```
enum FFPACK_C_LU_TAG
```

Enumerator

FfpackSlabRecursive	
FfpackTileRecursive	
FfpackSingular	

17.165.2.7 FFPACK_C_CHARPOLY_TAG

```
enum FFPACK_C_CHARPOLY_TAG
```

Enumerator

FfpackLUK	
FfpackKG	
FfpackHybrid	
FfpackKGFast	
FfpackDanilevski	
FfpackArithProg	
FfpackKGFastG	

17.165.2.8 FFPACK_C_MINPOLY_TAG

```
enum FFPACK_C_MINPOLY_TAG
```

Enumerator

FfpackDense	
FfpackKGF	

17.165.3 Function Documentation

17.165.3.1 LAPACKPerm2MathPerm()

```
void LAPACKPerm2MathPerm (
             size_t * MathP,
```

```
            const size_t * LapackP,
            const size_t N )
```

17.165.3.2 MathPerm2LAPACKPerm()

```
void MathPerm2LAPACKPerm (
            size_t * LapackP,
            const size_t * MathP,
            const size_t N )
```

17.165.3.3 MatrixApplyS_modular_double()

```
void MatrixApplyS_modular_double (
            const double p,
            double * A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            bool positive )
```

17.165.3.4 PermApplyS_double()

```
void PermApplyS_double (
            double * A,
            const size_t lda,
            const size_t width,
            const size_t M2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )
```

17.165.3.5 MatrixApplyT_modular_double()

```
void MatrixApplyT_modular_double (
            const double p,
            double * A,
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4,
            bool positive )
```

17.165.3.6 PermApplyT_double()

```
void PermApplyT_double (
            double * A,
```

```
            const size_t lda,
            const size_t width,
            const size_t N2,
            const size_t R1,
            const size_t R2,
            const size_t R3,
            const size_t R4 )
```

17.165.3.7 composePermutationsLLM()

```
void composePermutationsLLM (
            size_t * MathP,
            const size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.165.3.8 composePermutationsLLL()

```
void composePermutationsLLL (
            size_t * P1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.165.3.9 composePermutationsMLM()

```
void composePermutationsMLM (
            size_t * MathP1,
            const size_t * P2,
            const size_t R,
            const size_t N )
```

17.165.3.10 cyclic_shift_mathPerm()

```
void cyclic_shift_mathPerm (
            size_t * P,
            const size_t s )
```

17.165.3.11 cyclic_shift_row_modular_double()

```
void cyclic_shift_row_modular_double (
            const double p,
            double * A,
            size_t m,
            size_t n,
            size_t lda,
            bool positive )
```

17.165.3.12 cyclic_shift_col_modular_double()

```
void cyclic_shift_col_modular_double (
            const double p,
```

```
            double * A,
            size_t m,
            size_t n,
            size_t lda,
            bool positive )
```

17.165.3.13 applyP_modular_double()

```
void applyP_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const enum FFLAS_C_TRANSPOSE Trans,
            const size_t M,
            const size_t ibeg,
            const size_t iend,
            double * A,
            const size_t lda,
            const size_t * P,
            bool positive )
```

17.165.3.14 fgetrsin_modular_double()

```
void fgetrsin_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            double * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.165.3.15 fgetrs_modular_double()

```
double* fgetrs_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            const size_t R,
            double * A,
            const size_t lda,
            const size_t * P,
            const size_t * Q,
            double * X,
            const size_t ldx,
            const double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.165.3.16 fgesvin_modular_double()

```
size_t fgesvin_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double * B,
            const size_t ldb,
            int * info,
            bool positive )
```

17.165.3.17 fgesv_modular_double()

```
size_t fgesv_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t NRHS,
            double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
            const double * B,
            const size_t ldb,
            int * info )
```

17.165.3.18 ftrtri_modular_double()

```
void ftrtri_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_DIAG Diag,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.165.3.19 trinv_left_modular_double()

```
void trinv_left_modular_double (
            const double p,
            const size_t N,
            const double * L,
            const size_t ldl,
            double * X,
            const size_t ldx,
            bool positive )
```

17.165.3.20 ftrtrm_modular_double()

```
void ftrtrm_modular_double (
            const double p,
            const enum FFLAS_C_DIAG diag,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.165.3.21 PLUQ_modular_double()

```
size_t PLUQ_modular_double (
            const double p,
            const enum FFLAS_C_DIAG Diag,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            bool positive )
```

17.165.3.22 LUdivine_modular_double()

```
size_t LUdivine_modular_double (
            const double p,
            const enum FFLAS_C_DIAG Diag,
            const enum FFLAS_C_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const enum FFPACK_C_LU_TAG LuTag,
            const size_t cutoff,
            bool positive )
```

17.165.3.23 LUdivine_small_modular_double()

```
size_t LUdivine_small_modular_double (
            const double p,
            const enum FFLAS_C_DIAG Diag,
            const enum FFLAS_C_TRANSPOSE trans,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.24 LUdivine_gauss_modular_double()

```
size_t LUdivine_gauss_modular_double (
            const double p,
            const enum FFLAS_C_DIAG Diag,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.25 ColumnEchelonForm_modular_double()

```
size_t ColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.26 RowEchelonForm_modular_double()

```
size_t RowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.27 ColumnEchelonForm_modular_float()

```
size_t ColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.28 RowEchelonForm_modular_float()

```
size_t RowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.29 ColumnEchelonForm_modular_int32_t()

```
size_t ColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.30 RowEchelonForm_modular_int32_t()

```
size_t RowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.31 ReducedColumnEchelonForm_modular_double()

```
size_t ReducedColumnEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.32 ReducedRowEchelonForm_modular_double()

```
size_t ReducedRowEchelonForm_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.33 ReducedColumnEchelonForm_modular_float()

```
size_t ReducedColumnEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.34 ReducedRowEchelonForm_modular_float()

```
size_t ReducedRowEchelonForm_modular_float (
            const float p,
            const size_t M,
            const size_t N,
            float * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.35 ReducedColumnEchelonForm_modular_int32_t()

```
size_t ReducedColumnEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.36 ReducedRowEchelonForm_modular_int32_t()

```
size_t ReducedRowEchelonForm_modular_int32_t (
            const int32_t p,
            const size_t M,
            const size_t N,
            int32_t * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.37 ReducedRowEchelonForm2_modular_double()

```
size_t ReducedRowEchelonForm2_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Qt,
            const bool transform,
            bool positive )
```

17.165.3.38 REF_modular_double()

```
size_t REF_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            const size_t colbeg,
            const size_t rowbeg,
            const size_t colsize,
            size_t * Qt,
            size_t * P,
            bool positive )
```

17.165.3.39 Invertin_modular_double()

```
double* Invertin_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            int * nullity,
            bool positive )
```

17.165.3.40 Invert_modular_double()

```
double* Invert_modular_double (
            const double p,
```

```
            const size_t M,
            const double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
            int * nullity,
            bool positive )
```

17.165.3.41 Invert2_modular_double()

```
double* Invert2_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            double * X,
            const size_t ldx,
            int * nullity,
            bool positive )
```

17.165.3.42 KrylovElim_modular_double()

```
size_t KrylovElim_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t * P,
            size_t * Q,
            const size_t deg,
            size_t * iterates,
            size_t * inviterates,
            const size_t maxit,
            size_t virt,
            bool positive )
```

17.165.3.43 SpecRankProfile_modular_double()

```
size_t SpecRankProfile_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            const size_t deg,
            size_t * rankProfile,
            bool positive )
```

17.165.3.44 Rank_modular_double()

```
size_t Rank_modular_double (
            const double p,
            const size_t M,
            const size_t N,
```

```
double * A,
const size_t lda,
bool positive )
```

17.165.3.45 IsSingular_modular_double()

```
bool IsSingular_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.165.3.46 Det_modular_double()

```
double Det_modular_double (
            const double p,
            const size_t N,
            double * A,
            const size_t lda,
            bool positive )
```

17.165.3.47 Solve_modular_double()

```
double* Solve_modular_double (
            const double p,
            const size_t M,
            double * A,
            const size_t lda,
            double * x,
            const int incx,
            const double * b,
            const int incb,
            bool positive )
```

17.165.3.48 solveLB_modular_double()

```
void solveLB_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            double * L,
            const size_t ldl,
            const size_t * Q,
            double * B,
            const size_t ldb )
```

17.165.3.49 solveLB2_modular_double()

```
void solveLB2_modular_double (
            const double p,
```

```
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            const size_t R,
            double * L,
            const size_t ldl,
            const size_t * Q,
            double * B,
            const size_t ldb,
            bool positive )
```

17.165.3.50 RandomNullSpaceVector_modular_double()

```
void RandomNullSpaceVector_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double * X,
            const size_t incX,
            bool positive )
```

17.165.3.51 NullSpaceBasis_modular_double()

```
size_t NullSpaceBasis_modular_double (
            const double p,
            const enum FFLAS_C_SIDE Side,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** NS,
            size_t * ldn,
            size_t * NSdim,
            bool positive )
```

17.165.3.52 RowRankProfile_modular_double()

```
size_t RowRankProfile_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rkprofile,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.53 ColumnRankProfile_modular_double()

```
size_t ColumnRankProfile_modular_double (
            const double p,
            const size_t M,
```

```
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rkprofile,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.54 RankProfileFromLU()

```
void RankProfileFromLU (
            const size_t * P,
            const size_t N,
            const size_t R,
            size_t * rkprofile,
            const enum FFPACK_C_LU_TAG LuTag )
```

17.165.3.55 LeadingSubmatrixRankProfiles()

```
size_t LeadingSubmatrixRankProfiles (
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t LSm,
            const size_t LSn,
            const size_t * P,
            const size_t * Q,
            size_t * RRP,
            size_t * CRP )
```

17.165.3.56 RowRankProfileSubmatrixIndices_modular_double()

```
size_t RowRankProfileSubmatrixIndices_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rowindices,
            size_t ** colindices,
            size_t * R,
            bool positive )
```

17.165.3.57 ColRankProfileSubmatrixIndices_modular_double()

```
size_t ColRankProfileSubmatrixIndices_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            size_t ** rowindices,
            size_t ** colindices,
            size_t * R,
            bool positive )
```

17.165.3.58 RowRankProfileSubmatrix_modular_double()

```
size_t RowRankProfileSubmatrix_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** X,
            size_t * R,
            bool positive )
```

17.165.3.59 ColRankProfileSubmatrix_modular_double()

```
size_t ColRankProfileSubmatrix_modular_double (
            const double p,
            const size_t M,
            const size_t N,
            double * A,
            const size_t lda,
            double ** X,
            size_t * R,
            bool positive )
```

17.165.3.60 getTriangular_modular_double()

```
void getTriangular_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            bool positive )
```

17.165.3.61 getTriangularin_modular_double()

```
void getTriangularin_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const enum FFLAS_C_DIAG diag,
            const size_t M,
            const size_t N,
            const size_t R,
            double * A,
            const size_t lda,
            bool positive )
```

17.165.3.62 getEchelonForm_modular_double()

```
void getEchelonForm_modular_double (
```

```
const double p,
const enum FFLAS_C_UPLO Uplo,
const enum FFLAS_C_DIAG diag,
const size_t M,
const size_t N,
const size_t R,
const size_t * P,
const double * A,
const size_t lda,
double * T,
const size_t ldt,
const bool OnlyNonZeroVectors,
const enum FFPACK_C_LU_TAG LuTag,
bool positive )
```

17.165.3.63 getEchelonFormin_modular_double()

```
void getEchelonFormin_modular_double (
        const double p,
        const enum FFLAS_C_UPLO Uplo,
        const enum FFLAS_C_DIAG diag,
        const size_t M,
        const size_t N,
        const size_t R,
        const size_t * P,
        double * A,
        const size_t lda,
        const enum FFPACK_C_LU_TAG LuTag,
        bool positive )
```

17.165.3.64 getEchelonTransform_modular_double()

```
void getEchelonTransform_modular_double (
        const double p,
        const enum FFLAS_C_UPLO Uplo,
        const enum FFLAS_C_DIAG diag,
        const size_t M,
        const size_t N,
        const size_t R,
        const size_t * P,
        const size_t * Q,
        const double * A,
        const size_t lda,
        double * T,
        const size_t ldt,
        const enum FFPACK_C_LU_TAG LuTag,
        bool positive )
```

17.165.3.65 getReducedEchelonForm_modular_double()

```
void getReducedEchelonForm_modular_double (
        const double p,
        const enum FFLAS_C_UPLO Uplo,
        const size_t M,
        const size_t N,
        const size_t R,
```

```
            const size_t * P,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const bool OnlyNonZeroVectors,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.66 getReducedEchelonFormin_modular_double()

```
void getReducedEchelonFormin_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            double * A,
            const size_t lda,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.67 getReducedEchelonTransform_modular_double()

```
void getReducedEchelonTransform_modular_double (
            const double p,
            const enum FFLAS_C_UPLO Uplo,
            const size_t M,
            const size_t N,
            const size_t R,
            const size_t * P,
            const size_t * Q,
            const double * A,
            const size_t lda,
            double * T,
            const size_t ldt,
            const enum FFPACK_C_LU_TAG LuTag,
            bool positive )
```

17.165.3.68 PLUQtoEchelonPermutation()

```
void PLUQtoEchelonPermutation (
            const size_t N,
            const size_t R,
            const size_t * P,
            size_t * outPerm )
```

17.166 ffpack_charpoly.inl File Reference

```
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "ffpack_charpoly_mp.inl"
```

Namespaces

- FFPACK

  Finite Field PACK Set of elimination based routines for dense linear algebra.
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_charpoly_INL

Functions

- template< class PolRing >
  std::list< typename PolRing::Element > & CharPoly (const PolRing &R, std::list< typename PolRing::Element > &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template< class PolRing >
  PolRing::Element & CharPoly (const PolRing &R, typename PolRing::Element &charp, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, typename PolRing::Domain_t::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag=FfpackAuto, const size_t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)

  Compute the characteristic polynomial of the matrix A.
- template< class Field , class Polynomial , class RandIter >
  std::list< Polynomial > & LUKrylov (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr U, const size_t ldu, RandIter &G)
- template< class Field , class Polynomial >
  std::list< Polynomial > & LUKrylov_KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx)

17.166.1 Macro Definition Documentation

17.166.1.1 __FFLASFFPACK_charpoly_INL

```
#define __FFLASFFPACK_charpoly_INL
```

17.167 ffpack_charpoly_danilevski.inl File Reference

Namespaces

- FFPACK

  Finite Field PACK Set of elimination based routines for dense linear algebra.

Macros

- #define __FFLASFFPACK_ffpack_charpoly_danilveski_INL

Functions

- template< class Field , class Polynomial >
  std::list< Polynomial > & Danilevski (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)

17.167.1 Macro Definition Documentation

17.167.1.1 __FFLASFFPACK_ffpack_charpoly_danilveski_INL

```
#define __FFLASFFPACK_ffpack_charpoly_danilveski_INL
```

17.168 ffpack_charpoly_kgfast.inl File Reference

Namespaces

- FFPACK

    ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_ffpack_charpoly_kgfast_INL

Functions

- template<class Field , class Polynomial >
  int KGFast (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *kg_mc, size_t *kg_mb, size_t *kg_j)
- template<class Field >
  void fgemv_kgf (const Field &F, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr X, const size_t incX, typename Field::Element_ptr Y, const size_t incY, const size_t kg_mc, const size_t kg_mb, const size_t kg_j)

17.168.1 Macro Definition Documentation

17.168.1.1 __FFLASFFPACK_ffpack_charpoly_kgfast_INL

```
#define __FFLASFFPACK_ffpack_charpoly_kgfast_INL
```

17.169 ffpack_charpoly_kgfastgeneralized.inl File Reference

```
#include <iostream>
#include "fflas-ffpack/utils/fflas_io.h"
```

Namespaces

- FFPACK

    ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_ffpack_charpoly_kgfastgeneralized_INL

Functions

- template<class Field >
  Field::Element_ptr buildMatrix (const Field &F, typename Field::ConstElement_ptr E, typename Field::ConstElement_ptr C, const size_t lda, const size_t *B, const size_t *T, const size_t me, const size_t mc, const size_t lambda, const size_t mu)

- template< class Field , class Polynomial >
  std::list< Polynomial > & KGFast_generalized (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::Element_ptr A, const size_t lda)

17.169.1 Macro Definition Documentation

17.169.1.1 __FFLASFFPACK_ffpack_charpoly_kgfastgeneralized_INL

```
#define __FFLASFFPACK_ffpack_charpoly_kgfastgeneralized_INL
```

17.170 ffpack_charpoly_kglu.inl File Reference

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_ffpack_charpoly_kglu_INL

Functions

- template< class Field >
  size_t updateD (const Field &F, size_t ∗d, size_t k, std::vector< std::vector< typename Field::Element > > &minpt)
- template< class Field >
  size_t newD (const Field &F, size_t ∗d, bool &KeepOn, const size_t l, const size_t N, typename Field::Element_ptr X, const size_t ∗Q, std::vector< std::vector< typename Field::Element > > &minpt)
- template< class Field , class Polynomial >
  std::list< Polynomial > & KellerGehrig (const Field &F, std::list< Polynomial > &charp, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)

17.170.1 Macro Definition Documentation

17.170.1.1 __FFLASFFPACK_ffpack_charpoly_kglu_INL

```
#define __FFLASFFPACK_ffpack_charpoly_kglu_INL
```

17.171 ffpack_charpoly_mp.inl File Reference

```
#include <givaro/zring.h>
#include "givaro/givinteger.h"
#include "givaro/givpoly1.h"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/fflas-ffpack.h"
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFPACK_charpoly_mp_INL

Functions

- FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr CharPoly (const FFPACK::RNSInteger< FFPACK::rns_double > &F, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr charp, const size_t N, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A, const size_t lda, Givaro::ZRing< Givaro::Integer >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, size_t degree)
- template<> Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > >::Element & CharPoly (const Givaro↩ ::Poly1Dom< Givaro::ZRing< Givaro::Integer > > &R, Givaro::Poly1Dom< Givaro::ZRing< Givaro::Integer > >::Element &charp, const size_t N, Givaro::Integer *A, const size_t lda, Givaro::ZRing< Givaro::Integer >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, size_t degree)

17.171.1 Macro Definition Documentation

17.171.1.1 __FFPACK_charpoly_mp_INL

```
#define __FFPACK_charpoly_mp_INL
```

17.172 ffpack_det_mp.inl File Reference

```
#include <givaro/zring.h>
#include "givaro/givinteger.h"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/fflas-ffpack.h"
```

Namespaces

- FFPACK

  F*inite* ***F****ield* ***PACK*** *Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFPACK_det_mp_INL

Functions

- template<class PSHelper >
  FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr & Det (const FFPACK::RNSInteger< FFPACK::rns_double > &F, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr &det, const size_t N, typename FFPACK::RNSInteger< FFPACK::rns_double >::Element_ptr A, const size_t lda, const PSHelper &psH)
- template<class PSHelper >
  Givaro::Integer & Det (const Givaro::ZRing< Givaro::Integer > &F, Givaro::Integer &det, const size_t N, Givaro::Integer *A, const size_t lda, const PSHelper &psH, size_t *P, size_t *Q)

17.172.1 Macro Definition Documentation

17.172.1.1 __FFPACK_det_mp_INL

```
#define __FFPACK_det_mp_INL
```

17.173 ffpack_echelonforms.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_echelon_forms_INL
- #define __FFLASFFPACK_GAUSSJORDAN_BASECASE 256

Functions

- template<class Field >
  void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false)

  Extracts a triangular matrix from a compact storage A=L\U of rank R.
- template<class Field >
  void getTriangular (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda)

  Cleans up a compact storage A=L\U to reveal a triangular matrix of rank R.
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

  Auxiliary routine: determines the permutation that changes a PLUQ decomposition into a echelon form revealing PLUQ decomposition.
- template<class Field >
  void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or Column↵ EchelonForm.
- template<class Field >
  void getEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Cleans up a compact storage A=L\U obtained by RowEchelonForm or ColumnEchelonForm to reveal an echelon form of rank R.
- template<class Field >
  void getEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK↵ _LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelon↵ Form or ColumnEchelonForm.
- template<class Field >
  void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const bool OnlyNonZeroVectors=false, const FFPACK_LU_TAG Lu↵ Tag=FfpackSlabRecursive)

  Extracts a matrix in echelon form from a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.
- template<class Field >
  void getReducedEchelonForm (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, typename Field::Element_ptr A, const size_t lda, const FFPACK_↵ LU_TAG LuTag=FfpackSlabRecursive)

Cleans up a compact storage A=L\U of rank R obtained by ReducedRowEchelonForm or ReducedColumnEchelonForm with transform = true.

- template<class Field >
  void getReducedEchelonTransform (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr T, const size_t ldt, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Extracts a transformation matrix to echelon form from a compact storage A=L\U of rank R obtained by RowEchelonForm or ColumnEchelonForm.

17.173.1 Macro Definition Documentation

17.173.1.1 __FFLASFFPACK_ffpack_echelon_forms_INL

```
#define __FFLASFFPACK_ffpack_echelon_forms_INL
```

17.173.1.2 __FFLASFFPACK_GAUSSJORDAN_BASECASE

```
#define __FFLASFFPACK_GAUSSJORDAN_BASECASE 256
```

17.174 ffpack_fgesv.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_fgesv_INL

Functions

- template<class Field >
  size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, int ∗info)

  Square system solver.
- template<class Field >
  size_t fgesv (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int ∗info)

  Rectangular system solver.

17.174.1 Macro Definition Documentation

17.174.1.1 __FFLASFFPACK_ffpack_fgesv_INL

```
#define __FFLASFFPACK_ffpack_fgesv_INL
```

17.175 ffpack_fgetrs.inl File Reference

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_fgetrs_INL

Functions

- template<class Field >
  void fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t ∗P, const size_t ∗Q, typename Field::Element_ptr B, const size_t ldb, int ∗info)

  Solve the system $AX = B$ or $XA = B$.
- template<class Field >
  Field::Element_ptr fgetrs (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, const size_t R, typename Field::Element_ptr A, const size_t lda, const size_t ∗P, const size_t ∗Q, typename Field::Element_ptr X, const size_t ldx, typename Field::ConstElement_ptr B, const size_t ldb, int ∗info)

  Solve the system A X = B or X A = B.

17.175.1 Macro Definition Documentation

17.175.1.1 __FFLASFFPACK_ffpack_fgetrs_INL

```
#define __FFLASFFPACK_ffpack_fgetrs_INL
```

17.176 ffpack_frobenius.inl File Reference

```
#include <givaro/givranditer.h>
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Functions

- template<class Field >
  void CompressRows (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t ∗d, const size_t nb_blocs)
- template<class Field >
  void CompressRowsQK (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t ∗d, const size_t deg, const size_t nb_blocs)
- template<class Field >
  void DeCompressRows (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t ∗d, const size_t nb_blocs)

- template<class Field >
  void DeCompressRowsQK (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t deg, const size_t nb_blocs)
- template<class Field >
  void CompressRowsQA (Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class Field >
  void DeCompressRowsQA (Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t ldtmp, const size_t *d, const size_t nb_blocs)
- template<class PolRing >
  void RandomKrylovPrecond (const PolRing &PR, std::list< typename PolRing::Element > &completed↩ Factors, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, size_t &Nb, typename PolRing::Domain_t::Element_ptr &B, size_t &ldb, typename PolRing::Domain_t::RandIter &g, const size_↩ t degree=__FFLASFFPACK_ARITHPROG_THRESHOLD)
- template<class PolRing >
  std::list< typename PolRing::Element > & ArithProg (const PolRing &PR, std::list< typename PolRing::↩ Element > &frobeniusForm, const size_t N, typename PolRing::Domain_t::Element_ptr A, const size_t lda, const size_t degree)

17.177 ffpack_fsytrf.inl File Reference

```
#include "fflas-ffpack/utils/fflas_io.h"
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_fsytrf_INL

Functions

- template<class Field >
  bool fsytrf_BC_Crout (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv)
- template<class Field >
  size_t fsytrf_BC_RL (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv)
- template<class Field >
  size_t fsytrf_UP_RPM_BC_RL (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template<class Field >
  size_t fsytrf_LOW_RPM_BC_Crout (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template<class Field >
  size_t fsytrf_UP_RPM_BC_Crout (const Field &F, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P)
- template<class Field >
  size_t fsytrf_UP_RPM (const Field &Fi, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, size_t *P, size_t BCThreshold)
- template<class Field >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename

Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, FFLAS::ParSeqHelper::Sequential seq, size_t threshold)
- template<class Field , class Cut , class Param >
  bool fsytrf_nonunit (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr Dinv, const size_t incDinv, FFLAS::ParSeqHelper::Parallel< Cut, Param > par, size_t threshold)
- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOLD)

  Triangular factorization of symmetric matrices.
- template<class Field >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Sequential seq, const size_t threshold=__FFLASFFPACK_FSYTRF_THRESHOL
- template<class Field , class Cut , class Param >
  bool fsytrf (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par, const size_t threshold=__FFLASFFPACK_FSYTRF_
- template<class Field >
  size_t fsytrf_RPM (const Field &F, const FFLAS::FFLAS_UPLO UpLo, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t threshold)
- template<class Field >
  void getTridiagonal (const Field &F, const size_t N, const size_t R, typename Field::ConstElement_ptr A, const size_t lda, size_t *P, typename Field::Element_ptr T, const size_t ldt)

17.177.1 Macro Definition Documentation

17.177.1.1 __FFLASFFPACK_ffpack_fsytrf_INL

```
#define __FFLASFFPACK_ffpack_fsytrf_INL
```

17.178 ffpack_ftrssyr2k.inl File Reference

```
#include "fflas-ffpack/utils/fflas_io.h"
```

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_ftrssyr2k_INL

Functions

- template<class Field >
  void ftrssyr2k (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size←_t ldb, const size_t threshold=__FFLASFFPACK_FTRSSYR2K_THRESHOLD)

  Solve a triangular system in a symmetric sum: find B upper/lower triangular such that A^ T B + B^ T A = C where C is symmetric.

17.178.1 Macro Definition Documentation

17.178.1.1 __FFLASFFPACK_ffpack_ftrssyr2k_INL

```
#define __FFLASFFPACK_ffpack_ftrssyr2k_INL
```

17.179 ffpack_ftrstr.inl File Reference

```
#include "fflas-ffpack/utils/fflas_io.h"
```

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_ftrstr_INL

Functions

- template<class Field >
  void ftrstr (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diagA, const FFLAS::FFLAS_DIAG diagB, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const size_t threshold=__FFLASFFPACK_FTRSTR_THRESHOLD)

  Solve a triangular system with a triangular right hand side of the same shape.

17.179.1 Macro Definition Documentation

17.179.1.1 __FFLASFFPACK_ffpack_ftrstr_INL

```
#define __FFLASFFPACK_ffpack_ftrstr_INL
```

17.180 ffpack_ftrtr.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define ENABLE_ALL_CHECKINGS 1
- #define __FFLASFFPACK_ffpack_ftrtr_INL

Functions

- template<class Field >
  void ftrtri (const Field &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG Diag, const size_t N, typename Field::Element_ptr A, const size_t lda, const size_t threshold=__FFLASFFPACK_FTRTRI_THRESHOLD)

  Compute the inverse of a triangular matrix.
- template<class Field >
  void ftrtrm (const Field &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_DIAG diag, const size_t N, typename Field::Element_ptr A, const size_t lda)

Compute the product of two triangular matrices of opposite shape.

- template<class Field >
  void trinv_left (const Field &F, const size_t N, typename Field::ConstElement_ptr L, const size_t ldl, typename Field::Element_ptr X, const size_t ldx)

17.180.1 Macro Definition Documentation

17.180.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.180.1.2 __FFLASFFPACK_ffpack_ftrtr_INL

```
#define __FFLASFFPACK_ffpack_ftrtr_INL
```

17.181 ffpack_inst.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "ffpack_inst_implem.inl"
```

Macros

- #define __FFPACK_INST_C
- #define FFLAS_COMPILED
- #define INST_OR_DECL
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.181.1 Macro Definition Documentation

17.181.1.1 __FFPACK_INST_C

```
#define __FFPACK_INST_C
```

17.181.1.2 FFLAS_COMPILED

```
#define FFLAS_COMPILED
```

17.181.1.3 INST_OR_DECL

```
#define INST_OR_DECL
```

17.181.1.4 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.181.1.5 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.181.1.6 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.181.1.7 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.181.1.8 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.181.1.9 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.181.1.10 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.181.1.11 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.182 ffpack_inst.h File Reference

```
#include "givaro/modular.h"
#include "givaro/modular-balanced.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "ffpack_inst_implem.inl"
```

Macros

- #define FFLAS_COMPILED
- #define INST_OR_DECL <>
- #define FFLAS_FIELD Givaro::ModularBalanced
- #define FFLAS_ELT double
- #define FFLAS_ELT float

- #define FFLAS_ELT int64_t
- #define FFLAS_FIELD Givaro::Modular
- #define FFLAS_ELT double
- #define FFLAS_ELT float
- #define FFLAS_ELT int64_t

17.182.1 Macro Definition Documentation

17.182.1.1 FFLAS_COMPILED

```
#define FFLAS_COMPILED
```

17.182.1.2 INST_OR_DECL

```
#define INST_OR_DECL <>
```

17.182.1.3 FFLAS_FIELD [1/2]

```
#define FFLAS_FIELD Givaro::ModularBalanced
```

17.182.1.4 FFLAS_ELT [1/6]

```
#define FFLAS_ELT double
```

17.182.1.5 FFLAS_ELT [2/6]

```
#define FFLAS_ELT float
```

17.182.1.6 FFLAS_ELT [3/6]

```
#define FFLAS_ELT int64_t
```

17.182.1.7 FFLAS_FIELD [2/2]

```
#define FFLAS_FIELD Givaro::Modular
```

17.182.1.8 FFLAS_ELT [4/6]

```
#define FFLAS_ELT double
```

17.182.1.9 FFLAS_ELT [5/6]

```
#define FFLAS_ELT float
```

17.182.1.10 FFLAS_ELT [6/6]

```
#define FFLAS_ELT int64_t
```

17.183 ffpack_inst_implem.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Functions

- void composePermutationsLLM (size_t ∗MathP, const size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in MathP as a MathPermutation format.
- void composePermutationsLLL (size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.
- void composePermutationsMLM (size_t ∗MathP1, const size_t ∗P2, const size_t R, const size_t N)

  Computes MathP1 x Diag (I_R, P2) where MathP1 is a MathPermutation and P2 a LAPACK permutation and store the result in MathP1 as a MathPermutation format.
- void cyclic_shift_mathPerm (size_t ∗P, const size_t s)
- template< typename Base_t >
  void cyclic_shift_row_col (Base_t ∗A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void cyclic_shift_row (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT ∗A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void cyclic_shift_col (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT ∗A, size_t m, size_t n, size_t lda)
- template INST_OR_DECL void applyP (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, FFLAS_ELT ∗A, const size_t lda, const size_t ∗P)
- template INST_OR_DECL void fgetrs (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, FFLAS_ELT ∗B, const size_t ldb, int ∗info)
- template INST_OR_DECL FFLAS_ELT ∗ fgetrs (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, const size_t R, FFLAS_ELT ∗A, const size_t lda, const size_t ∗P, const size_t ∗Q, FFLAS_ELT ∗X, const size_t ldx, const FFLAS_ELT ∗B, const size_t ldb, int ∗info)
- template INST_OR_DECL size_t fgesv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗B, const size_t ldb, int ∗info)
- template INST_OR_DECL size_t fgesv (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t NRHS, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t ldx, const FFLAS_ELT ∗B, const size_t ldb, int ∗info)
- template INST_OR_DECL void ftrtri (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG Diag, const size_t N, FFLAS_ELT ∗A, const size_t lda, const size_↩
  t threshold)
- template INST_OR_DECL void trinv_left (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t N, const FFLAS_ELT ∗L, const size_t ldl, FFLAS_ELT ∗X, const size_t ldx)
- template INST_OR_DECL void ftrtrm (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE side, const FFLAS::FFLAS_DIAG diag, const size_t N, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL size_t PLUQ (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q)
- template INST_OR_DECL size_t LUdivine (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, FFLAS_ELT ∗A, const size↩
  _t lda, size_t ∗P, size_t ∗Qt, const FFPACK_LU_TAG LuTag, const size_t cutoff)
- template INST_OR_DECL size_t LUdivine_small (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const FFPACK_LU_TAG LuTag)

- template INST_OR_DECL size_t LUdivine_gauss (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t RowEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ReducedRowEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ColumnEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ReducedColumnEchelonForm (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Qt, const bool transform, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL FFLAS_ELT ∗ Invert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, int &nullity)
- template INST_OR_DECL FFLAS_ELT ∗ Invert (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t ldx, int &nullity)
- template INST_OR_DECL FFLAS_ELT ∗ Invert2 (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t ldx, int &nullity)
- template INST_OR_DECL std::list< Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element > & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, std::list< Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element > &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element & CharPoly (const Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > > &R, Givaro::Poly1Dom< FFLAS_FIELD< FFLAS_ELT > >::Element &charp, const size_t N, FFLAS_ELT ∗A, const size_t lda, const FFPACK_CHARPOLY_TAG CharpTag, const size_t degree)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda, FFLAS_FIELD< FFLAS_ELT >::RandIter &G)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL std::vector< FFLAS_ELT > & MatVecMinPoly (const FFLAS_FIELD< FFLAS_ELT > &F, std::vector< FFLAS_ELT > &minP, const size_t N, const FFLAS_ELT ∗A, const size_t lda, const FFLAS_ELT ∗V, const size_t incv)
- template INST_OR_DECL size_t KrylovElim (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const size_t deg, size_t ∗iterates, size_t ∗inviterates, const size_t maxit, size_t virt)
- template INST_OR_DECL size_t SpecRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, const size_t deg, size_t ∗rankProfile)
- template INST_OR_DECL size_t Rank (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL bool IsSingular (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL FFLAS_ELT & Det (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT &det, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗P, size_t ∗Q)
- template INST_OR_DECL FFLAS_ELT & Det (const FFLAS_FIELD< FFLAS_ELT > &F, FFLAS_ELT &det, const size_t N, FFLAS_ELT ∗A, const size_t lda, const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter::Threads > &parH, size_t ∗P, size_t ∗Q)

- template INST_OR_DECL FFLAS_ELT ∗ Solve (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗x, const int incx, const FFLAS_ELT ∗b, const int incb)
- template INST_OR_DECL void solveLB (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗L, const size_t ldl, const size_t ∗Q, FFLAS_ELT ∗B, const size_t ldb)
- template INST_OR_DECL void solveLB2 (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗L, const size_t ldl, const size_t ∗Q, FFLAS_ELT ∗B, const size_t ldb)
- template INST_OR_DECL void RandomNullSpaceVector (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗X, const size_t incX)
- template INST_OR_DECL size_t NullSpaceBasis (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_SIDE Side, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&NS, size_t &ldn, size_t &NSdim)
- template INST_OR_DECL size_t RowRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL size_t ColumnRankProfile (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const FFPACK_LU_TAG LuTag)

  Recovers the column/row rank profile from the permutation of an LU decomposition.
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)

  Recovers the row and column rank profiles of any leading submatrix from the PLUQ decomposition.
- template INST_OR_DECL size_t RowRankProfileSubmatrixIndices (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)
- template INST_OR_DECL size_t ColRankProfileSubmatrixIndices (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)
- template INST_OR_DECL size_t RowRankProfileSubmatrix (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&X, size_t &R)
- template INST_OR_DECL size_t ColRankProfileSubmatrix (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t M, const size_t N, FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗&X, size_t &R)
- template INST_OR_DECL void getTriangular< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors)
- template INST_OR_DECL void getTriangular< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, FFLAS_ELT ∗A, const size_t lda)
- template INST_OR_DECL void getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, FFLAS_ELT ∗A, const size_t lda, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const FFLAS::FFLAS_DIAG diag, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const bool OnlyNonZeroVectors, const FFPACK_LU_TAG LuTag)

- template INST_OR_DECL void getReducedEchelonForm< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, FFLAS_ELT ∗A, const size_t lda, const FFPACK_LU_TAG LuTag)
- template INST_OR_DECL void getReducedEchelonTransform< FFLAS_FIELD< FFLAS_ELT > > (const FFLAS_FIELD< FFLAS_ELT > &F, const FFLAS::FFLAS_UPLO Uplo, const size_t M, const size_t N, const size_t R, const size_t ∗P, const size_t ∗Q, const FFLAS_ELT ∗A, const size_t lda, FFLAS_ELT ∗T, const size_t ldt, const FFPACK_LU_TAG LuTag)
- void PLUQtoEchelonPermutation (const size_t N, const size_t R, const size_t ∗P, size_t ∗outPerm)

  Auxiliary routine: determines the permutation that changes a PLUQ decomposition into a echelon form revealing PLUQ decomposition.
- template INST_OR_DECL FFLAS_ELT ∗ LQUPtoInverseOfFullRankMinor (const FFLAS_FIELD< FFLAS_ELT > &F, const size_t rank, FFLAS_ELT ∗A_factors, const size_t lda, const size_t ∗QtPointer, FFLAS_ELT ∗X, const size_t ldx)

17.184 ffpack_invert.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_invert_INL

Functions

- template<class Field >
  Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, int &nullity)

  Invert the given matrix in place or computes its nullity if it is singular.
- template<class Field >
  Field::Element_ptr Invert (const Field &F, const size_t M, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

  Invert the given matrix or computes its nullity if it is singular.
- template<class Field >
  Field::Element_ptr Invert2 (const Field &F, const size_t M, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, int &nullity)

  Invert the given matrix or computes its nullity if it is singular.

17.184.1 Macro Definition Documentation

17.184.1.1 __FFLASFFPACK_ffpack_invert_INL

```
#define __FFLASFFPACK_ffpack_invert_INL
```

17.185 ffpack_krylovelim.inl File Reference

Macros

- #define __FFLASFFPACK_ffpack_krylovelim_INL

17.185.1 Macro Definition Documentation

17.185.1.1 __FFLASFFPACK_ffpack_krylovelim_INL

```
#define __FFLASFFPACK_ffpack_krylovelim_INL
```

17.186 ffpack_ludivine.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_bounds.inl"
```

Data Structures

- class callLUdivine_small< Element >
- class callLUdivine_small< double >
- class callLUdivine_small< float >

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_ffpack_ludivine_INL

Functions

- template<class Field >
  size_t LUdivine_gauss (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)
- template<class Field >
  size_t LUdivine_small (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag)
- template<class Field >
  size_t LUdivine (const Field &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFPACK::FFPACK_LU_TAG LuTag, const size_t cutoff)
- template<class Field >
  size_t LUdivine_construct (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size↩_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, typename Field::Element_ptr u, const size_t incu, size_t *P, bool computeX, const FFPACK::FFPACK↩_MINPOLY_TAG MinTag, const size_t kg_mc, const size_t kg_mb, const size_t kg_j)

17.186.1 Macro Definition Documentation

17.186.1.1 __FFLASFFPACK_ffpack_ludivine_INL

```
#define __FFLASFFPACK_ffpack_ludivine_INL
```

17.187 ffpack_ludivine_mp.inl File Reference

```
#include <givaro/modular-integer.h>
#include <givaro/givinteger.h>
#include "fflas-ffpack/field/rns-integer-mod.h"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/ffpack/ffpack_ludivine.inl"
```

Namespaces

- FFPACK

  Finite Field PACK Set of elimination based routines for dense linear algebra.

Macros

- #define __FFPACK_ludivine_mp_INL

Functions

- template<> size_t LUdivine (const Givaro::Modular< Givaro::Integer > &F, const FFLAS::FFLAS_DIAG Diag, const FFLAS::FFLAS_TRANSPOSE trans, const size_t M, const size_t N, typename Givaro::Integer ∗A, const size_t lda, size_t ∗P, size_t ∗Q, const FFPACK::FFPACK_LU_TAG LuTag, const size_t cutoff)

17.187.1 Macro Definition Documentation

17.187.1.1 __FFPACK_ludivine_mp_INL

```
#define __FFPACK_ludivine_mp_INL
```

17.188 ffpack_minpoly.inl File Reference

Namespaces

- FFPACK

  Finite Field PACK Set of elimination based routines for dense linear algebra.
- FFPACK::Protected

Macros

- #define __FFLASFFPACK_ffpack_minpoly_INL

Functions

- template<class Field , class Polynomial >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda)

  Compute the minimal polynomial of the matrix A.
- template<class Field , class Polynomial , class RandIter >
  Polynomial & MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, RandIter &G)

  Compute the minimal polynomial of the matrix A.

- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr v, const size_t incv)

  Compute the minimal polynomial of the matrix A and a vector v, namely the first linear dependency relation in the Krylov basis $(v, Av, ..., A^N v)$.
- template<class Field , class Polynomial >
  Polynomial & MatVecMinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr v, const size_t incv, typename Field::Element_ptr K, const size_t ldk, size_t ∗P)
- template<class Field , class Polynomial >
  Polynomial & Hybrid_KGF_LUK_MinPoly (const Field &F, Polynomial &minP, const size_t N, typename Field::ConstElement_ptr A, const size_t lda, typename Field::Element_ptr X, const size_t ldx, size_t ∗P, const FFPACK_MINPOLY_TAG MinTag=FFPACK::FfpackDense, const size_t kg_mc=0, const size_t kg_↩ mb=0, const size_t kg_j=0)

17.188.1 Macro Definition Documentation

17.188.1.1 __FFLASFFPACK_ffpack_minpoly_INL

```
#define __FFLASFFPACK_ffpack_minpoly_INL
```

17.189 ffpack_permutation.inl File Reference

```
#include <givaro/zring.h>
#include "fflas-ffpack/fflas/fflas_fassign.h"
```

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_permutation_INL
- #define FFLASFFPACK_PERM_BKSIZE 32

Functions

- template<class Field >
  void MonotonicApplyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P, const size_t R)

  Apply a R-monotonically increasing permutation P, to the matrix A.
- template<class Field >
  void MonotonicCompress (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t ∗MathP, const size_t R, const size_t maxpiv, const size_t rowstomove, const std::vector< bool > &ispiv)
- template<class Field >
  void MonotonicCompressMorePivots (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t ∗MathP, const size_t R, const size_t rowstomove, const size_t lenP)
- template<class Field >
  void MonotonicCompressCycles (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t ∗MathP, const size_t lenP)

- template<class Field >
void MonotonicExpand (const Field &F, const FFLAS::FFLAS_SIDE Side, const size_t M, typename Field::Element_ptr A, const size_t lda, const size_t incA, const size_t ∗MathP, const size_t R, const size_t maxpiv, const size_t rowstomove, const std::vector< bool > &ispiv)
- template<class Field >
void applyP_block (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P)
- template<class Field >
void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field >
void doApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field , class Cut , class Param >
void MatrixApplyS (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class T >
void PermApplyS (T ∗A, const size_t lda, const size_t width, const size_t M2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
void doApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr tmp, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- template<class Field >
void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Sequential seq)
- template<class Field , class Cut , class Param >
void MatrixApplyT (const Field &F, typename Field::Element_ptr A, const size_t lda, const size_↩
t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)
- template<class T >
void PermApplyT (T ∗A, const size_t lda, const size_t width, const size_t N2, const size_t R1, const size_t R2, const size_t R3, const size_t R4)
- void LAPACKPerm2MathPerm (size_t ∗MathP, const size_t ∗LapackP, const size_t N)

  Conversion of a permutation from LAPACK format to Math format.
- void MathPerm2LAPACKPerm (size_t ∗LapackP, const size_t ∗MathP, const size_t N)

  Conversion of a permutation from Maths format to LAPACK format.
- void composePermutationsLLL (size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.
- void composePermutationsLLM (size_t ∗MathP, const size_t ∗P1, const size_t ∗P2, const size_t R, const size_t N)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in MathP as a MathPermutation format.

- void composePermutationsMLM (size_t ∗MathP1, const size_t ∗P2, const size_t R, const size_t N)

  Computes MathP1 x Diag (I_R, P2) where MathP1 is a MathPermutation and P2 a LAPACK permutation and store the result in MathP1 as a MathPermutation format.
- void cyclic_shift_mathPerm (size_t ∗P, const size_t s)
- template<class Field >
  void cyclic_shift_row_col (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  void cyclic_shift_row (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<typename T >
  void cyclic_shift_row (const RNSIntegerMod< T > &F, typename T::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  void cyclic_shift_col (const Field &F, typename Field::Element_ptr A, size_t m, size_t n, size_t lda)
- template<typename T >
  void cyclic_shift_col (const RNSIntegerMod< T > &F, typename T::Element_ptr A, size_t m, size_t n, size_t lda)
- template<class Field >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t M, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P)

  Computes P1 x Diag (I_R, P2) where P1 is a LAPACK and P2 a LAPACK permutation and store the result in P1 as a LAPACK permutation.
- template<class Field , class Cut , class Param >
  void applyP (const Field &F, const FFLAS::FFLAS_SIDE Side, const FFLAS::FFLAS_TRANSPOSE Trans, const size_t m, const size_t ibeg, const size_t iend, typename Field::Element_ptr A, const size_t lda, const size_t ∗P, const FFLAS::ParSeqHelper::Parallel< Cut, Param > par)

17.189.1 Macro Definition Documentation

17.189.1.1 __FFLASFFPACK_ffpack_permutation_INL

```
#define __FFLASFFPACK_ffpack_permutation_INL
```

17.189.1.2 FFLASFFPACK_PERM_BKSIZE

```
#define FFLASFFPACK_PERM_BKSIZE 32
```

17.190 ffpack_pluq.inl File Reference

Namespaces

- FFPACK

  *Finite **Field** **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_pluq_INL
- #define CROUT

Functions

- template<class Field >
  size_t PLUQ_basecaseV3 (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element ∗A, const size_t lda, size_t ∗P, size_t ∗Q)

- template<class Field >
  size_t PLUQ_basecaseV2 (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element *A, const size_t lda, size_t *P, size_t *Q)
- template<class Field >
  size_t PLUQ_basecaseCrout (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size←_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)
- template<class Field >
  size_t _PLUQ (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, size_t BCThreshold)
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q, const FFLAS::ParSeqHelper::Sequential &PSHelper, size_t BCThreshold=__FFLASFFPACK_PLUQ_THRESHOLD)
- template<class Field >
  size_t PLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t *P, size_t *Q)

  Compute a PLUQ factorization of the given matrix.

17.190.1 Macro Definition Documentation

17.190.1.1 __FFLASFFPACK_ffpack_pluq_INL

```
#define __FFLASFFPACK_ffpack_pluq_INL
```

17.190.1.2 CROUT

```
#define CROUT
```

17.191 ffpack_pluq_mp.inl File Reference

```
#include "fflas-ffpack/field/rns-integer-mod.h"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/fflas-ffpack.h"
#include "givaro/givinteger.h"
#include "givaro/modular-integer.h"
```

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFPACK_pluq_mp_INL

Functions

- template<class Cut , class Param >
  size_t PLUQ (const Givaro::Modular< Givaro::Integer > &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Givaro::Integer *A, const size_t lda, size_t *P, size_t *Q, size_t BCThreshold, FFLAS::ParSeqHelper::Parallel< Cut, Param > &PSHelper)

17.191.1 Macro Definition Documentation

17.191.1.1 __FFPACK_pluq_mp_INL

```
#define __FFPACK_pluq_mp_INL
```

17.192 ffpack_ppluq.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_ppluq_INL
- #define __FFLAS__TRSM_READONLY
- #define PBASECASE_K 256

Functions

- template< class Field >
  void threads_fgemm (const size_t m, const size_t n, const size_t r, int nbthreads, size_t ∗W1, size_t ∗W2, size_t ∗W3, size_t gamma)
- template< class Field >
  void threads_ftrsm (const size_t m, const size_t n, int nbthreads, size_t ∗t1, size_t ∗t2)
- template< class Field >
  size_t PLUQ (const Field &Fi, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q, const FFLAS::ParSeqHelper::Parallel< FFLAS::CuttingStrategy::Recursive, FFLAS::StrategyParameter::Threads > &PSHelper)
- template< class Field >
  size_t pPLUQ (const Field &F, const FFLAS::FFLAS_DIAG Diag, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗P, size_t ∗Q)

17.192.1 Macro Definition Documentation

17.192.1.1 __FFLASFFPACK_ffpack_ppluq_INL

```
#define __FFLASFFPACK_ffpack_ppluq_INL
```

17.192.1.2 __FFLAS__TRSM_READONLY

```
#define __FFLAS__TRSM_READONLY
```

17.192.1.3 PBASECASE_K

```
#define PBASECASE_K 256
```

17.193 ffpack_rankprofiles.inl File Reference

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_ffpack_rank_profiles_INL

Functions

- template<class Field >
  size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the row rank profile of A.
- template<class Field >
  size_t pRowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t RowRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- template<class Field >
  size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag=FfpackSlabRecursive)

  Computes the column rank profile of A.
- template<class Field >
  size_t pColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, size_t numthreads=0, const FFPACK_LU_TAG LuTag=FfpackTileRecursive)
- template<class Field , class PSHelper >
  size_t ColumnRankProfile (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rkprofile, const FFPACK_LU_TAG LuTag, PSHelper &psH)
- void RankProfileFromLU (const size_t ∗P, const size_t N, const size_t R, size_t ∗rkprofile, const FFPACK_↵ LU_TAG LuTag)

  Recovers the column/row rank profile from the permutation of an LU decomposition.
- size_t LeadingSubmatrixRankProfiles (const size_t M, const size_t N, const size_t R, const size_t LSm, const size_t LSn, const size_t ∗P, const size_t ∗Q, size_t ∗RRP, size_t ∗CRP)

  Recovers the row and column rank profiles of any leading submatrix from the PLUQ decomposition.
- template<class Field >
  size_t RowRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  RowRankProfileSubmatrixIndices.
- template<class Field >
  size_t ColRankProfileSubmatrixIndices (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, size_t ∗&rowindices, size_t ∗&colindices, size_t &R)

  Computes the indices of the submatrix r∗r X of A whose columns correspond to the column rank profile of A.
- template<class Field >
  size_t RowRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Computes the r∗r submatrix X of A, by picking the row rank profile rows of A.
- template<class Field >
  size_t ColRankProfileSubmatrix (const Field &F, const size_t M, const size_t N, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr &X, size_t &R)

  Compute the $r \times r$ submatrix X of A, by picking the row rank profile rows of A.

- template<class Field >
  Field::Element_ptr LQUPtoInverseOfFullRankMinor (const Field &F, const size_t rank, typename Field::Element_ptr A_factors, const size_t lda, const size_t *QtPointer, typename Field::Element_ptr X, const size_t ldx)

  LQUPtoInverseOfFullRankMinor.

17.193.1 Macro Definition Documentation

17.193.1.1 __FFLASFFPACK_ffpack_rank_profiles_INL

```
#define __FFLASFFPACK_ffpack_rank_profiles_INL
```

17.194 fgemm_classical.inl File Reference

```
#include <cmath>
#include "fflas-ffpack/field/field-traits.h"
```

Macros

- #define __FFLASFFPACK_fflas_fflas_fgemm_classical_INL

17.194.1 Macro Definition Documentation

17.194.1.1 __FFLASFFPACK_fflas_fflas_fgemm_classical_INL

```
#define __FFLASFFPACK_fflas_fflas_fgemm_classical_INL
```

17.195 fgemm_classical_mp.inl File Reference

matrix multiplication with multiprecision input (either over Z or over Z/pZ)

```
#include <givaro/modular-integer.h>
#include <givaro/zring.h>
#include "fflas-ffpack/field/rns-double.h"
#include "fflas-ffpack/field/rns-integer.h"
#include "fflas-ffpack/field/rns-integer-mod.h"
#include "fflas-ffpack/field/field-traits.h"
#include "fflas-ffpack/fflas/fflas_helpers.inl"
#include "fflas-ffpack/fflas/fflas_bounds.inl"
```

Data Structures

- struct MMHelper< Field, AlgoTrait, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeqTrait >
- struct MMHelper< FFPACK::RNSInteger< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >
- struct MMHelper< FFPACK::RNSIntegerMod< E >, AlgoTrait, ModeCategories::DefaultTag, ParSeqTrait >

Namespaces

- FFLAS

Macros

- #define __FFPACK_fgemm_classical_INL

Functions

- template< typename RNS , typename ParSeqTrait >
  FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Compose< ParSeqHelper::Sequential, ParSeqTrait > > &H)
- template< typename RNS >
  FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Sequential > &H)
- template< typename RNS , typename ParSeqTrait >
  FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Compose< ParSeqHelper::Parallel< CuttingStrategy::RNSModulus, StrategyParameter::Threads >, ParSeqTrait > > &H)
- template< typename RNS , typename Cut , typename Param >
  FFPACK::RNSInteger< RNS >::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename FFPACK::RNSInteger< RNS >::Element alpha, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Ad, const size_t lda, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr Bd, const size_t ldb, const typename FFPACK::RNSInteger< RNS >::Element beta, typename FFPACK::RNSInteger< RNS >::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Classic, ModeCategories::DefaultTag, ParSeqHelper::Parallel< Cut, Param > > &H)
- template< class ParSeq >
  Givaro::Integer * fgemm (const Givaro::ZRing< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, const Givaro::Integer *B, const size_t ldb, Givaro::Integer beta, Givaro::Integer *C, const size_t ldc, MMHelper< Givaro::ZRing< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template< typename RNS , class ModeT >
  RNS::Element_ptr fgemm (const FFPACK::RNSInteger< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename RNS::Element alpha, typename RNS::ConstElement_ptr Ad, const size_t lda, typename RNS::ConstElement_ptr Bd, const size_t ldb, const typename RNS::Element beta, typename RNS::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSInteger< RNS >, MMHelperAlgo::Winograd, ModeT, ParSeqHelper::Sequential > &H)
- template< typename RNS >
  RNS::Element_ptr fgemm (const FFPACK::RNSIntegerMod< RNS > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename RNS::Element alpha, typename RNS::ConstElement_ptr Ad, const size_t lda, typename RNS::ConstElement_ptr Bd, const size_t ldb, const typename RNS::Element beta, typename RNS::Element_ptr Cd, const size_t ldc, MMHelper< FFPACK::RNSIntegerMod< RNS >, MMHelperAlgo::Winograd > &H)

- Givaro::Integer * fgemm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, const Givaro::Integer *B, const size_t ldb, const Givaro::Integer beta, Givaro::Integer *C, const size_t ldc, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag > > &H)
- template<class ParSeq >
  Givaro::Integer * fgemm (const Givaro::Modular< Givaro::Integer > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const Givaro::Integer alpha, const Givaro::Integer *A, const size_t lda, const Givaro::Integer *B, const size_t ldb, const Givaro::Integer beta, Givaro::Integer *C, const size_t ldc, MMHelper< Givaro::Modular< Givaro::Integer >, MMHelperAlgo::Auto, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)
- template<size_t K1, size_t K2, class ParSeq >
  RecInt::ruint< K1 > * fgemm (const Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > > &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const RecInt::ruint< K1 > alpha, const RecInt::ruint< K1 > *A, const size_t lda, const RecInt::ruint< K1 > *B, const size_t ldb, RecInt::ruint< K1 > beta, RecInt::ruint< K1 > *C, const size_t ldc, MMHelper< Givaro::Modular< RecInt::ruint< K1 >, RecInt::ruint< K2 > >, MMHelperAlgo::Classic, ModeCategories::ConvertTo< ElementCategories::RNSElementTag >, ParSeq > &H)

17.195.1 Detailed Description

matrix multiplication with multiprecision input (either over Z or over Z/pZ)

17.195.2 Macro Definition Documentation

17.195.2.1 __FFPACK_fgemm_classical_INL

```
#define __FFPACK_fgemm_classical_INL
```

17.196 fgemm_winograd.inl File Reference

```
#include <stdint.h>
#include <givaro/modular.h>
#include <givaro/zring.h>
#include "fgemm_classical.inl"
#include "schedule_winograd.inl"
#include "schedule_winograd_acc.inl"
#include "schedule_winograd_acc_ip.inl"
#include "schedule_winograd_ip.inl"
#include "fflas-ffpack/fflas-ffpack-config.h"
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_fflas_fgemm_winograd_INL
- #define NEWWINO

Functions

- template<class Field >
  int WinogradThreshold (const Field &F)

  Computes the number of recursive levels to perform.
- template<> int WinogradThreshold (const Givaro::Modular< float > &F)
- template<> int WinogradThreshold (const Givaro::ModularBalanced< double > &F)
- template<> int WinogradThreshold (const Givaro::ModularBalanced< float > &F)
- template<class Field >
  int WinogradSteps (const Field &F, const size_t &m)

  Computes the number of recursive levels to perform.
- template<class Field , class FieldMode >
  void DynamicPeeling (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmin, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmax)
- template<class Field , class FieldMode >
  void DynamicPeeling2 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmin, const typename MMHelper< Field, MMHelperAlgo::Winograd, FieldMode >::DelayedField::Element Cmax)
- template<class Field , class FieldMode >
  void WinogradCalc (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldMode > &H)
- template<class Field , class ModeT >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, ModeT > &H)
- template<class Field , class ModeT , class Cut , class Param >
  Field::Element_ptr fgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::WinogradPar, ModeT, ParSeqHelper::Parallel< Cut, Param > > &H)

17.196.1 Macro Definition Documentation

17.196.1.1 __FFLASFFPACK_fflas_fflas_fgemm_winograd_INL

```
#define __FFLASFFPACK_fflas_fflas_fgemm_winograd_INL
```

17.196.1.2 NEWWINO

```
#define NEWWINO
```

17.197 field-traits.h File Reference

Field Traits.

```
#include <type_traits>
#include "fflas-ffpack/field/rns-double-elt.h"
#include "recint/rmint.h"
#include "givaro/modular-general.h"
#include "givaro/zring.h"
```

Data Structures

- struct GenericTag

  generic ring.
- struct ModularTag

  This is a modular field like e.g. `Modular<T>` *or* `ModularBalanced<T>`
- struct UnparametricTag

  If the field uses a representation with infix operators.
- struct DefaultTag

  No specific mode of action: use standard field operations.
- struct DefaultBoundedTag

  Use standard field operations, but keeps track of bounds on input and output.
- struct ConvertTo< T >

  Force conversion to appropriate element type of ElementCategory T.
- struct DelayedTag

  Performs field operations with delayed mod reductions. Ensures result is reduced.
- struct LazyTag

  Performs field operations with delayed mod only when necessary. Result may not be reduced.
- struct GenericTag

  default is generic
- struct MachineFloatTag

  float or double
- struct MachineIntTag

  short, int, long, long long, and unsigned variants
- struct FixedPrecIntTag

  Fixed precision integers above machine precision: Givaro::recInt.
- struct ArbitraryPrecIntTag

  Arbitrary precision integers: GMP.
- struct RNSElementTag

  Representation in a Residue Number System.
- struct ElementTraits< Element >

  ElementTraits.
- struct ElementTraits< float >
- struct ElementTraits< double >
- struct ElementTraits< int8_t >
- struct ElementTraits< int16_t >
- struct ElementTraits< int32_t >
- struct ElementTraits< int64_t >
- struct ElementTraits< uint8_t >
- struct ElementTraits< uint16_t >
- struct ElementTraits< uint32_t >
- struct ElementTraits< uint64_t >
- struct ElementTraits< Givaro::Integer >

- struct ElementTraits< RecInt::rint< K > >
- struct ElementTraits< RecInt::ruint< K > >
- struct ElementTraits< RecInt::rmint< K, MG > >
- struct ElementTraits< FFPACK::rns_double_elt >
- struct ModeTraits< Field >

  ModeTraits.
- struct ModeTraits< Givaro::Modular< Element, Compute > >
- struct ModeTraits< Givaro::Modular< int64_t, uint64_t > >
- struct ModeTraits< Givaro::Modular< int8_t, Compute > >
- struct ModeTraits< Givaro::Modular< int16_t, Compute > >
- struct ModeTraits< Givaro::Modular< int32_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint8_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint16_t, Compute > >
- struct ModeTraits< Givaro::Modular< uint32_t, Compute > >
- struct ModeTraits< Givaro::Modular< Givaro::Integer, Compute > >
- struct ModeTraits< Givaro::Modular< RecInt::ruint< K >, Compute > >
- struct ModeTraits< Givaro::ModularBalanced< Element > >
- struct ModeTraits< Givaro::ModularBalanced< int8_t > >
- struct ModeTraits< Givaro::ModularBalanced< int16_t > >
- struct ModeTraits< Givaro::ModularBalanced< int32_t > >
- struct ModeTraits< Givaro::ModularBalanced< Givaro::Integer > >
- struct ModeTraits< Givaro::ZRing< Givaro::Integer > >
- struct ModeTraits< Givaro::ZRing< float > >
- struct ModeTraits< Givaro::ZRing< double > >
- struct ModeTraits< Givaro::Montgomery< T > >
- struct FieldTraits< Field >

  FieldTrait.
- struct FieldTraits< Givaro::ZRing< RecInt::ruint< K > > >
- struct FieldTraits< Givaro::Modular< Element > >
- struct FieldTraits< Givaro::ModularBalanced< Element > >
- struct FieldTraits< Givaro::ZRing< double > >
- struct FieldTraits< Givaro::ZRing< float > >
- struct FieldTraits< Givaro::ZRing< int16_t > >
- struct FieldTraits< Givaro::ZRing< uint16_t > >
- struct FieldTraits< Givaro::ZRing< int32_t > >
- struct FieldTraits< Givaro::ZRing< uint32_t > >
- struct FieldTraits< Givaro::ZRing< int64_t > >
- struct FieldTraits< Givaro::ZRing< uint64_t > >
- struct FieldTraits< Givaro::ZRing< Givaro::Integer > >
- struct FieldTraits< FFPACK::RNSInteger< T > >
- struct FieldTraits< FFPACK::RNSIntegerMod< T > >
- struct associatedDelayedField< Field >
- struct associatedDelayedField< const Givaro::Modular< T, X > >
- struct associatedDelayedField< const Givaro::ModularBalanced< T > >
- struct associatedDelayedField< const Givaro::ZRing< T > >
- struct associatedDelayedField< const FFPACK::RNSIntegerMod< RNS > >

Namespaces

- RecInt
- Givaro
- FFPACK

    Finite Field PACK Set of elimination based routines for dense linear algebra.
- FFLAS
- FFLAS::FieldCategories

    Traits and categories will need to be placed in a proper file later.
- FFLAS::ModeCategories

    Specifies the mode of action for an algorithm w.r.t.
- FFLAS::ElementCategories

Functions

- template<class Field , class enable = void>
  Field::Residu_t maxCardinality ()
- template<> uint64_t maxCardinality< Givaro::Modular< int64_t > > ()
- template<> uint32_t maxCardinality< Givaro::Modular< int32_t > > ()
- template<class Field >
  Field::Residu_t minCardinality ()

17.197.1 Detailed Description

Field Traits.

17.198 field.doxy File Reference

17.199 flimits.h File Reference

```
#include <climits>
#include <limits>
#include <type_traits>
#include <givaro/givinteger.h>
```

Data Structures

- struct limits< unsigned char >
- struct limits< signed char >
- struct limits< char >
- struct limits< unsigned short int >
- struct limits< short int >
- struct limits< unsigned int >
- struct limits< int >
- struct limits< unsigned long >
- struct limits< long >
- struct limits< unsigned long long >
- struct limits< long long >
- struct limits< float >
- struct limits< double >
- struct limits< Givaro::Integer >
- struct limits< RecInt::ruint< K > >
- struct limits< RecInt::rint< K > >

Functions

- template<class T , class E >
  std::enable_if< std::is_signed< T >::value==std::is_signed< E >::value, bool >::type in_range (E e)
- template<class T , class E >
  std::enable_if<(std::is_signed< T >::value) &&!(std::is_signed< E >::value), bool >::type in_range (E e)
- template<class T , class E >
  std::enable_if<!(std::is_signed< T >::value) &&(std::is_signed< E >::value), bool >::type in_range (E e)

17.199.1 Function Documentation

17.199.1.1 in_range() [1/3]

```
std::enable_if<std::is_signed<T>::value == std::is_signed<E>::value, bool>::type in_range (
            E e )
```

17.199.1.2 in_range() [2/3]

```
std::enable_if<(std::is_signed<T>::value) && !(std::is_signed<E>::value), bool>::type in_↩
range (
            E e )
```

17.199.1.3 in_range() [3/3]

```
std::enable_if<!(std::is_signed<T>::value) && (std::is_signed<E>::value), bool>::type in_↩
range (
            E e )
```

17.200 fsyrk.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))
- #define GFOPS(n, t) (CUBE(double(n)/1000.0)/(3.0∗t))

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main ()

17.200.1 Macro Definition Documentation

17.200.1.1 CUBE

```
#define CUBE(
            x ) ((x)*(x)*(x))
```

17.200.1.2 GFOPS

```
#define GFOPS(
            n,
            t ) (CUBE(double(n)/1000.0)/(3.0*t))
```

17.200.2 Typedef Documentation

17.200.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.200.3 Function Documentation

17.200.3.1 main()

```
int main (
           void )
```

17.201 fsytrf.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))
- #define GFOPS(n, t) (CUBE(double(n)/1000.0)/(3.0∗t))

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main ()

17.201.1 Macro Definition Documentation

17.201.1.1 CUBE

```
#define CUBE(
             x ) ((x)*(x)*(x))
```

17.201.1.2 GFOPS

```
#define GFOPS(
             n,
             t ) (CUBE(double(n)/1000.0)/(3.0*t))
```

17.201.2 Typedef Documentation

17.201.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.201.3 Function Documentation

17.201.3.1 main()

```
int main (
            void )
```

17.202 ftrtri.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)*(x)*(x))
- #define GFOPS(n, t) (CUBE(double(n)/1000.0)/(3.0*t))

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main ()

17.202.1 Macro Definition Documentation

17.202.1.1 CUBE

```
#define CUBE(
            x ) ((x)*(x)*(x))
```

17.202.1.2 GFOPS

```
#define GFOPS(
            n,
            t ) (CUBE(double(n)/1000.0)/(3.0*t))
```

17.202.2 Typedef Documentation

17.202.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.202.3 Function Documentation

17.202.3.1 main()

```
int main (
           void )
```

17.203 hyb_zo.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/hyb_zo/hyb_zo_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/hyb_zo/hyb_zo_spmv.inl"
#include "fflas-ffpack/fflas/fflas_sparse/hyb_zo/hyb_zo_spmm.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::HYB_ZO >

Namespaces

- FFLAS

17.204 hyb_zo_pspmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmm_INL

Functions

- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::↩ UnparametricTag)
- template<class Field >
  void pfspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, uint64_t kmax)

17.204.1 Macro Definition Documentation

17.204.1.1 __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmm_INL

```
#define __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmm_INL
```

17.205 hyb_zo_pspmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, uint64_t kmax)

17.205.1 Macro Definition Documentation

17.205.1.1 __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_HYB_ZO_pspmv_INL
```

17.206 hyb_zo_spmm.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_HYB_ZO_spmm_INL

Functions

- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::GenericTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, FieldCategories::↩ UnparametricTag)
- template<class Field >
  void fspmm (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, size_t blockSize, typename Field::ConstElement_ptr x, int ldx, typename Field::Element_ptr y, int ldy, uint64_t kmax)

17.206.1 Macro Definition Documentation

17.206.1.1 __FFLASFFPACK_fflas_sparse_HYB_ZO_spmm_INL

```
#define __FFLASFFPACK_fflas_sparse_HYB_ZO_spmm_INL
```

17.207 hyb_zo_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_HYB_ZO_spmv_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::GenericTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::HYB_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, uint64_t kmax)

17.207.1 Macro Definition Documentation

17.207.1.1 __FFLASFFPACK_fflas_sparse_HYB_ZO_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_HYB_ZO_spmv_INL
```

17.208 hyb_zo_utils.inl File Reference

Namespaces

- FFLAS

Macros

- #define __FFLASFFPACK_fflas_sparse_HYB_ZO_utils_INL

Functions

- template< class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::HYB_ZO > &A)
- template< class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::HYB_ZO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)
- template< typename _Field >
  std::ostream & operator<< (std::ostream &os, const Sparse< _Field, SparseMatrix_t::HYB_ZO > &A)

17.208.1 Macro Definition Documentation

17.208.1.1 __FFLASFFPACK_fflas_sparse_HYB_ZO_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_HYB_ZO_utils_INL
```

17.209 igemm.doxy File Reference

17.210 igemm.h File Reference

```
#include "igemm_kernels.h"
#include "igemm_tools.h"
#include "fflas-ffpack/utils/fflas_memory.h"
#include "igemm.inl"
```

Namespaces

- FFLAS
- FFLAS::Protected

Enumerations

- enum number_kind { zero =0 , one =1 , mone =-1 , other =2 }

Functions

- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, int64_t *C, size_t ldc)
- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB, enum number_kind alpha_kind>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, int64_t *C, size_t ldc)
- void igemm (const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *A, size_t lda, const int64_t *B, size_t ldb, const int64_t beta, int64_t *C, size_t ldc)

- void igemm_ (const enum FFLAS_ORDER Order, const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, const size_t M, const size_t N, const size_t K, const int64_t alpha, const int64_t ∗A, const size_t lda, const int64_t ∗B, const size_t ldb, const int64_t beta, int64_t ∗C, const size_t ldc)

17.211 igemm.inl File Reference

```
#include "fflas-ffpack/utils/fflas_memory.h"
```

Namespaces

- FFLAS
- FFLAS::Protected

Macros

- #define __FFLASFFPACK_fflas_igemm_igemm_INL

Functions

- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t ∗A, size_t lda, const int64_t ∗B, size_t ldb, int64_t ∗C, size_t ldc)
- template<enum FFLAS_TRANSPOSE tA, enum FFLAS_TRANSPOSE tB, enum number_kind alpha_kind>
  void igemm_colmajor (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t ∗A, size_t lda, const int64_t ∗B, size_t ldb, int64_t ∗C, size_t ldc)
- void igemm (const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t ∗A, size_t lda, const int64_t ∗B, size_t ldb, const int64_t beta, int64_t ∗C, size_t ldc)
- void igemm_ (const enum FFLAS_ORDER Order, const enum FFLAS_TRANSPOSE TransA, const enum FFLAS_TRANSPOSE TransB, const size_t M, const size_t N, const size_t K, const int64_t alpha, const int64_t ∗A, const size_t lda, const int64_t ∗B, const size_t ldb, const int64_t beta, int64_t ∗C, const size_t ldc)

17.211.1 Macro Definition Documentation

17.211.1.1 __FFLASFFPACK_fflas_igemm_igemm_INL

```
#define __FFLASFFPACK_fflas_igemm_igemm_INL
```

17.212 igemm_kernels.h File Reference

```
#include "igemm_kernels.inl"
```

Namespaces

- FFLAS
- FFLAS::details

Functions

- template<enum number_kind K>
  void igebb44 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t ∗blA, const int64_t ∗blB, int64_t ∗C, size_t ldc)

- template<enum number_kind K>
  void igebb24 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb14 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb41 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb21 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb11 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebp (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *blockA, size_t lda, const int64_t *blockB, size_t ldb, int64_t *C, size_t ldc)

17.213 igemm_kernels.inl File Reference

```
#include "fflas-ffpack/utils/fflas_memory.h"
#include "igemm_tools.h"
```

Namespaces

- FFLAS
- FFLAS::details

Macros

- #define __FFLASFFPACK_fflas_igemm_igemm_kernels_INL

Functions

- template<enum number_kind K>
  void igebb44 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb24 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb14 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb41 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb21 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebb11 (size_t i, size_t j, size_t depth, size_t pdeth, const int64_t alpha, const int64_t *blA, const int64_t *blB, int64_t *C, size_t ldc)
- template<enum number_kind K>
  void igebp (size_t rows, size_t cols, size_t depth, const int64_t alpha, const int64_t *blockA, size_t lda, const int64_t *blockB, size_t ldb, int64_t *C, size_t ldc)

17.213.1 Macro Definition Documentation

17.213.1.1 __FFLASFFPACK_fflas_igemm_igemm_kernels_INL

```
#define __FFLASFFPACK_fflas_igemm_igemm_kernels_INL
```

17.214 igemm_tools.h File Reference

```
#include "igemm_tools.inl"
```

Namespaces

- FFLAS
- FFLAS::details

Functions

- template<size_t k, bool transpose>
  void pack_lhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- template<size_t k, bool transpose>
  void pack_rhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- void gebp (size_t rows, size_t cols, size_t depth, int64_t ∗C, size_t ldc, const int64_t ∗blockA, size_t lda, const int64_t ∗BlockB, size_t ldb, int64_t ∗BlockW)
- void BlockingFactor (size_t &m, size_t &n, size_t &k)

17.215 igemm_tools.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_simd.h"
```

Namespaces

- FFLAS
- FFLAS::details

Macros

- #define __FFLASFFPACK_fflas_igemm_igemm_tools_INL

Functions

- template<size_t k, bool transpose>
  void pack_rhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- template<size_t k, bool transpose>
  void pack_lhs (int64_t ∗XX, const int64_t ∗X, size_t ldx, size_t rows, size_t cols)
- void BlockingFactor (size_t &m, size_t &n, size_t &k)

17.215.1 Macro Definition Documentation

17.215.1.1 __FFLASFFPACK_fflas_igemm_igemm_tools_INL

```
#define __FFLASFFPACK_fflas_igemm_igemm_tools_INL
```

17.216 interfaces.doxy File Reference

17.217 kaapi_routines.inl File Reference

Macros

- #define __FFLASFFPACK_KAAPI_ROUTINES_INL

17.217.1 Macro Definition Documentation

17.217.1.1 __FFLASFFPACK_KAAPI_ROUTINES_INL

```
#define __FFLASFFPACK_KAAPI_ROUTINES_INL
```

17.218 lapack.C File Reference

```
#include "fflas-ffpack/config-blas.h"
```

Macros

- #define __FFLASFFPACK_CONFIGURATION
- #define __FFLASFFPACK_HAVE_LAPACK 1

Functions

- int main ()

17.218.1 Macro Definition Documentation

17.218.1.1 __FFLASFFPACK_CONFIGURATION

```
#define __FFLASFFPACK_CONFIGURATION
```

17.218.1.2 __FFLASFFPACK_HAVE_LAPACK

```
#define __FFLASFFPACK_HAVE_LAPACK 1
```

17.218.2 Function Documentation

17.218.2.1 main()

```
int main (
            void )
```

17.219 mainpage.doxy File Reference

17.220 Matio.h File Reference

```
#include <cstring>
#include <stdio.h>
#include <stdlib.h>
#include "fflas_memory.h"
```

Functions

- template<class Field >
  Field::Element_ptr read_field (const Field &F, const char *mat_file, size_t *tni, size_t *tnj)
- template<class Field >
  std::ostream & write_field (const Field &F, std::ostream &c, typename Field::ConstElement_ptr E, int n, int m, int id, bool mapleFormat=false, bool column_major=false)

17.220.1 Function Documentation

17.220.1.1 read_field()

```
Field::Element_ptr read_field (
            const Field & F,
            const char * mat_file,
            size_t * tni,
            size_t * tnj )
```

17.220.1.2 write_field()

```
std::ostream& write_field (
            const Field & F,
            std::ostream & c,
            typename Field::ConstElement_ptr E,
            int n,
            int m,
            int id,
            bool mapleFormat = false,
            bool column_major = false )
```

17.221 matmul.C File Reference

```
#include <iostream>
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- int main (int argc, char **argv)

  This example computes the matrix multiplication over a defined finite field.

17.221.1 Function Documentation

17.221.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

This example computes the matrix multiplication over a defined finite field.
Outputs the product of the matrix given as input.

17.222 matmul.doxy File Reference

17.223 parallel.h File Reference

```
#include "fflas-ffpack/config.h"
#include "fflas-ffpack/paladin/blockcuts.inl"
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define index_t size_t
- #define TASK(M, I) {I;}
- #define WAIT
- #define CHECK_DEPENDENCIES
- #define BARRIER
- #define PAR_BLOCK
- #define SYNCH_GROUP(Args...) {{Args};}
- #define THREAD_INDEX 0
- #define NUM_THREADS 1
- #define SET_THREADS(num_threads) {}
- #define MAX_THREADS 1
- #define READ(Args...)
- #define WRITE(Args...)
- #define READWRITE(Args...)
- #define CONSTREFERENCE(...)
- #define VALUE(...)
- #define BEGIN_PARALLEL_MAIN(Args...) int main(Args) {
- #define END_PARALLEL_MAIN(void) return 0; }
- #define FORBLOCK1D(iter, m, Helper, Args...)
- #define FOR1D(i, m, Helper, Args...)
- #define PARFORBLOCK1D(iter, m, Helper, Args...)
- #define PARFOR1D(iter, m, Helper, Args...)
- #define FORBLOCK2D(iter, m, n, Helper, Args...)
- #define FOR2D(i, j, m, n, Helper, Args...)
- #define PARFORBLOCK2D(iter, m, n, Helper, Args...) FORBLOCK2D(iter, m, n, Helper, Args)
- #define PARFOR2D(i, j, m, n, Helper, Args...) FOR2D(i, j, m, n, Helper, Args)
- #define COMMA ,
- #define MODE(...) __VA_ARGS__
- #define RETURNPARAM(f, P1, Args...) P1=f(Args)
- #define NUMARGS(...) PP_NARG_(__VA_ARGS__,PP_RSEQ_N())
- #define PP_NARG_(...) PP_ARG_N(__VA_ARGS__)
- #define PP_ARG_N(_1, _2, _3, _4, _5, _6, _7, _8, _9, _10, _11, _12, _13, _14, _15, _16, _17, _18, _19, _20, _21, _22, _23, _24, _25, _26, _27, _28, _29, _30, _31, _32, _33, _34, _35, _36, _37, _38, _39, _40, _41, _42, _43, _44, _45, _46, _47, _48, _49, _50, _51, _52, _53, _54, _55, _56, _57, _58, _59, _60, _61, _62, _63, N, ...) N
- #define PP_RSEQ_N()

- #define NOSPLIT() FFLAS::ParSeqHelper::Sequential()
- #define splitting_0() FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,FFLAS::StrategyParameter::Threads>()
- #define splitting_1(a) FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,FFLAS::StrategyParameter::Threads>(a
- #define splitting_2(a, c) FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,c>(a)
- #define splitting_3(a, b, c) FFLAS::ParSeqHelper::Parallel<b,c>(a)
- #define splitt(_1, _2, _3, NAME, ...) NAME
- #define SPLITTER(...) splitt(__VA_ARGS__, splitting_3, splitting_2, splitting_1, splitting_0)(__VA_ARGS__)

17.223.1 Macro Definition Documentation

17.223.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.223.1.2 index_t

```
#define index_t size_t
```

17.223.1.3 TASK

```
#define TASK(
              M,
              I ) {I;}
```

17.223.1.4 WAIT

```
#define WAIT
```

17.223.1.5 CHECK_DEPENDENCIES

```
#define CHECK_DEPENDENCIES
```

17.223.1.6 BARRIER

```
#define BARRIER
```

17.223.1.7 PAR_BLOCK

```
#define PAR_BLOCK
```

17.223.1.8 SYNCH_GROUP

```
#define SYNCH_GROUP(
              Args... ) {{Args};}
```

17.223.1.9 THREAD_INDEX

```
#define THREAD_INDEX 0
```

17.223.1.10 NUM_THREADS

```
#define NUM_THREADS 1
```

17.223.1.11 SET_THREADS

```
#define SET_THREADS(
              num_threads ) {}
```

17.223.1.12 MAX_THREADS

```
#define MAX_THREADS 1
```

17.223.1.13 READ

```
#define READ(
              Args...  )
```

17.223.1.14 WRITE

```
#define WRITE(
              Args...  )
```

17.223.1.15 READWRITE

```
#define READWRITE(
              Args...  )
```

17.223.1.16 CONSTREFERENCE

```
#define CONSTREFERENCE(
              ...  )
```

17.223.1.17 VALUE

```
#define VALUE(
              ...  )
```

17.223.1.18 BEGIN_PARALLEL_MAIN

```
#define BEGIN_PARALLEL_MAIN(
              Args...  ) int main(Args) {
```

17.223.1.19 END_PARALLEL_MAIN

```
#define END_PARALLEL_MAIN(
              void ) return 0; }
```

17.223.1.20 FORBLOCK1D

```
#define FORBLOCK1D(
        iter,
        m,
        Helper,
        Args... )
```

Value:

```
{ FFLAS::ForStrategy1D<std::remove_const<decltype(m)>::type, typename decltype(Helper)::Cut, typename
       decltype(Helper)::Param> iter(m, Helper); \
    for(iter.initialize(); !iter.isTerminated(); ++iter)            \
    {Args;} }
```

17.223.1.21 FOR1D

```
#define FOR1D(
        i,
        m,
        Helper,
        Args... )
```

Value:

```
FORBLOCK1D(_internal_iterator, m, Helper,                               \
           for(auto i=_internal_iterator.begin(); i!=_internal_iterator.end(); ++i) \
           { Args; })
```

17.223.1.22 PARFORBLOCK1D

```
#define PARFORBLOCK1D(
        iter,
        m,
        Helper,
        Args... )
```

Value:

```
for(std::remove_const<decltype(m)>::type iter=0; iter<m; ++iter)      \
{ Args; }
```

17.223.1.23 PARFOR1D

```
#define PARFOR1D(
        iter,
        m,
        Helper,
        Args... )
```

Value:

```
for(std::remove_const<decltype(m)>::type iter=0; iter<m; ++iter)      \
{ Args; }
```

17.223.1.24 FORBLOCK2D

```
#define FORBLOCK2D(
        iter,
        m,
        n,
        Helper,
        Args... )
```

Value:

```
{ FFLAS::ForStrategy2D<std::remove_const<decltype(m)>::type, typename decltype(Helper)::Cut, typename
       decltype(Helper)::Param> iter(m,n,Helper); \
    for(iter.initialize(); !iter.isTerminated(); ++iter)             \
    { Args; } }
```

17.223.1.25 FOR2D

```
#define FOR2D(
              i,
              j,
              m,
              n,
              Helper,
              Args... )
```

Value:

```
FORBLOCK2D(_internal_iterator, m, n, Helper,                              \
           for(auto i=_internal_iterator.ibegin(); i!=_internal_iterator.iend(); ++i) \
           for(auto j=_internal_iterator.jbegin(); j!=_internal_iterator.jend(); ++j) \
           { Args; })
```

17.223.1.26 PARFORBLOCK2D

```
#define PARFORBLOCK2D(
              iter,
              m,
              n,
              Helper,
              Args... ) FORBLOCK2D(iter, m, n, Helper, Args)
```

17.223.1.27 PARFOR2D

```
#define PARFOR2D(
              i,
              j,
              m,
              n,
              Helper,
              Args... ) FOR2D(i, j, m, n, Helper, Args)
```

17.223.1.28 COMMA

```
#define COMMA ,
```

17.223.1.29 MODE

```
#define MODE(
              ... ) __VA_ARGS__
```

17.223.1.30 RETURNPARAM

```
#define RETURNPARAM(
              f,
              P1,
              Args... ) P1=f(Args)
```

17.223.1.31 NUMARGS

```
#define NUMARGS(
              ... ) PP_NARG_(__VA_ARGS__,PP_RSEQ_N())
```

17.223.1.32 PP_NARG_

```
#define PP_NARG_(
              ... ) PP_ARG_N(__VA_ARGS__)
```

17.223.1.33 PP_ARG_N

```
#define PP_ARG_N(
              _1,
              _2,
              _3,
              _4,
              _5,
              _6,
              _7,
              _8,
              _9,
              _10,
              _11,
              _12,
              _13,
              _14,
              _15,
              _16,
              _17,
              _18,
              _19,
              _20,
              _21,
              _22,
              _23,
              _24,
              _25,
              _26,
              _27,
              _28,
              _29,
              _30,
              _31,
              _32,
              _33,
              _34,
              _35,
              _36,
              _37,
              _38,
              _39,
              _40,
              _41,
              _42,
              _43,
              _44,
              _45,
              _46,
              _47,
              _48,
              _49,
              _50,
```

```
            _51,
            _52,
            _53,
            _54,
            _55,
            _56,
            _57,
            _58,
            _59,
            _60,
            _61,
            _62,
            _63,
            N,
            ... ) N
```

17.223.1.34 PP_RSEQ_N

```
#define PP_RSEQ_N( )
```

Value:

```
63,62,61,60,                  \
59,58,57,56,55,54,53,52,51,50, \
49,48,47,46,45,44,43,42,41,40, \
39,38,37,36,35,34,33,32,31,30, \
29,28,27,26,25,24,23,22,21,20, \
19,18,17,16,15,14,13,12,11,10, \
9,8,7,6,5,4,3,2,1,0
```

17.223.1.35 NOSPLIT

```
#define NOSPLIT( ) FFLAS::ParSeqHelper::Sequential()
```

17.223.1.36 splitting_0

```
#define splitting_0( ) FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,FFLAS::StrategyParameter::T
```

17.223.1.37 splitting_1

```
#define splitting_1(
            a ) FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,FFLAS::StrategyParameter::Threa
```

17.223.1.38 splitting_2

```
#define splitting_2(
            a,
            c ) FFLAS::ParSeqHelper::Parallel<FFLAS::CuttingStrategy::Block,c>(a)
```

17.223.1.39 splitting_3

```
#define splitting_3(
            a,
            b,
            c ) FFLAS::ParSeqHelper::Parallel<b,c>(a)
```

17.223.1.40 splitt

```
#define splitt(
            _1,
            _2,
            _3,
            NAME,
            ... ) NAME
```

17.223.1.41 SPLITTER

```
#define SPLITTER(
            ... ) splitt(__VA_ARGS__, splitting_3, splitting_2, splitting_1, splitting_0)(↩
__VA_ARGS__)
```

17.224 pfgemm_variants.inl File Reference

Namespaces

- FFLAS

Functions

- template< class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Block, StrategyParameter::Threads > > &H)
- template< class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_↩t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeDAdaptive > > &H)
- template< class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_↩t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoDAdaptive > > &H)
- template< class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr AA, const size_t lda, const typename Field::ConstElement_ptr BB, const size_↩t ldb, const typename Field::Element beta, typename Field::Element *C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::TwoD > > &H)
- template< class Field , class AlgoT , class FieldTrait >
  Field::Element_ptr pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeD > > &H)
- template< class Field , class AlgoT , class FieldTrait >
  Field::Element * pfgemm (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb,

const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::ThreeDInPlace > > &H)

17.225 pfgemv.inl File Reference

Namespaces

- FFLAS

Functions

- template<class Field , class AlgoT , class FieldTrait >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Recursive, StrategyParameter::Threads > > &H)
- template<class Field , class AlgoT , class FieldTrait , class Cut >
  Field::Element_ptr fgemv (const Field &F, const FFLAS_TRANSPOSE ta, const size_t m, const size_t n, const typename Field::Element alpha, const typename Field::ConstElement_ptr A, const size_t lda, const typename Field::ConstElement_ptr X, const size_t incX, const typename Field::Element beta, typename Field::Element_ptr Y, const size_t incY, MMHelper< Field, AlgoT, FieldTrait, ParSeqHelper::Parallel< CuttingStrategy::Row, Cut > > &H)

17.226 pluq.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include <ctime>
```

Macros

- #define CUBE(x) ((x)∗(x)∗(x))
- #define GFOPS(m, n, r, t) (2.0/3.0∗CUBE(double(n)/1000.0) +2∗m/1000.0∗n/1000.0∗double(r)/1000.0 - double(r)/1000.0∗double(r)/1000.0∗(m+n)/1000)/t

Typedefs

- typedef Givaro::Timer TTimer

Functions

- int main ()

17.226.1 Macro Definition Documentation

17.226.1.1 CUBE

```
#define CUBE(
                x ) ((x)*(x)*(x))
```

17.226.1.2 GFOPS

```
#define GFOPS(
                m,
                n,
                r,
                t ) (2.0/3.0*CUBE(double(n)/1000.0) +2*m/1000.0*n/1000.0*double(r)/1000.0 - double(r)/1000.←
0*double(r)/1000.0*(m+n)/1000)/t
```

17.226.2 Typedef Documentation

17.226.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.226.3 Function Documentation

17.226.3.1 main()

```
int main (
              void )
```

17.227 pluq.C File Reference

```
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Functions

- int main (int argc, char **argv)

17.227.1 Function Documentation

17.227.1.1 main()

```
int main (
              int argc,
              char ** argv )
```

17.228 rank.C File Reference

```
#include <iostream>
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- int main (int argc, char **argv)

  This example computes the rank of a matrix over a defined finite field.

17.228.1 Function Documentation

17.228.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

This example computes the rank of a matrix over a defined finite field.
Outputs the rank.

17.229 read_sparse.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <fstream>
#include <string>
#include <cstdlib>
#include <iterator>
```

Data Structures

- struct Coo< Field >
- struct readMyMachineType< Field, T >
- struct readMyMachineType< Field, mpz_t >

Namespaces

- FFLAS
- FFLAS::details_spmv

Macros

- #define DNS_BIN_VER 0
- #define mask_t uint64_t

Functions

- template<class Field , bool sorted = true, bool read_integer = false>
  void readSmsFormat (const std::string &path, const Field &f, index_t *&row, index_t *&col, typename Field::Element_ptr &val, index_t &rowdim, index_t &coldim, uint64_t &nnz)
- template<class Field >
  void readSprFormat (const std::string &path, const Field &f, index_t *&row, index_t *&col, typename Field::Element_ptr &val, index_t &rowdim, index_t &coldim, uint64_t &nnz)

- template<class T >
  std::enable_if< std::is_integral< T >::value, int > getDataType ()
- template<class T >
  std::enable_if< std::is_floating_point< T >::value, int > getDataType ()
- template<class T >
  std::enable_if< std::is_same< T, mpz_t >::value, int > getDataType ()
- template<class T >
  int getDataType ()
- template<class Field >
  void readMachineType (const Field &F, typename Field::Element &modulo, typename Field::Element_ptr val, std::ifstream &file, const uint64_t dims, const mask_t data_type, const mask_t field_desc)
- template<class Field >
  void readDnsFormat (const std::string &path, const Field &F, index_t &rowdim, index_t &coldim, typename Field::Element_ptr &val)
- template<class Field >
  void writeDnsFormat (const std::string &path, const Field &F, const index_t &rowdim, const index_t &coldim, typename Field::Element_ptr A, index_t ldA)

17.229.1 Macro Definition Documentation

17.229.1.1 DNS_BIN_VER

```
#define DNS_BIN_VER 0
```

17.229.1.2 mask_t

```
#define mask_t uint64_t
```

17.230 regression-check.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular.h>
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- bool check1 ()
- bool check2 ()
- bool check3 ()
- bool check4 ()
- bool checkZeroDimCharpoly ()
- bool checkZeroDimMinPoly ()
- bool gf2ModularBalanced ()
- int main ()

17.230.1 Function Documentation

17.230.1.1 check1()

```
bool check1 ( )
```

17.230.1.2 check2()

```
bool check2 ( )
```

17.230.1.3 check3()

```
bool check3 ( )
```

17.230.1.4 check4()

```
bool check4 ( )
```

17.230.1.5 checkZeroDimCharpoly()

```
bool checkZeroDimCharpoly ( )
```

17.230.1.6 checkZeroDimMinPoly()

```
bool checkZeroDimMinPoly ( )
```

17.230.1.7 gf2ModularBalanced()

```
bool gf2ModularBalanced ( )
```

17.230.1.8 main()

```
int main (
             void )
```

17.231 rns-double-elt.h File Reference

rns elt structure with double support

```
#include "fflas-ffpack/utils/fflas_memory.h"
#include "fflas-ffpack/utils/cast.h"
```

Data Structures

- struct rns_double_elt
- struct rns_double_elt_ptr
- struct rns_double_elt_cstptr

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

Functions

- template<> rns_double_elt_ptr fflas_const_cast (rns_double_elt_cstptr x)
- template<> rns_double_elt_cstptr fflas_const_cast (rns_double_elt_ptr x)

17.231.1 Detailed Description

rns elt structure with double support

17.232 rns-double-recint.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_freduce.h"
```

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_field_rns_double_recint_INL

17.232.1 Macro Definition Documentation

17.232.1.1 __FFLASFFPACK_field_rns_double_recint_INL

```
#define __FFLASFFPACK_field_rns_double_recint_INL
```

17.233 rns-double.h File Reference

rns structure with double support

```
#include <iterator>
#include <vector>
#include <givaro/modular-floating.h>
#include <givaro/givinteger.h>
#include <givaro/givintprime.h>
#include "givaro/modular-extended.h"
#include <recint/ruint.h>
#include "fflas-ffpack/config-blas.h"
#include "fflas-ffpack/utils/fflas_memory.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include "fflas-ffpack/field/rns-double-elt.h"
#include "rns-double.inl"
#include "rns-double-recint.inl"
```

Data Structures

- struct rns_double
- struct rns_double_extended
- class rnsRandIter< RNS >

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFLAS

Macros

- #define ROUND_DOWN(x, s) ((x) & ~((s)-1))

Functions

- template<> void fflas_delete (FFPACK::rns_double_elt_ptr A)
- template<> void fflas_delete (FFPACK::rns_double_elt_cstptr A)

17.233.1 Detailed Description

rns structure with double support

17.233.2 Macro Definition Documentation

17.233.2.1 ROUND_DOWN

```
#define ROUND_DOWN(
              x,
              s ) ((x) & ~((s)-1))
```

17.234 rns-double.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_freduce.h"
```

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*

Macros

- #define __FFLASFFPACK_field_rns_double_INL

17.234.1 Macro Definition Documentation

17.234.1.1 __FFLASFFPACK_field_rns_double_INL

```
#define __FFLASFFPACK_field_rns_double_INL
```

17.235 rns-integer-mod.h File Reference

representation of `Z/pZ` using RNS representation (note: fixed precision)

```
#include <vector>
#include <cmath>
#include <recint/recint.h>
#include <givaro/modular-integer.h>
#include <givaro/givinteger.h>
#include <givaro/udl.h>
#include "givaro/modular-extended.h"
#include "fflas-ffpack/field/rns-double.h"
#include "fflas-ffpack/field/rns-integer.h"
```

```
#include "fflas-ffpack/fflas/fflas_level1.inl"
#include "fflas-ffpack/fflas/fflas_level2.inl"
#include "fflas-ffpack/fflas/fflas_level3.inl"
#include "fflas-ffpack/fflas/fflas_enum.h"
#include "fflas-ffpack/fflas/fflas_fscal_mp.inl"
```

Data Structures

- class RNSIntegerMod< RNS >
- class RNSIntegerMod< RNS >::RandIter

Namespaces

- FFPACK

  ***F**inite **F**ield **PACK** Set of elimination based routines for dense linear algebra.*
- FFLAS

Functions

- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const Alignment align)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSIntegerMod< FFPACK::rns_double > &F, const size_t m, const size_t n, const Alignment align)
- template<typename RNS >
  void finit_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer *B, const size_t ldb, typename RNS::Element_ptr A)
- template<typename RNS >
  void finit_trans_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer *B, const size_t ldb, typename RNS::Element_ptr A)
- template<typename RNS >
  void fconvert_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, Givaro::←Integer alpha, Givaro::Integer *B, const size_t ldb, typename RNS::ConstElement_ptr A)
- template<typename RNS >
  void fconvert_trans_rns (const FFPACK::RNSIntegerMod< RNS > &F, const size_t m, const size_t n, Givaro::Integer alpha, Givaro::Integer *B, const size_t ldb, typename RNS::ConstElement_ptr A)

17.235.1 Detailed Description

representation of $\mathbb{Z}/p\mathbb{Z}$ using RNS representation (note: fixed precision)

17.236 rns-integer.h File Reference

representation of $\mathbb{Z}$ using RNS representation (note: fixed precision)

```
#include <givaro/givinteger.h>
#include "fflas-ffpack/field/rns-double.h"
```

Data Structures

- class RNSInteger< RNS >
- class RNSInteger< RNS >::RandIter

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*
- FFLAS

Functions

- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const Alignment align)
- template<> FFPACK::rns_double_elt_ptr fflas_new (const FFPACK::RNSInteger< FFPACK::rns_double > &F, const size_t m, const size_t n, const Alignment align)
- template<typename RNS >
  void finit_rns (const FFPACK::RNSInteger< RNS > &F, const size_t m, const size_t n, size_t k, const Givaro::Integer *B, const size_t ldb, typename FFPACK::RNSInteger< RNS >::Element_ptr A)
- template<typename RNS >
  void fconvert_rns (const FFPACK::RNSInteger< RNS > &F, const size_t m, const size_t n, Givaro::Integer alpha, Givaro::Integer *B, const size_t ldb, typename FFPACK::RNSInteger< RNS >::ConstElement_ptr A)

17.236.1 Detailed Description

representation of $\mathbb{Z}$ using RNS representation (note: fixed precision)

17.237 rns.h File Reference

Namespaces

- FFPACK

  *Finite Field **PACK** Set of elimination based routines for dense linear algebra.*

17.238 rns.inl File Reference

```
#include "rns-double.h"
#include "rns-integer.h"
#include "rns-integer-mod.h"
```

Macros

- #define __FFLASFFPACK_field_rns_INL

17.238.1 Macro Definition Documentation

17.238.1.1 __FFLASFFPACK_field_rns_INL

```
#define __FFLASFFPACK_field_rns_INL
```

17.239 schedule_bini.inl File Reference

Bini implementation.

Namespaces

- FFLAS
- FFLAS::BLAS3

Macros

- #define __FFLASFFPACK_fgemm_bini_INL

Functions

- template< class Field >
  void Bini (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const size_t kmax, const size_t w, const FFLAS_BASE base, const size_t rec_level)

17.239.1 Detailed Description

Bini implementation.

17.239.2 Macro Definition Documentation

17.239.2.1 __FFLASFFPACK_fgemm_bini_INL

```
#define __FFLASFFPACK_fgemm_bini_INL
```

17.240 schedule_winograd.inl File Reference

Namespaces

- FFLAS
- FFLAS::BLAS3

Macros

- #define __FFLASFFPACK_fgemm_winograd_INL

Functions

- template< class Field , class FieldTrait , class Strat , class Param >
  Field::Element_ptr WinoPar (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::WinogradPar, FieldTrait, ParSeqHelper::Parallel< Strat, Param > > &WH)
- template< class Field , class FieldTrait >
  void Winograd (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, Field←Trait > &WH)

17.240.1 Macro Definition Documentation

17.240.1.1 __FFLASFFPACK_fgemm_winograd_INL

```
#define __FFLASFFPACK_fgemm_winograd_INL
```

17.241 schedule_winograd_acc.inl File Reference

Namespaces

- FFLAS
- FFLAS::BLAS3

Macros

- #define __FFLASFFPACK_fgemm_winograd_acc_INL

Functions

- template< class Field , class FieldTrait >
  void WinogradAcc_3_23 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template< class Field , class FieldTrait >
  void WinogradAcc_3_21 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::ConstElement_ptr A, const size_t lda, typename Field::ConstElement_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template< class Field , class FieldTrait >
  void WinogradAcc_2_24 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::↩ Winograd, FieldTrait > &WH)
- template< class Field , class FieldTrait >
  void WinogradAcc_2_27 (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, MMHelper< Field, MMHelperAlgo::↩ Winograd, FieldTrait > &WH)

17.241.1 Macro Definition Documentation

17.241.1.1 __FFLASFFPACK_fgemm_winograd_acc_INL

```
#define __FFLASFFPACK_fgemm_winograd_acc_INL
```

17.242 schedule_winograd_acc_ip.inl File Reference

Namespaces

- FFLAS
- FFLAS::BLAS3

Macros

- #define __FFLASFFPACK_fgemm_winograd_acc_ip_INL

Functions

- template<class Field , class FieldTrait >
  void WinogradAcc_LR (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, Field↩ Trait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_R_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelper↩ Algo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void WinogradAcc_L_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)

17.242.1 Macro Definition Documentation

17.242.1.1 __FFLASFFPACK_fgemm_winograd_acc_ip_INL

```
#define __FFLASFFPACK_fgemm_winograd_acc_ip_INL
```

17.243 schedule_winograd_ip.inl File Reference

Namespaces

- FFLAS
- FFLAS::BLAS3

Macros

- #define __FFLASFFPACK_fgemm_winograd_ip_INL

Functions

- template<class Field , class FieldTrait >
  void Winograd_LR_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, Field↩ Trait > &WH)
- template<class Field , class FieldTrait >
  void Winograd_L_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, typename Field::Element_ptr A, const size_t lda, const typename Field::Element_ptr B, const size_t ldb, const typename Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelperAlgo::Winograd, FieldTrait > &WH)
- template<class Field , class FieldTrait >
  void Winograd_R_S (const Field &F, const FFLAS_TRANSPOSE ta, const FFLAS_TRANSPOSE tb, const size_t mr, const size_t nr, const size_t kr, const typename Field::Element alpha, const typename Field::Element_ptr A, const size_t lda, typename Field::Element_ptr B, const size_t ldb, const typename

Field::Element beta, typename Field::Element_ptr C, const size_t ldc, const MMHelper< Field, MMHelper↩ Algo::Winograd, FieldTrait > &WH)

17.243.1 Macro Definition Documentation

17.243.1.1 __FFLASFFPACK_fgemm_winograd_ip_INL

```
#define __FFLASFFPACK_fgemm_winograd_ip_INL
```

17.244 sell.h File Reference

```
#include "fflas-ffpack/fflas/fflas_sparse/sell/sell_utils.inl"
#include "fflas-ffpack/fflas/fflas_sparse/sell/sell_spmv.inl"
```

Data Structures

- struct Sparse< _Field, SparseMatrix_t::SELL >
- struct Sparse< _Field, SparseMatrix_t::SELL_ZO >

Namespaces

- FFLAS

17.245 sell_pspmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_sell_pspmv_INL

Functions

- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void pfspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const int64_t kmax)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void pfspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

- template<class Field >
  void pfspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.245.1 Macro Definition Documentation

17.245.1.1 __FFLASFFPACK_fflas_sparse_sell_pspmv_INL

```
#define __FFLASFFPACK_fflas_sparse_sell_pspmv_INL
```

17.246 sell_spmv.inl File Reference

Namespaces

- FFLAS
- FFLAS::sparse_details_impl

Macros

- #define __FFLASFFPACK_fflas_sparse_sell_spmv_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, const uint64_t kmax)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::GenericTag)
- template<class Field >
  void fspmv_one_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone_simd (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_one (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)
- template<class Field >
  void fspmv_mone (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x_, typename Field::Element_ptr y_, FieldCategories::UnparametricTag)

17.246.1 Macro Definition Documentation

17.246.1.1 __FFLASFFPACK_fflas_sparse_sell_spmv_INL

```
#define __FFLASFFPACK_fflas_sparse_sell_spmv_INL
```

17.247 sell_utils.inl File Reference

Data Structures

- struct Info
- struct Coo< ValT, IdxT >

Namespaces

- FFLAS
- FFLAS::sell_details

Macros

- #define __FFLASFFPACK_fflas_sparse_sell_utils_INL

Functions

- template<class Field >
  void fspmv (const Field &F, const Sparse< Field, SparseMatrix_t::SELL_ZO > &A, typename Field::ConstElement_ptr x, typename Field::Element_ptr y, FieldCategories::ModularTag)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::SELL > &A)
- template<class Field >
  void sparse_delete (const Sparse< Field, SparseMatrix_t::SELL_ZO > &A)
- template<class Field >
  void sparse_print (const Sparse< Field, SparseMatrix_t::SELL > &A)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::SELL > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz, uint64_t sigma=0)
- template<class Field , class IndexT >
  void sparse_init (const Field &F, Sparse< Field, SparseMatrix_t::SELL_ZO > &A, const IndexT *row, const IndexT *col, typename Field::ConstElement_ptr dat, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.247.1 Macro Definition Documentation

17.247.1.1 __FFLASFFPACK_fflas_sparse_sell_utils_INL

```
#define __FFLASFFPACK_fflas_sparse_sell_utils_INL
```

17.248 simd.doxy File Reference

17.249 simd128.inl File Reference

```
#include "simd128_float.inl"
#include "simd128_double.inl"
```

Data Structures

- struct Simd128i_base

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_INL

Typedefs

- template< class T >
  using Simd128 = Simd128_impl< std::is_arithmetic< T >::value, std::is_integral< T >::value, std::is_↩
  signed< T >::value, sizeof(T)>

17.249.1 Macro Definition Documentation

17.249.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_INL
```

17.249.2 Typedef Documentation

17.249.2.1 Simd128

```
using Simd128 = Simd128_impl<std::is_arithmetic<T>::value, std::is_integral<T>::value, std↩
::is_signed<T>::value, sizeof(T)>
```

17.250 simd128_double.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd128_impl< true, false, true, 8 >

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_double_INL

17.250.1 Macro Definition Documentation

17.250.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_double_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_double_INL
```

17.251 simd128_float.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd128_impl< true, false, true, 4 >

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_float_INL

17.251.1 Macro Definition Documentation

17.251.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_float_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_float_INL
```

17.252 simd128_int16.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd128_impl< true, true, true, 2 >
- union Simd128_impl< true, true, true, 2 >::Converter
- struct Simd128_impl< true, true, false, 2 >
- union Simd128_impl< true, true, false, 2 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_int16_INL

17.252.1 Macro Definition Documentation

17.252.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_int16_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_int16_INL
```

17.253 simd128_int32.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd128_impl< true, true, true, 4 >
- union Simd128_impl< true, true, true, 4 >::Converter
- struct Simd128_impl< true, true, false, 4 >
- union Simd128_impl< true, true, false, 4 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_int32_INL

17.253.1 Macro Definition Documentation

17.253.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_int32_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_int32_INL
```

17.254 simd128_int64.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include "fflas-ffpack/utils/bit_manipulation.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd128_impl< true, true, true, 8 >
- union Simd128_impl< true, true, true, 8 >::Converter
- struct Simd128_impl< true, true, false, 8 >
- union Simd128_impl< true, true, false, 8 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd128_int64_INL
- #define vect_t Simd128_impl<true,true,true,8>::vect_t

17.254.1 Macro Definition Documentation

17.254.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd128_int64_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd128_int64_INL
```

17.254.1.2 vect_t

```
#define vect_t Simd128_impl<true,true,true,8>::vect_t
```

17.255 simd256.inl File Reference

```
#include "simd256_float.inl"
#include "simd256_double.inl"
```

Data Structures

- struct Simd256fp_base
- struct Simd256i_base

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_INL

Typedefs

- template< class T >
  using Simd256 = Simd256_impl< std::is_arithmetic< T >::value, std::is_integral< T >::value, std::is_↩ signed< T >::value, sizeof(T)>

17.255.1 Macro Definition Documentation

17.255.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_INL
```

17.255.2 Typedef Documentation

17.255.2.1 Simd256

```
using Simd256 = Simd256_impl<std::is_arithmetic<T>::value, std::is_integral<T>::value, std↩
::is_signed<T>::value, sizeof(T)>
```

17.256 simd256_double.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, false, true, 8 >
- union Simd256_impl< true, false, true, 8 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_double_INL

17.256.1 Macro Definition Documentation

17.256.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_double_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_double_INL
```

17.257 simd256_float.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, false, true, 4 >

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_float_INL

17.257.1 Macro Definition Documentation

17.257.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_float_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_float_INL
```

17.258 simd256_int16.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, true, true, 2 >
- union Simd256_impl< true, true, true, 2 >::Converter
- struct Simd256_impl< true, true, false, 2 >
- union Simd256_impl< true, true, false, 2 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_int16_INL

17.258.1 Macro Definition Documentation

17.258.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_int16_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_int16_INL
```

17.259 simd256_int32.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, true, true, 4 >
- union Simd256_impl< true, true, true, 4 >::Converter
- struct Simd256_impl< true, true, false, 4 >
- union Simd256_impl< true, true, false, 4 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_int32_INL

17.259.1 Macro Definition Documentation

17.259.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_int32_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_int32_INL
```

17.260 simd256_int64.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include "fflas-ffpack/utils/bit_manipulation.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, true, true, 8 >
- union Simd256_impl< true, true, true, 8 >::Converter
- struct Simd256_impl< true, true, false, 8 >
- union Simd256_impl< true, true, false, 8 >::Converter

Macros

- #define __FFLASFFPACK_fflas_ffpack_utils_simd256_int64_INL
- #define vect_t Simd256_impl<true, true, true, 8>::vect_t

17.260.1 Macro Definition Documentation

17.260.1.1 __FFLASFFPACK_fflas_ffpack_utils_simd256_int64_INL

```
#define __FFLASFFPACK_fflas_ffpack_utils_simd256_int64_INL
```

17.260.1.2 vect_t

```
#define vect_t Simd256_impl<true, true, true, 8>::vect_t
```

17.261 simd512.inl File Reference

```
#include "simd512_float.inl"
#include "simd512_double.inl"
#include "simd512_int64.inl"
```

Data Structures

- struct Simd512i_base

Macros

- #define __FFLASFFPACK_simd512_INL

Typedefs

- template< class T >
  using Simd512 = Simd512_impl< std::is_arithmetic< T >::value, std::is_integral< T >::value, std::is_↩ signed< T >::value, sizeof(T)>

17.261.1 Macro Definition Documentation

17.261.1.1 __FFLASFFPACK_simd512_INL

```
#define __FFLASFFPACK_simd512_INL
```

17.261.2 Typedef Documentation

17.261.2.1 Simd512

```
using Simd512 = Simd512_impl<std::is_arithmetic<T>::value, std::is_integral<T>::value, std↩
::is_signed<T>::value, sizeof(T)>
```

17.262 simd512_double.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd512_impl< true, false, true, 8 >

Macros

- #define __FFLASFFPACK_simd512_double_INL

17.262.1 Macro Definition Documentation

17.262.1.1 __FFLASFFPACK_simd512_double_INL

```
#define __FFLASFFPACK_simd512_double_INL
```

17.263 simd512_float.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd512_impl< true, false, true, 4 >

Macros

- #define __FFLASFFPACK_simd512_float_INL

17.263.1 Macro Definition Documentation

17.263.1.1 __FFLASFFPACK_simd512_float_INL

```
#define __FFLASFFPACK_simd512_float_INL
```

17.264 simd512_int32.inl File Reference

```
#include "fflas-ffpack/fflas/fflas_simd/simd512_int64.inl"
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd256_impl< true, true, true, 4 >
- union Simd256_impl< true, true, true, 4 >::Converter
- struct Simd256_impl< true, true, false, 4 >
- union Simd256_impl< true, true, false, 4 >::Converter

Macros

- #define __FFLASFFPACK_simd512_int32_INL

17.264.1 Macro Definition Documentation

17.264.1.1 __FFLASFFPACK_simd512_int32_INL

```
#define __FFLASFFPACK_simd512_int32_INL
```

17.265 simd512_int64.inl File Reference

```
#include "givaro/givtypestring.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include "fflas-ffpack/utils/bit_manipulation.h"
#include <vector>
#include <type_traits>
```

Data Structures

- struct Simd512_impl< true, true, true, 8 >
- union Simd512_impl< true, true, true, 8 >::Converter
- struct Simd512_impl< true, true, false, 8 >
- union Simd512_impl< true, true, false, 8 >::Converter

Macros

- #define _simd512_int64_INL
- #define vect_t Simd512_impl<true, true, true, 8>::vect_t

17.265.1 Macro Definition Documentation

17.265.1.1 _simd512_int64_INL

```
#define _simd512_int64_INL
```

17.265.1.2 vect_t

```
#define vect_t Simd512_impl<true, true, true, 8>::vect_t
```

17.266 simd_modular.inl File Reference

Data Structures

- class FieldSimd< _Field >

17.267 solve.C File Reference

```
#include <iostream>
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- int main (int argc, char **argv)

  This example solve the quare system defined by the input over a defined finite field.

17.267.1 Function Documentation

17.267.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

This example solve the quare system defined by the input over a defined finite field.

17.268 sparse_matrix_traits.h File Reference

```
#include <type_traits>
```

Data Structures

- struct isSparseMatrix< Field, M >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_HYB > >
- struct isSparseMatrix< Field, Sparse< Field, SparseMatrix_t::HYB_ZO > >
- struct isZOSparseMatrix< F, M >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::CSR_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::COO_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::SELL_ZO > >
- struct isZOSparseMatrix< Field, Sparse< Field, SparseMatrix_t::ELL_simd_ZO > >
- struct isSparseMatrixSimdFormat< F, M >
- struct isSparseMatrixMKLFormat< F, M >
- struct tfn_plus
- struct tfn_mul
- struct tfn_mul_eq
- struct tfn_minus
- struct tfn_plus_eq
- struct tfn_minus_eq
- struct has_plus_impl< C >
- struct has_mul_impl< C >
- struct has_mul_eq_impl< C >
- struct has_plus_eq_impl< C >
- struct has_minus_eq_impl< C >
- struct has_minus_impl< C >
- struct has_operation< T >

Namespaces

- FFLAS

Typedefs

- using ZOSparseMatrix = std::true_type
- using NotZOSparseMatrix = std::false_type
- using SimdSparseMatrix = std::true_type
- using NoSimdSparseMatrix = std::false_type
- using MKLSparseMatrixFormat = std::true_type
- using NotMKLSparseMatrixFormat = std::false_type
- template< class T >
  using has_plus = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_plus_impl< T > >::type
- template< class T >
  using has_minus = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_minus_impl< T > >::type
- template< class T >
  using has_equal = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, std::is_copy_assignable< T > >::type
- template< class T >
  using has_plus_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_plus_eq_impl< T > >::type
- template< class T >
  using has_minus_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_minus_eq_impl< T > >::type
- template< class T >
  using has_mul = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_mul_impl< T > >::type
- template< class T >
  using has_mul_eq = typename std::conditional< std::is_arithmetic< T >::value, std::true_type, has_mul_eq_impl< T > >::type

17.269 test-charpoly-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include <time.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Macros

- #define ENABLE_CHECKER_charpoly 1
- #define TIME_CHECKER_CHARPOLY 1

Functions

- template< class Field , class Polynomial >
  void printPolynomial (const Field &F, Polynomial &v)
- int main (int argc, char **argv)

17.269.1 Macro Definition Documentation

17.269.1.1 ENABLE_CHECKER_charpoly

```
#define ENABLE_CHECKER_charpoly 1
```

17.269.1.2 TIME_CHECKER_CHARPOLY

```
#define TIME_CHECKER_CHARPOLY 1
```

17.269.2 Function Documentation

17.269.2.1 printPolynomial()

```
void printPolynomial (
            const Field & F,
            Polynomial & v )
```

17.269.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.270 test-charpoly.C File Reference

```
#include <iostream>
#include <iomanip>
#include "givaro/modular.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <random>
#include <chrono>
```

Functions

- template<class Field , class RandIter >
  bool launch_test (const Field &F, size_t n, typename Field::Element ∗A, size_t lda, size_t nbit, RandIter &G, FFPACK::FFPACK_CHARPOLY_TAG CT)
- template<class Field >
  bool run_with_field (const Givaro::Integer p, uint64_t bits, size_t n, std::string file, int variant, size_t iter, uint64_t seed)
- int main (int argc, char ∗∗argv)

17.270.1 Function Documentation

17.270.1.1 launch_test()

```
bool launch_test (
            const Field & F,
```

```
            size_t n,
            typename Field::Element * A,
            size_t lda,
            size_t nbit,
            RandIter & G,
            FFPACK::FFPACK_CHARPOLY_TAG CT )
```

17.270.1.2 run_with_field()

```
bool run_with_field (
            const Givaro::Integer p,
            uint64_t bits,
            size_t n,
            std::string file,
            int variant,
            size_t iter,
            uint64_t seed )
```

17.270.1.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.271 test-compressQ.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <list>
#include <vector>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Typedefs

- typedef Givaro::Modular< double > Field

Functions

- template<class T >
  std::ostream & printvect (std::ostream &o, vector< T > &vect)
- int main (int argc, char **argv)

17.271.1 Typedef Documentation

17.271.1.1 Field

```
typedef Givaro::Modular<double> Field
```

17.271.2 Function Documentation

17.271.2.1 printvect()

```
std::ostream& printvect (
            std::ostream & o,
            vector< T > & vect )
```

Bug does not belong here

17.271.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.272 test-det-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include <time.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/checkers/checkers_ffpack.h"
#include "fflas-ffpack/checkers/checkers_ffpack.inl"
```

Macros

- #define ENABLE_CHECKER_Det 1
- #define TIME_CHECKER_Det 1

Functions

- int main (int argc, char **argv)

17.272.1 Macro Definition Documentation

17.272.1.1 ENABLE_CHECKER_Det

```
#define ENABLE_CHECKER_Det 1
```

17.272.1.2 TIME_CHECKER_Det

```
#define TIME_CHECKER_Det 1
```

17.272.2 Function Documentation

17.272.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.273 test-det.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
```

Functions

- template<class Field , class RandIter >
  bool test_det (Field &F, size_t n, int iter, RandIter &G)
- int main (int argc, char **argv)

17.273.1 Function Documentation

17.273.1.1 test_det()

```
bool test_det (
            Field & F,
            size_t n,
            int iter,
            RandIter & G )
```

Todo test with stride

17.273.1.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.274 test-echelon.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <iomanip>
#include <givaro/modular-balanced.h>
#include <givaro/udl.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

```
#include <random>
#include <chrono>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define __FFLASFFPACK_GAUSSJORDAN_BASECASE 25
- #define __FFLASFFPACK_PLUQ_THRESHOLD 25

Functions

- template<class Field , class RandIter >
  bool test_colechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)
- template<class Field , class RandIter >
  bool test_rowechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)
- template<class Field , class RandIter >
  bool test_redcolechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG LuTag, RandIter &G, bool par)
- template<class Field , class RandIter >
  bool test_redrowechelon (Field &F, size_t m, size_t n, size_t r, size_t iters, FFPACK::FFPACK_LU_TAG Lu↩Tag, RandIter &G, bool par)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t r, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.274.1 Macro Definition Documentation

17.274.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.274.1.2 __FFLASFFPACK_GAUSSJORDAN_BASECASE

```
#define __FFLASFFPACK_GAUSSJORDAN_BASECASE 25
```

17.274.1.3 __FFLASFFPACK_PLUQ_THRESHOLD

```
#define __FFLASFFPACK_PLUQ_THRESHOLD 25
```

17.274.2 Function Documentation

17.274.2.1 test_colechelon()

```
bool test_colechelon (
            Field & F,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
```

```
            FFPACK::FFPACK_LU_TAG LuTag,
            RandIter & G,
            bool par )
```

Todo check lda

17.274.2.2 test_rowechelon()

```
bool test_rowechelon (
            Field & F,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            FFPACK::FFPACK_LU_TAG LuTag,
            RandIter & G,
            bool par )
```

Todo check lda

17.274.2.3 test_redcolechelon()

```
bool test_redcolechelon (
            Field & F,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            FFPACK::FFPACK_LU_TAG LuTag,
            RandIter & G,
            bool par )
```

Todo check lda

17.274.2.4 test_redrowechelon()

```
bool test_redrowechelon (
            Field & F,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            FFPACK::FFPACK_LU_TAG LuTag,
            RandIter & G,
            bool par )
```

Todo check lda

17.274.2.5 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
```

```
size_t m,
size_t n,
size_t r,
size_t iters,
uint64_t seed )
```

17.274.2.6 main()

```
int main (
    int argc,
    char ** argv )
```

17.275 test-fadd.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <typeinfo>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "assert.h"
```

Functions

- template<class Field >
  bool test_fadd (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- template<class Field >
  bool test_faddin (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- template<class Field >
  bool test_fsub (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- template<class Field >
  bool test_fsubin (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- int main (int ac, char **av)

17.275.1 Function Documentation

17.275.1.1 test_fadd()

```
bool test_fadd (
    const Field & F,
    size_t m,
    size_t k,
    size_t n,
    bool timing,
    uint64_t seed )
```

17.275.1.2 test_faddin()

```
bool test_faddin (
    const Field & F,
    size_t m,
    size_t k,
```

```
            size_t n,
            bool timing,
            uint64_t seed )
```

17.275.1.3 test_fsub()

```
bool test_fsub (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            uint64_t seed )
```

17.275.1.4 test_fsubin()

```
bool test_fsubin (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            uint64_t seed )
```

17.275.1.5 main()

```
int main (
            int ac,
            char ** av )
```

17.276 test-fdot.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/paladin/parallel.h"
#include "fflas-ffpack/paladin/fflas_plevel1.h"
#include <givaro/zring.h>
#include <givaro/modular.h>
#include <random>
#include <chrono>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field >
  bool check_fdot (const Field &F, size_t n, typename Field::ConstElement_ptr a, size_t inca, typename Field::ConstElement_ptr b, size_t incb)

- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t BS, size_t n, size_t iters, uint64_t seed)
- bool run_with_Integer (size_t BS, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.276.1 Macro Definition Documentation

17.276.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.276.2 Function Documentation

17.276.2.1 check_fdot()

```
bool check_fdot (
            const Field & F,
            size_t n,
            typename Field::ConstElement_ptr a,
            size_t inca,
            typename Field::ConstElement_ptr b,
            size_t incb )
```

17.276.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t BS,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.276.2.3 run_with_Integer()

```
bool run_with_Integer (
            size_t BS,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.276.2.4 main()

```
int main (
            int argc,
            char ** argv )
```

17.277 test-fgemm-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include <time.h>
```

```
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<class Field , class RandIter >
  bool launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, int m, int n, int k, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.277.1 Macro Definition Documentation

17.277.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.277.2 Function Documentation

17.277.2.1 launch_MM_dispatch()

```
bool launch_MM_dispatch (
            const Field & F,
            const int mm,
            const int nn,
            const int kk,
            const typename Field::Element alpha,
            const typename Field::Element beta,
            const size_t iters,
            RandIter & G )
```

Bug test for ldX equal

Bug test for transpo

Todo does nbw actually do nbw recursive calls and then call blas (check ?) ?

17.277.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            int m,
            int n,
            int k,
            size_t iters,
            uint64_t seed )
```

17.277.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.278 test-fgemm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include <iomanip>
#include <iostream>
#include <givaro/modular.h>
#include <recint/rint.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <random>
```

Macros

- #define ENABLE_CHECKER_fgemm 1

Functions

- template<class Field >
  bool check_MM (const Field &F, const typename Field::Element_ptr Cd, enum FFLAS_TRANSPOSE &ta, enum FFLAS_TRANSPOSE &tb, const size_t m, const size_t n, const size_t k, const typename Field::Element &alpha, const typename Field::Element_ptr A, size_t lda, const typename Field::Element_ptr B, size_t ldb, const typename Field::Element &beta, const typename Field::Element_ptr C, size_t ldc)
- template<class Field , class RandIter >
  bool launch_MM (const Field &F, const size_t m, const size_t n, const size_t k, const typename Field::Element alpha, const typename Field::Element beta, const size_t ldc, const size_t lda, enum FFLAS_TRANSPOSE ta, const size_t ldb, enum FFLAS_TRANSPOSE tb, size_t iters, int nbw, bool par, RandIter &G)
- template<class Field , class RandIter >
  bool launch_MM_dispatch (const Field &F, const int mm, const int nn, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, const int nbw, const bool par, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, int m, int n, int k, int nbw, size_t iters, bool par, size_t seed)
- int main (int argc, char **argv)

17.278.1 Macro Definition Documentation

17.278.1.1 ENABLE_CHECKER_fgemm

```
#define ENABLE_CHECKER_fgemm 1
```

17.278.2 Function Documentation

17.278.2.1 check_MM()

```
bool check_MM (
            const Field & F,
            const typename Field::Element_ptr Cd,
            enum FFLAS_TRANSPOSE & ta,
            enum FFLAS_TRANSPOSE & tb,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element & alpha,
            const typename Field::Element_ptr A,
            size_t lda,
            const typename Field::Element_ptr B,
            size_t ldb,
            const typename Field::Element & beta,
            const typename Field::Element_ptr C,
            size_t ldc )
```

17.278.2.2 launch_MM()

```
bool launch_MM (
            const Field & F,
            const size_t m,
            const size_t n,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element beta,
            const size_t ldc,
            const size_t lda,
            enum FFLAS_TRANSPOSE ta,
            const size_t ldb,
            enum FFLAS_TRANSPOSE tb,
            size_t iters,
            int nbw,
            bool par,
            RandIter & G )
```

17.278.2.3 launch_MM_dispatch()

```
bool launch_MM_dispatch (
            const Field & F,
            const int mm,
            const int nn,
            const int kk,
            const typename Field::Element alpha,
            const typename Field::Element beta,
            const size_t iters,
            const int nbw,
            const bool par,
            RandIter & G )
```

Bug test for ldX equal

Bug test for transpo

Todo does nbw actually do nbw recursive calls and then call blas (check ?) ?

17.278.2.4 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            int m,
            int n,
            int k,
            int nbw,
            size_t iters,
            bool par,
            size_t seed )
```

17.278.2.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.279 test-fgemv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <givaro/modular.h>
#include <recint/rint.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
```

Functions

- template<class Field >
  bool check_MV (const Field &F, const typename Field::Element_ptr Cd, enum FFLAS_TRANSPOSE &ta, const size_t m, const size_t k, const typename Field::Element &alpha, const typename Field::Element_ptr A, size_t lda, const typename Field::Element_ptr X, size_t incX, const typename Field::Element &beta, const typename Field::Element_ptr Y, size_t incY)
- template<class Field , class RandIter >
  bool launch_MV (const Field &F, const size_t m, const size_t k, const typename Field::Element alpha, const typename Field::Element beta, const size_t lda, enum FFLAS_TRANSPOSE ta, const size_t incX, const size_t incY, size_t iters, bool par, RandIter &G)
- template<class Field , class RandIter >
  bool launch_MV_dispatch (const Field &F, const int mm, const int kk, const typename Field::Element alpha, const typename Field::Element beta, const size_t iters, const bool par, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, int m, int k, size_t iters, bool par, uint64_t seed)
- int main (int argc, char **argv)

17.279.1 Function Documentation

17.279.1.1 check_MV()

```
bool check_MV (
            const Field & F,
            const typename Field::Element_ptr Cd,
            enum FFLAS_TRANSPOSE & ta,
            const size_t m,
            const size_t k,
            const typename Field::Element & alpha,
            const typename Field::Element_ptr A,
            size_t lda,
            const typename Field::Element_ptr X,
            size_t incX,
            const typename Field::Element & beta,
            const typename Field::Element_ptr Y,
            size_t incY )
```

17.279.1.2 launch_MV()

```
bool launch_MV (
            const Field & F,
            const size_t m,
            const size_t k,
            const typename Field::Element alpha,
            const typename Field::Element beta,
            const size_t lda,
            enum FFLAS_TRANSPOSE ta,
            const size_t incX,
            const size_t incY,
            size_t iters,
            bool par,
            RandIter & G )
```

17.279.1.3 launch_MV_dispatch()

```
bool launch_MV_dispatch (
            const Field & F,
            const int mm,
            const int kk,
            const typename Field::Element alpha,
            const typename Field::Element beta,
            const size_t iters,
            const bool par,
            RandIter & G )
```

17.279.1.4 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            int m,
            int k,
            size_t iters,
            bool par,
            uint64_t seed )
```

17.279.1.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.280 test-fger.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <givaro/modular-integral.h>
#include <givaro/modular-balanced.h>
#include <givaro/givintprime.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Macros

- #define TIME 1

Functions

- template<class Field >
  bool check_fger (const Field &F, const typename Field::Element_ptr Cd, const size_t m, const size_t n, const typename Field::Element &alpha, const typename Field::Element_ptr x, const size_t incx, const typename Field::Element_ptr y, const size_t incy, const typename Field::Element_ptr C, const size_t ldc)
- template<class Field , class RandIter >
  bool launch_fger (const Field &F, const size_t m, const size_t n, const typename Field::Element alpha, const size_t ldc, const size_t inca, const size_t incb, size_t iters, RandIter &G)
- template<class Field , class RandIter >
  bool launch_fger_dispatch (const Field &F, const size_t nn, const typename Field::Element alpha, const size_t iters, RandIter &G)
- template<class Field >
  bool run_with_field (int64_t q, uint64_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.280.1 Macro Definition Documentation

17.280.1.1 TIME

```
#define TIME 1
```

17.280.2 Function Documentation

17.280.2.1 check_fger()

```
bool check_fger (
            const Field & F,
            const typename Field::Element_ptr Cd,
```

```
            const size_t m,
            const size_t n,
            const typename Field::Element & alpha,
            const typename Field::Element_ptr x,
            const size_t incx,
            const typename Field::Element_ptr y,
            const size_t incy,
            const typename Field::Element_ptr C,
            const size_t ldc )
```

17.280.2.2 launch_fger()

```
bool launch_fger (
            const Field & F,
            const size_t m,
            const size_t n,
            const typename Field::Element alpha,
            const size_t ldc,
            const size_t inca,
            const size_t incb,
            size_t iters,
            RandIter & G )
```

17.280.2.3 launch_fger_dispatch()

```
bool launch_fger_dispatch (
            const Field & F,
            const size_t nn,
            const typename Field::Element alpha,
            const size_t iters,
            RandIter & G )
```

Bug test for incx equal

Bug test for transpo

Todo does nbw actually do nbw recursive calls and then call blas (check ?) ?

17.280.2.4 run_with_field()

```
bool run_with_field (
            int64_t q,
            uint64_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.280.2.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.281 test-fgesv.C File Reference

```
#include <iostream>
#include <iomanip>
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
```

Functions

- template<class Field , class RandIter >
  bool test_square_fgesv (Field &F, FFLAS_SIDE side, string fileA, string fileB, size_t m, size_t k, size_t r, RandIter &G)
- template<class Field , class RandIter >
  bool test_rect_fgesv (Field &F, FFLAS_SIDE side, string fileA, string fileB, size_t m, size_t n, size_t k, size_t r, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t k, size_t r, size_t iters, string fileA, string fileB, uint64_t &seed)
- int main (int argc, char **argv)

17.281.1 Function Documentation

17.281.1.1 test_square_fgesv()

```
bool test_square_fgesv (
            Field & F,
            FFLAS_SIDE side,
            string fileA,
            string fileB,
            size_t m,
            size_t k,
            size_t r,
            RandIter & G )
```

17.281.1.2 test_rect_fgesv()

```
bool test_rect_fgesv (
            Field & F,
            FFLAS_SIDE side,
            string fileA,
            string fileB,
            size_t m,
            size_t n,
            size_t k,
            size_t r,
            RandIter & G )
```

17.281.1.3 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
```

```
            uint64_t b,
            size_t m,
            size_t n,
            size_t k,
            size_t r,
            size_t iters,
            string fileA,
            string fileB,
            uint64_t & seed )
```

17.281.1.4 main()

```
int main (
            int argc,
            char ** argv )
```

17.282 test-finit.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <typeinfo>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "assert.h"
#include <random>
#include <chrono>
```

Functions

- template<class Field >
  bool test_freduce (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t m, size_t k, size_t n, size_t iters, bool timing, uint64_t seed)
- int main (int ac, char **av)

17.282.1 Function Documentation

17.282.1.1 test_freduce()

```
bool test_freduce (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            uint64_t seed )
```

17.282.1.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t m,
            size_t k,
            size_t n,
            size_t iters,
            bool timing,
            uint64_t seed )
```

17.282.1.3 main()

```
int main (
            int ac,
            char ** av )
```

17.283 test-fscal.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <typeinfo>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "assert.h"
```

Functions

- template<class Field , class RandIter >
  bool test_fscal (const Field &F, const typename Field::Element &alpha, size_t m, size_t k, size_t n, bool timing, RandIter &G)
- template<class Field >
  bool test_fscal (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- template<class Field , class RandIter >
  bool test_fscalin (const Field &F, const typename Field::Element &alpha, size_t m, size_t k, size_t n, bool timing, RandIter &G)
- template<class Field >
  bool test_fscalin (const Field &F, size_t m, size_t k, size_t n, bool timing, uint64_t seed)
- int main (int ac, char **av)

17.283.1 Function Documentation

17.283.1.1 test_fscal() [1/2]

```
bool test_fscal (
            const Field & F,
            const typename Field::Element & alpha,
            size_t m,
            size_t k,
            size_t n,
```

```
            bool timing,
            RandIter & G )
```

17.283.1.2 test_fscal() [2/2]

```
bool test_fscal (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            uint64_t seed )
```

17.283.1.3 test_fscalin() [1/2]

```
bool test_fscalin (
            const Field & F,
            const typename Field::Element & alpha,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            RandIter & G )
```

17.283.1.4 test_fscalin() [2/2]

```
bool test_fscalin (
            const Field & F,
            size_t m,
            size_t k,
            size_t n,
            bool timing,
            uint64_t seed )
```

17.283.1.5 main()

```
int main (
            int ac,
            char ** av )
```

17.284 test-fsyr2k.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_fsyr2k (const Field &F, size_t n, size_t k, const typename Field::Element &alpha, const typename Field::Element &beta, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_TRANSPOSE trans, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t k, int a, int c, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.284.1 Macro Definition Documentation

17.284.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.284.2 Function Documentation

17.284.2.1 check_fsyr2k()

```
bool check_fsyr2k (
            const Field & F,
            size_t n,
            size_t k,
            const typename Field::Element & alpha,
            const typename Field::Element & beta,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_TRANSPOSE trans,
            RandIter & Rand )
```

17.284.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t k,
            int a,
            int c,
            size_t iters,
            uint64_t seed )
```

17.284.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.285 test-fsyrk.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_fsyrk (const Field &F, size_t n, size_t k, size_t w, const typename Field::Element &alpha, const typename Field::Element &beta, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_TRANSPOSE trans, RandIter &Rand)
- template<typename Field , class RandIter >
  bool check_fsyrk_diag (const Field &F, size_t n, size_t k, const typename Field::Element &alpha, const typename Field::Element &beta, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_TRANSPOSE trans, RandIter &Rand)
- template<typename Field , class RandIter >
  bool check_fsyrk_bkdiag (const Field &F, size_t n, size_t k, const typename Field::Element &alpha, const typename Field::Element &beta, FFLAS_UPLO uplo, FFLAS_TRANSPOSE trans, RandIter &Rand)
- template<class Field , class RandIter >
  bool check_computeS1S2 (const Field &F, size_t N, size_t K, FFLAS_TRANSPOSE trans, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t k, size_t w, int a, int c, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.285.1 Macro Definition Documentation

17.285.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.285.2 Function Documentation

17.285.2.1 check_fsyrk()

```
bool check_fsyrk (
            const Field & F,
            size_t n,
            size_t k,
            size_t w,
            const typename Field::Element & alpha,
```

```
const typename Field::Element & beta,
FFLAS::FFLAS_UPLO uplo,
FFLAS::FFLAS_TRANSPOSE trans,
RandIter & Rand )
```

17.285.2.2 check_fsyrk_diag()

```
bool check_fsyrk_diag (
            const Field & F,
            size_t n,
            size_t k,
            const typename Field::Element & alpha,
            const typename Field::Element & beta,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_TRANSPOSE trans,
            RandIter & Rand )
```

17.285.2.3 check_fsyrk_bkdiag()

```
bool check_fsyrk_bkdiag (
            const Field & F,
            size_t n,
            size_t k,
            const typename Field::Element & alpha,
            const typename Field::Element & beta,
            FFLAS_UPLO uplo,
            FFLAS_TRANSPOSE trans,
            RandIter & Rand )
```

17.285.2.4 check_computeS1S2()

```
bool check_computeS1S2 (
            const Field & F,
            size_t N,
            size_t K,
            FFLAS_TRANSPOSE trans,
            RandIter & G )
```

17.285.2.5 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t k,
            size_t w,
            int a,
            int c,
            size_t iters,
            uint64_t seed )
```

17.285.2.6 main()

```
int main (
```

```
int argc,
char ** argv )
```

17.286 test-fsytrf.C File Reference

```
#include <iostream>
#include <iterator>
#include <vector>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include <iomanip>
#include <random>
#include <chrono>
#include <givaro/modular.h>
#include "fflas-ffpack/utils/test-utils.h"
```

Functions

- template<typename T >
  std::ostream & operator<< (std::ostream &os, const std::vector< T > &x)
- template<class Field , class RandIter >
  bool test_RPM_fsytrf (Field &F, FFLAS_UPLO uplo, string file, size_t n, size_t r, RandIter &G, size_t threshold)
- template<class Field , class RandIter >
  bool test_generic_fsytrf (Field &F, FFLAS_UPLO uplo, string file, size_t n, RandIter &G, size_t threshold)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t n, size_t r, size_t iters, string file, size_t threshold, uint64_t &seed)
- int main (int argc, char **argv)

17.286.1 Function Documentation

17.286.1.1 operator<<()

```
std::ostream& operator<< (
    std::ostream & os,
    const std::vector< T > & x )
```

17.286.1.2 test_RPM_fsytrf()

```
bool test_RPM_fsytrf (
    Field & F,
    FFLAS_UPLO uplo,
    string file,
    size_t n,
    size_t r,
    RandIter & G,
    size_t threshold )
```

17.286.1.3 test_generic_fsytrf()

```
bool test_generic_fsytrf (
            Field & F,
            FFLAS_UPLO uplo,
            string file,
            size_t n,
            RandIter & G,
            size_t threshold )
```

17.286.1.4 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t n,
            size_t r,
            size_t iters,
            string file,
            size_t threshold,
            uint64_t & seed )
```

17.286.1.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.287 test-ftrmm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-integer.h>
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL

Functions

- template<typename Field , class RandIter >
  bool check_ftrmm (const Field &F, size_t m, size_t n, const typename Field::Element &alpha, FFLAS::FFLAS_SIDE side, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_TRANSPOSE trans, FFLAS::FFLAS_DIAG diag, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t m, size_t n, uint64_t a, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.287.1 Macro Definition Documentation

17.287.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.287.2 Function Documentation

17.287.2.1 check_ftrmm()

```
bool check_ftrmm (
            const Field & F,
            size_t m,
            size_t n,
            const typename Field::Element & alpha,
            FFLAS::FFLAS_SIDE side,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_TRANSPOSE trans,
            FFLAS::FFLAS_DIAG diag,
            RandIter & Rand )
```

17.287.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t m,
            size_t n,
            uint64_t a,
            size_t iters,
            uint64_t seed )
```

17.287.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.288 test-ftrmv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <chrono>
#include <random>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrmv (const Field &F, size_t n, FFLAS_UPLO uplo, FFLAS_TRANSPOSE trans, FFLAS_DIAG diag, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.288.1 Macro Definition Documentation

17.288.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.288.1.2 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.288.2 Function Documentation

17.288.2.1 check_ftrmv()

```
bool check_ftrmv (
            const Field & F,
            size_t n,
            FFLAS_UPLO uplo,
            FFLAS_TRANSPOSE trans,
            FFLAS_DIAG diag,
            RandIter & Rand )
```

17.288.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.288.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.289 test-ftrsm-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include <time.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- int main (int argc, char **argv)

17.289.1 Macro Definition Documentation

17.289.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.289.2 Function Documentation

17.289.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.290 test-ftrsm.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-integer.h>
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <random>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrsm (const Field &F, size_t m, size_t n, const typename Field::Element &alpha, FFLAS::FFLAS_SIDE side, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_TRANSPOSE trans, FFLAS::FFLAS_DIAG diag, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t m, size_t n, uint64_t a, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.290.1 Macro Definition Documentation

17.290.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.290.1.2 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.290.2 Function Documentation

17.290.2.1 check_ftrsm()

```
bool check_ftrsm (
            const Field & F,
            size_t m,
            size_t n,
            const typename Field::Element & alpha,
            FFLAS::FFLAS_SIDE side,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_TRANSPOSE trans,
            FFLAS::FFLAS_DIAG diag,
            RandIter & Rand )
```

17.290.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t m,
            size_t n,
            uint64_t a,
            size_t iters,
            uint64_t seed )
```

17.290.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.291 test-ftrssyr2k.C File Reference

```
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-integer.h>
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <random>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrssyr2k (const Field &F, size_t n, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_DIAG diagA, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.291.1 Macro Definition Documentation

17.291.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.291.2 Function Documentation

17.291.2.1 check_ftrssyr2k()

```
bool check_ftrssyr2k (
            const Field & F,
            size_t n,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_DIAG diagA,
            RandIter & Rand )
```

17.291.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.291.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.292 test-ftrstr.C File Reference

```
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-integer.h>
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <random>
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrstr (const Field &F, size_t n, FFLAS::FFLAS_SIDE side, FFLAS::FFLAS_UPLO uplo, FFLAS::FFLAS_DIAG diagA, FFLAS::FFLAS_DIAG diagB, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.292.1 Macro Definition Documentation

17.292.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.292.2 Function Documentation

17.292.2.1 check_ftrstr()

```
bool check_ftrstr (
            const Field & F,
            size_t n,
            FFLAS::FFLAS_SIDE side,
            FFLAS::FFLAS_UPLO uplo,
            FFLAS::FFLAS_DIAG diagA,
```

```
            FFLAS::FFLAS_DIAG diagB,
            RandIter & Rand )
```

17.292.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.292.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.293 test-ftrsv.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrsv (const Field &F, size_t n, FFLAS_UPLO uplo, FFLAS_TRANSPOSE trans, FFLAS_DIAG diag, RandIter &Rand)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.293.1 Macro Definition Documentation

17.293.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.293.1.2 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.293.2 Function Documentation

17.293.2.1 check_ftrsv()

```
bool check_ftrsv (
            const Field & F,
            size_t n,
            FFLAS_UPLO uplo,
            FFLAS_TRANSPOSE trans,
            FFLAS_DIAG diag,
            RandIter & Rand )
```

17.293.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.293.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.294 test-ftrtri.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/ffpack/ffpack.h"
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL
- #define ENABLE_ALL_CHECKINGS 1

Functions

- template<typename Field , class RandIter >
  bool check_ftrtri (const Field &F, size_t n, FFLAS_UPLO uplo, FFLAS_DIAG diag, RandIter &Rand)

- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.294.1 Macro Definition Documentation

17.294.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.294.1.2 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.294.2 Function Documentation

17.294.2.1 check_ftrtri()

```
bool check_ftrtri (
            const Field & F,
            size_t n,
            FFLAS_UPLO uplo,
            FFLAS_DIAG diag,
            RandIter & Rand )
```

17.294.2.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.294.2.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.295 test-interfaces-c.c File Reference

```
#include <fflas-ffpack/interfaces/libs/fflas_c.h>
#include <fflas-ffpack/interfaces/libs/ffpack_c.h>
#include <stdlib.h>
#include <stdio.h>
```

Functions

- int main ()

17.295.1 Function Documentation

17.295.1.1 main()

```
int main (
            void )
```

17.296 test-invert-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- int main (int argc, char **argv)

17.296.1 Macro Definition Documentation

17.296.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.296.2 Function Documentation

17.296.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.297 test-io.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <random>
#include <givaro/modular.h>
#include <givaro/zring.h>
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/args-parser.h"
```

Data Structures

- struct CompactElement< Element >
- struct CompactElement< double >
- struct CompactElement< float >
- struct CompactElement< int64_t >
- struct CompactElement< int32_t >
- struct CompactElement< int16_t >

Functions

- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.297.1 Function Documentation

17.297.1.1 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t m,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.297.1.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.298 test-lu.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-balanced.h>
#include <iostream>
#include <iomanip>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/args-parser.h"
#include <random>
```

Macros

- #define BASECASE_K 37
- #define __FFLASFFPACK_SEQUENTIAL
- #define __LUDIVINE_CUTOFF 1

Functions

- template<class Field , FFLAS::FFLAS_DIAG diag, FFLAS_TRANSPOSE trans>
  bool test_LUdivine (const Field &F, typename Field::ConstElement_ptr A, size_t lda, size_t r, size_t m, size_t n)

  Tests the LUdivine routine.
- template<class Field , FFLAS_DIAG diag>
  bool verifPLUQ (const Field &F, typename Field::ConstElement_ptr A, size_t lda, typename Field::Element_ptr PLUQ, size_t ldpluq, size_t *P, size_t *Q, size_t m, size_t n, size_t R)

  Verifies that B = PLUQ where A stores [L\U].
- template<class Field , FFLAS_DIAG diag, class RandIter >
  bool test_pluq (const Field &F, typename Field::ConstElement_ptr A, size_t r, size_t m, size_t n, size_t lda, RandIter &G)

  Tests the LUdivine routine.
- template<class Field , FFLAS_DIAG diag, FFLAS_TRANSPOSE trans, class RandIter >
  bool launch_test (const Field &F, size_t r, size_t m, size_t n, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t r, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

Variables

- Givaro::Timer tperm
- Givaro::Timer tgemm
- Givaro::Timer tBC
- Givaro::Timer ttrsm
- Givaro::Timer trest
- Givaro::Timer timtot
- size_t mvcnt = 0

17.298.1 Macro Definition Documentation

17.298.1.1 BASECASE_K

```
#define BASECASE_K 37
```

17.298.1.2 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.298.1.3 __LUDIVINE_CUTOFF

```
#define __LUDIVINE_CUTOFF 1
```

17.298.2 Function Documentation

17.298.2.1 test_LUdivine()

```
bool test_LUdivine (
            const Field & F,
            typename Field::ConstElement_ptr A,
            size_t lda,
            size_t r,
            size_t m,
            size_t n )
```

Tests the LUdivine routine.

Template Parameters

Field	Field
Diag	Unit diagonal in U
Trans	

Parameters

F	field
A	Matrix (preallocated)
r	rank of A
m	rows
n	cols
lda	leading dim of A

Returns

0 iff correct, 1 otherwise

17.298.2.2 verifPLUQ()

```
bool verifPLUQ (
            const Field & F,
            typename Field::ConstElement_ptr A,
            size_t lda,
            typename Field::Element_ptr PLUQ,
            size_t ldpluq,
            size_t * P,
            size_t * Q,
            size_t m,
            size_t n,
            size_t R )
```

Verifies that B = PLUQ where A stores [L\U].

Template Parameters

Field	Field
Diag	Unit diagonal in U

Parameters

F	field
A	Matrix (preallocated)

Parameters

r	rank of A
m	rows
n	cols
lda	leading dim of A

Returns

0 iff correct, 1 otherwise

17.298.2.3 test_pluq()

```
bool test_pluq (
            const Field & F,
            typename Field::ConstElement_ptr A,
            size_t r,
            size_t m,
            size_t n,
            size_t lda,
            RandIter & G )
```

Tests the LUdivine routine.

Template Parameters

Field	Field
Diag	Unit diagonal in U
Trans	

Parameters

F	field
A	Matrix (preallocated)
r	rank of A
m	rows
n	cols
lda	leading dim of A

Returns

0 iff correct, 1 otherwise

17.298.2.4 launch_test()

```
bool launch_test (
            const Field & F,
            size_t r,
            size_t m,
            size_t n,
            RandIter & G )
```

17.298.2.5 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            uint64_t seed )
```

17.298.2.6 main()

```
int main (
            int argc,
            char ** argv )
```

17.298.3 Variable Documentation

17.298.3.1 tperm

```
Givaro::Timer tperm
```

17.298.3.2 tgemm

```
Givaro::Timer tgemm
```

17.298.3.3 tBC

```
Givaro::Timer tBC
```

17.298.3.4 ttrsm

```
Givaro::Timer ttrsm
```

17.298.3.5 trest

```
Givaro::Timer trest
```

17.298.3.6 timtot

```
Givaro::Timer timtot
```

17.298.3.7 mvcnt

```
size_t mvcnt = 0
```

17.299 test-maxdelayeddim.C File Reference

```
#include <givaro/modular.h>
#include <recint/rint.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include <stdlib.h>
#include <stdio.h>
```

Macros

- #define MAX_WITH_SIZE_T(x) ((static_cast<uint64_t>(std::numeric_limits<size_t>::max()) < x)? std↩ ::numeric_limits<size_t>::max() : x)

Functions

- template<class Field >
  bool test (Givaro::Integer p, size_t kmax)
- int main ()

17.299.1 Macro Definition Documentation

17.299.1.1 MAX_WITH_SIZE_T

```
#define MAX_WITH_SIZE_T(
            x ) ( (static_cast<uint64_t>(std::numeric_limits<size_t>::max()) < x)? std↩
::numeric_limits<size_t>::max() : x )
```

17.299.2 Function Documentation

17.299.2.1 test()

```
bool test (
            Givaro::Integer p,
            size_t kmax )
```

17.299.2.2 main()

```
int main (
            void )
```

17.300 test-minpoly.C File Reference

```
#include <iomanip>
#include <iostream>
#include <random>
#include <chrono>
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/utils/test-utils.h"
```

```
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include <givaro/modular-integer.h>
#include <givaro/givpoly1factor.h>
#include <givaro/givpoly1.h>
```

Functions

- template<typename Field , class RandIter >
  bool check_minpoly (const Field &F, size_t n, RandIter &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t n, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.300.1 Function Documentation

17.300.1.1 check_minpoly()

```
bool check_minpoly (
            const Field & F,
            size_t n,
            RandIter & G )
```

17.300.1.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t n,
            size_t iters,
            uint64_t seed )
```

17.300.1.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.301 test-multifile1.C File Reference

```
#include "fflas-ffpack/fflas-ffpack.h"
```

17.302 test-multifile2.C File Reference

```
#include "fflas-ffpack/fflas-ffpack.h"
```

Functions

- int main (void)

17.302.1 Function Documentation

17.302.1.1 main()

```
int main (
            void  )
```

17.303 test-nullspace.C File Reference

```
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/fflas_io.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/timer.h"
```

Functions

- template<class Field >
  std::string checkingMessage (const Field &F)
- template<class Field >
  Field::Element_ptr readOrRandomMatrixWithRankAndRandomRPM (const Field &F, std::string file, size_t &m, size_t &n, size_t &lda, size_t &r, uint64_t seed)

  If file is not empty, read it and set m, n, lda and r.
- template<class Field >
  bool test_nullspace (Field &F, FFLAS::FFLAS_SIDE side, size_t m, size_t n, size_t r, typename Field::Element_ptr A, size_t lda)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t r, size_t iters, std::string file, uint64_t &seed)
- int main (int argc, char **argv)

17.303.1 Function Documentation

17.303.1.1 checkingMessage()

```
std::string checkingMessage (
            const Field & F )
```

17.303.1.2 readOrRandomMatrixWithRankAndRandomRPM()

```
Field::Element_ptr readOrRandomMatrixWithRankAndRandomRPM (
            const Field & F,
            std::string file,
            size_t & m,
            size_t & n,
            size_t & lda,
            size_t & r,
            uint64_t seed )
```

If file is not empty, read it and set m, n, lda and r.
Otherwise, generate a random matrix of size m x n with random lda.

17.303.1.3 test_nullspace()

```
bool test_nullspace (
            Field & F,
            FFLAS::FFLAS_SIDE side,
            size_t m,
            size_t n,
            size_t r,
            typename Field::Element_ptr A,
            size_t lda )
```

17.303.1.4 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            std::string file,
            uint64_t & seed )
```

17.303.1.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.304 test-permutations.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <iostream>
#include <givaro/modular.h>
#include "fflas-ffpack/ffpack/ffpack.h"
```

Functions

- bool checkMonotonicApplyP (FFLAS_SIDE Side, FFLAS_TRANSPOSE trans, size_t ∗P, size_t N, size_t R)
- int main ()

Variables

- Givaro::Timer tperm
- Givaro::Timer tgemm
- Givaro::Timer tBC
- Givaro::Timer ttrsm
- Givaro::Timer trest
- Givaro::Timer timtot

17.304.1 Function Documentation

17.304.1.1 checkMonotonicApplyP()

```
bool checkMonotonicApplyP (
            FFLAS_SIDE Side,
            FFLAS_TRANSPOSE trans,
            size_t * P,
            size_t N,
            size_t R )
```

17.304.1.2 main()

```
int main (
            void )
```

17.304.2 Variable Documentation

17.304.2.1 tperm

```
Givaro::Timer tperm
```

17.304.2.2 tgemm

```
Givaro::Timer tgemm
```

17.304.2.3 tBC

```
Givaro::Timer tBC
```

17.304.2.4 ttrsm

```
Givaro::Timer ttrsm
```

17.304.2.5 trest

```
Givaro::Timer trest
```

17.304.2.6 timtot

```
Givaro::Timer timtot
```

17.305 test-pluq-check.C File Reference

```
#include <iostream>
#include <stdlib.h>
#include <time.h>
#include "fflas-ffpack/fflas-ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
```

Macros

- #define ENABLE_ALL_CHECKINGS 1

Functions

- int main (int argc, char **argv)

17.305.1 Macro Definition Documentation

17.305.1.1 ENABLE_ALL_CHECKINGS

```
#define ENABLE_ALL_CHECKINGS 1
```

17.305.2 Function Documentation

17.305.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.306 test-quasisep.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include <givaro/modular-balanced.h>
#include <iostream>
#include <iomanip>
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/args-parser.h"
#include <random>
```

Functions

- template<class Field , FFLAS_DIAG diag, class RandIter >
  bool test_BruhatGenerator (const Field &F, size_t n, size_t r, size_t t, typename Field::ConstElement_ptr A, size_t lda, typename Field::Element_ptr TS, size_t l, RandIter &G)
- template<class Field , FFLAS_DIAG diag, class RandIter >
  bool launch_test (const Field &F, size_t n, size_t r, size_t t, size_t l, RandIter &G)
- template<class Field , class RandGen >
  bool testLTQSRPM (const Field &F, size_t n, size_t r, size_t t, RandGen &G)
- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t n, size_t r, size_t t, size_t l, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.306.1 Function Documentation

17.306.1.1 test_BruhatGenerator()

```
bool test_BruhatGenerator (
            const Field & F,
            size_t n,
            size_t r,
            size_t t,
            typename Field::ConstElement_ptr A,
            size_t lda,
            typename Field::Element_ptr TS,
            size_t l,
            RandIter & G )
```

17.306.1.2 launch_test()

```
bool launch_test (
            const Field & F,
            size_t n,
            size_t r,
            size_t t,
            size_t l,
            RandIter & G )
```

17.306.1.3 testLTQSRPM()

```
bool testLTQSRPM (
            const Field & F,
            size_t n,
            size_t r,
            size_t t,
            RandGen & G )
```

17.306.1.4 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t n,
            size_t r,
            size_t t,
            size_t l,
            size_t iters,
            uint64_t seed )
```

17.306.1.5 main()

```
int main (
            int argc,
            char ** argv )
```

17.307 test-rankprofiles.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/args-parser.h"
```

```
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <iostream>
#include <iomanip>
#include <random>
#include <chrono>
```

Macros

- #define __FFLASFFPACK_SEQUENTIAL

Functions

- template<class Field >
  bool run_with_field (Givaro::Integer q, uint64_t b, size_t m, size_t n, size_t r, size_t iters, uint64_t seed, bool par)
- int main (int argc, char **argv)

17.307.1 Macro Definition Documentation

17.307.1.1 __FFLASFFPACK_SEQUENTIAL

```
#define __FFLASFFPACK_SEQUENTIAL
```

17.307.2 Function Documentation

17.307.2.1 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            uint64_t b,
            size_t m,
            size_t n,
            size_t r,
            size_t iters,
            uint64_t seed,
            bool par )
```

17.307.2.2 main()

```
int main (
            int argc,
            char ** argv )
```

17.308 test-rpm.C File Reference

```
#include <iostream>
#include "givaro/modular.h"
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/args-parser.h"
```

```
#include "fflas-ffpack/ffpack/ffpack.h"
```

Functions

- bool checkRPM (size_t M, size_t N, size_t R)
- bool checkSymmetricRPM (size_t N, size_t R)
- int main (int argc, char **argv)

17.308.1 Function Documentation

17.308.1.1 checkRPM()

```
bool checkRPM (
            size_t M,
            size_t N,
            size_t R )
```

17.308.1.2 checkSymmetricRPM()

```
bool checkSymmetricRPM (
            size_t N,
            size_t R )
```

17.308.1.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.309 test-simd.C File Reference

```
#include "givaro/givinteger.h"
#include "givaro/modular.h"
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/fflas/fflas_simd.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/align-allocator.h"
#include <array>
#include <vector>
#include <random>
#include <string>
#include <functional>
#include <limits>
#include <type_traits>
#include <algorithm>
```

Data Structures

- struct ALL< true, v... >
- struct ALL< false, v... >
- struct ALL<>

- struct count_nonconst_lvalue_reference< T, O... >
- struct count_nonconst_lvalue_reference< T &, O... >
- struct count_nonconst_lvalue_reference< const T &, O... >
- struct count_nonconst_lvalue_reference<>
- struct is_all_same< T, Args... >
- struct is_all_same<>
- struct width< T >
- struct width< float >
- struct width< double >
- class TestOneMethod< Simd >
- struct ScalFunctionsBase< Element, typename enable_if< is_floating_point< Element >::value >::type >
- class ScalFunctionsBase< Element, typename enable_if< is_floating_point< Element >::value >::type >::FloatingPointTestD
- struct ScalFunctionsBase< Element, typename enable_if< is_integral< Element >::value >::type >
- struct ScalFunctions< Element >

Macros

- #define _TEST_ONE(K, f1, f2, r, n)
- #define TEST_ONE_OP(f)
- #define TEST_ONE_OP_WZ(f)
- #define TEST_IMPL(SIZE, Elt)

Functions

- template<typename Element >
  enable_if< is_integral< Element >::value, bool >::type check_eq (Element x, Element y)
- template<typename Element >
  enable_if< is_floating_point< Element >::value, bool >::type check_eq (Element x, Element y)
- template<typename Element >
  bool cmp (vector< Element > out_scal, vector< Element > out_simd)
- template<typename Ret , typename T >
  Ret eval_func_on_array (function< Ret()> f, array< T, 0 > &arr)
- template<typename T , typename... TArgs>
  void eval_func_on_array (function< void(T, TArgs...)> f, array< typename decay< T >::type, sizeof...(TArgs)+1 > &arr)
- template<typename Ret , typename T , typename... TArgs>
  Ret eval_func_on_array (function< Ret(T, TArgs...)> f, array< typename decay< T >::type, sizeof...(TArgs)+1 > &arr)
- template<typename E >
  std::ostream & operator<< (std::ostream &o, const vector< E > &V)
- template<typename Simd , typename Element >
  enable_if< is_floating_point< Element >::value, bool >::type test_impl_base ()
- template<typename Simd , typename Element >
  enable_if< is_integral< Element >::value, bool >::type test_impl_base ()
- template<typename Simd , typename Element >
  bool test_impl ()
- int main (int argc, char *argv[ ])

17.309.1 Macro Definition Documentation

17.309.1.1 _TEST_ONE

```
#define _TEST_ONE(
              K,
              f1,
              f2,
              r,
              n )
```

Value:

```
        do {      \
        K T(f1, f2, r, n);                    \
        bool b = T.writeResultLine();         \
        if (b == false)                       \
            T.writeDebugData();               \
        btest &= b;                           \
    } while (0)
```

17.309.1.2 TEST_ONE_OP

```
#define TEST_ONE_OP(
              f )
```

Value:

```
        _TEST_ONE(TestOneMethod<Simd>,                 \
        function<decltype(Simd::f)>(Simd::f),                          \
        function<decltype(Scal::f)>(Scal::f),                          \
        function<decltype(Scal::genInputs)>(Scal::genInputs), #f)
```

17.309.1.3 TEST_ONE_OP_WZ

```
#define TEST_ONE_OP_WZ(
              f )
```

Value:

```
        _TEST_ONE(TestOneMethod<Simd>,                       \
        function<decltype(Simd::f)>(Simd::f),                                  \
        function<decltype(Scal::f)>(Scal::f),                                  \
        function<decltype(Scal::genInputsWithZero)>(Scal::genInputsWithZero),\
        #f " test with zero")
```

17.309.1.4 TEST_IMPL

```
#define TEST_IMPL(
              SIZE,
              Elt )
```

Value:

```
        do {        \
        pass &= test_impl<Simd##SIZE<Elt>, Elt>(); \
        cout « endl; \
    } while (0)
```

17.309.2 Function Documentation

17.309.2.1 check_eq() [1/2]

```
enable_if<is_integral<Element>::value, bool>::type check_eq (
             Element x,
             Element y )
```

17.309.2.2 check_eq() [2/2]

```
enable_if<is_floating_point<Element>::value, bool>::type check_eq (
```

```
            Element x,
            Element y )
```

17.309.2.3 cmp()

```
bool cmp (
            vector< Element > out_scal,
            vector< Element > out_simd )
```

17.309.2.4 eval_func_on_array() [1/3]

```
Ret eval_func_on_array (
            function< Ret()> f,
            array< T, 0 > & arr )
```

17.309.2.5 eval_func_on_array() [2/3]

```
void eval_func_on_array (
            function< void(T, TArgs...)> f,
            array< typename decay< T >::type, sizeof...(TArgs)+1 > & arr )
```

17.309.2.6 eval_func_on_array() [3/3]

```
Ret eval_func_on_array (
            function< Ret(T, TArgs...)> f,
            array< typename decay< T >::type, sizeof...(TArgs)+1 > & arr )
```

17.309.2.7 operator<<()

```
std::ostream& operator<< (
            std::ostream & o,
            const vector< E > & V )
```

17.309.2.8 test_impl_base() [1/2]

```
enable_if<is_floating_point<Element>::value, bool>::type test_impl_base ( )
```

17.309.2.9 test_impl_base() [2/2]

```
enable_if<is_integral<Element>::value, bool>::type test_impl_base ( )
```

17.309.2.10 test_impl()

```
bool test_impl ( )
```

17.309.2.11 main()

```
int main (
            int argc,
            char * argv[] )
```

17.310 test-solve.C File Reference

```
#include <givaro/modular-integer.h>
#include <iomanip>
#include <iostream>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
```

Functions

- template<typename Field , class RandIter >
  bool check_solve (const Field &F, size_t m, RandIter &Rand, bool isParallel)
- template<class Field >
  bool run_with_field (Givaro::Integer q, size_t b, size_t m, size_t iters, uint64_t seed)
- int main (int argc, char **argv)

17.310.1 Function Documentation

17.310.1.1 check_solve()

```
bool check_solve (
            const Field & F,
            size_t m,
            RandIter & Rand,
            bool isParallel )
```

17.310.1.2 run_with_field()

```
bool run_with_field (
            Givaro::Integer q,
            size_t b,
            size_t m,
            size_t iters,
            uint64_t seed )
```

17.310.1.3 main()

```
int main (
            int argc,
            char ** argv )
```

17.311 test-storage-transpose.C File Reference

```
#include <iomanip>
#include <iostream>
#include <random>
#include "fflas-ffpack/utils/args-parser.h"
#include "fflas-ffpack/utils/test-utils.h"
#include "fflas-ffpack/utils/fflas_io.h"
```

```
#include "fflas-ffpack/utils/fflas_memory.h"
#include <givaro/modular.h>
#include <recint/rint.h>
#include "fflas-ffpack/fflas/fflas_transpose.h"
```

Data Structures

- class Test< Elt >

Functions

- int main (int argc, char **argv)

17.311.1 Function Documentation

17.311.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

17.312 test-utils.h File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/debug.h"
#include "fflas-ffpack/ffpack/ffpack.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <givaro/givinteger.h>
#include <givaro/givintprime.h>
#include <givaro/givranditer.h>
#include <givaro/givtimer.h>
#include <random>
#include <functional>
```

Namespaces

- FFLAS
- FFPACK

  F*inite* ***F****ield* ***PACK*** *Set of elimination based routines for dense linear algebra.*

Functions

- uint64_t getSeed ()
- template<typename Field >
  Field * chooseField (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< int32_t > * chooseField< Givaro::ZRing< int32_t > > (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< int64_t > * chooseField< Givaro::ZRing< int64_t > > (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< float > * chooseField< Givaro::ZRing< float > > (Givaro::Integer q, uint64_t b, uint64_t seed)
- template<> Givaro::ZRing< double > * chooseField< Givaro::ZRing< double > > (Givaro::Integer q, uint64_t b, uint64_t seed)

17.313 timer.h File Reference

```
#include <time.h>
#include <givaro/givtimer.h>
```

Namespaces

- FFLAS

Typedefs

- typedef Givaro::Timer Timer
- typedef Givaro::BaseTimer BaseTimer
- typedef Givaro::UserTimer UserTimer
- typedef Givaro::SysTimer SysTimer

17.314 utils.h File Reference

```
#include <algorithm>
#include <numeric>
#include <vector>
```

Data Structures

- struct StatsMatrix

Namespaces

- FFLAS

Functions

- template<class It >
  double computeDeviation (It begin, It end)
- template<class Field >
  StatsMatrix getStat (const Field &F, const index_t *row, const index_t *col, typename Field::ConstElement_ptr val, uint64_t rowdim, uint64_t coldim, uint64_t nnz)

17.315 winograd.C File Reference

```
#include "fflas-ffpack/fflas-ffpack-config.h"
#include "fflas-ffpack/utils/fflas_randommatrix.h"
#include <iostream>
#include <fstream>
#include <givaro/modular.h>
#include <givaro/modular-balanced.h>
#include "fflas-ffpack/utils/timer.h"
#include "fflas-ffpack/fflas/fflas.h"
#include <ctime>
```

Macros

- #define DOUBLE_TO_FLOAT_CROSSOVER 0
- #define GFOPS(n, t) (2.0/t*(double)n/1000.0*(double)n/1000.0*(double)n/1000.0)

Typedefs

- typedef Givaro::Timer TTimer

Functions

- template<class Field >
  bool balanced (const Field &)
- template<class T >
  bool balanced (const Givaro::ModularBalanced< T > &)
- int main ()

17.315.1 Macro Definition Documentation

17.315.1.1 DOUBLE_TO_FLOAT_CROSSOVER

```
#define DOUBLE_TO_FLOAT_CROSSOVER 0
```

17.315.1.2 GFOPS

```
#define GFOPS(
              n,
              t ) (2.0/t*(double)n/1000.0*(double)n/1000.0*(double)n/1000.0)
```

17.315.2 Typedef Documentation

17.315.2.1 TTimer

```
typedef Givaro::Timer TTimer
```

17.315.3 Function Documentation

17.315.3.1 balanced() [1/2]

```
bool balanced (
             const Field & )
```

17.315.3.2 balanced() [2/2]

```
bool balanced (
             const Givaro::ModularBalanced< T > & )
```

17.315.3.3 main()

```
int main (
             void )
```

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