ReproBLAS

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Data Structure Documentation

3.1 dIComplex_ Struct Reference

Data Fields

- double **m** [2 ∗DEFAULT_FOLD]
- double **c** [2 ∗DEFAULT_FOLD]

The documentation for this struct was generated from the following file:

- include/indexed.h

3.2 Idouble_ Struct Reference

Data Fields

- double **m** [DEFAULT_FOLD]
- double **c** [DEFAULT_FOLD]

The documentation for this struct was generated from the following file:

- include/indexed.h

3.3 Ifloat_ Struct Reference

Data Fields

- float **m** [DEFAULT_FOLD]
- float **c** [DEFAULT_FOLD]

The documentation for this struct was generated from the following file:

- include/indexed.h

3.4 sIComplex_ Struct Reference

Data Fields

- float **m** [2 ∗DEFAULT_FOLD]
- float **c** [2 ∗DEFAULT_FOLD]

The documentation for this struct was generated from the following file:

- include/indexed.h

Chapter 4

File Documentation

4.1 include/indexed.h File Reference

indexed.h defines the indexed types and the lower level functions associated with their use.

```
#include <complex.h>
#include <math.h>
#include <stddef.h>
```

Data Structures

- struct ldouble_
- struct dlComplex_
- struct lfloat_
- struct slComplex_

Macros

- #define **DEFAULT_FOLD** 3
- #define **ldouble** l_double
- #define **lfloat** l_float
- #define **dlcomplex** l_double_Complex
- #define **slcomplex** l_float_Complex

Typedefs

- typedef double double_indexed

  The indexed double datatype.
- typedef double double_complex_indexed

  The indexed complex double datatype.
- typedef float float_indexed

  The indexed float datatype.
- typedef float float_complex_indexed

  The indexed complex float datatype.
- typedef struct ldouble_ **l_double**
- typedef struct dlComplex_ **l_double_Complex**
- typedef struct lfloat_ **l_float**
- typedef struct slComplex_ **l_float_Complex**

Functions

- size_t disize (const int fold)

  indexed double precision size
- size_t zisize (const int fold)

  indexed complex double precision size
- size_t sisize (const int fold)

  indexed single precision size
- size_t cisize (const int fold)

  indexed complex single precision size
- double_indexed * dialloc (const int fold)

  indexed double precision allocation
- double_complex_indexed * zialloc (const int fold)

  indexed complex double precision allocation
- float_indexed * sialloc (const int fold)

  indexed single precision allocation
- float_complex_indexed * cialloc (const int fold)

  indexed complex single precision allocation
- int dinum (const int fold)

  indexed double precision size
- int zinum (const int fold)

  indexed complex double precision size
- int sinum (const int fold)

  indexed single precision size
- int cinum (const int fold)

  indexed complex single precision size
- int diwidth ()

  Get indexed double precision bin width.
- int siwidth ()

  Get indexed single precision bin width.
- int dicapacity ()

  Get indexed double precision deposit capacity.
- int sicapacity ()

  Get indexed single precision deposit capacity.
- double dbound (const int index)

  Get double precision bound corresponding to index.
- void **dmbound** (const int fold, const int index, double *repX, const int increpX, double *carX, const int inccarX)
- int dindex (const double X)

  Get index of double precision.
- int **dmindex** (const double *repX)
- float sbound (const int index)

  Get single precision bound corresponding to index.
- void **smbound** (const int fold, const int index, float *repX, const int increpX, float *carX, const int inccarX)
- int sindex (const float X)

  Get index of single precision.
- int **smindex** (const float *repX)
- void ciprint (const int fold, const float_complex_indexed *X)

  Print indexed complex single precision.
- void **cmprint** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX)
- void diprint (const int fold, const double_indexed *X)

  Print indexed double precision.

- void **dmprint** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX)
- void siprint (const int fold, const float_indexed *X)

  Print indexed single precision.
- void **smprint** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX)
- void ziprint (const int fold, const double_complex_indexed *X)

  Print indexed complex double precision.
- void **zmprint** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX)
- void didiset (const int fold, const double_indexed *X, double_indexed *Y)

  Set indexed double precision (Y = X)
- void **dmdmset** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, double *repY, const int increpY, double *carY, const int inccarY)
- void ziziset (const int fold, const double_complex_indexed *X, double_complex_indexed *Y)

  Set indexed complex double precision (Y = X)
- void **zmzmset** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, double *repY, const int increpY, double *carY, const int inccarY)
- void zidiset (const int fold, const double_indexed *X, double_complex_indexed *Y)

  Set indexed complex double precision to indexed double precision (Y = X)
- void **zmdmset** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, double *repY, const int increpY, double *carY, const int inccarY)
- void sisiset (const int fold, const float_indexed *X, float_indexed *Y)

  Set indexed single precision (Y = X)
- void **smsmset** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, float *repY, const int increpY, float *carY, const int inccarY)
- void ciciset (const int fold, const float_complex_indexed *X, float_complex_indexed *Y)

  Set indexed complex single precision (Y = X)
- void **cmcmset** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, float *repY, const int increpY, float *carY, const int inccarY)
- void cisiset (const int fold, const float_indexed *X, float_complex_indexed *Y)

  Set indexed complex single precision to indexed single precision (Y = X)
- void **cmsmset** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, float *repY, const int increpY, float *carY, const int inccarY)
- void disetzero (const int fold, double_indexed *X)

  Set indexed double precision to 0 (X = 0)
- void **dmsetzero** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void zisetzero (const int fold, double_complex_indexed *X)

  Set indexed double precision to 0 (X = 0)
- void **zmsetzero** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void sisetzero (const int fold, float_indexed *X)

  Set indexed single precision to 0 (X = 0)
- void **smsetzero** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- void cisetzero (const int fold, float_complex_indexed *X)

  Set indexed single precision to 0 (X = 0)
- void **cmsetzero** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- void didiadd (const int fold, const double_indexed *X, double_indexed *Y)

  Add indexed double precision (Y += X)
- void **dmdmadd** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, double *repY, const int increpY, double *carY, const int inccarY)
- void ziziadd (const int fold, const double_complex_indexed *X, double_complex_indexed *Y)

  Add indexed complex double precision (Y += X)
- void **zmzmadd** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, double *repY, const int increpY, double *carY, const int inccarY)
- void sisiadd (const int fold, const float_indexed *X, float_indexed *Y)

  Add indexed single precision (Y += X)

- void **smsmadd** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, float *repY, const int increpY, float *carY, const int inccarY)
- void ciciadd (const int fold, const float_complex_indexed *X, float_complex_indexed *Y)

  Add indexed complex single precision (Y += X)
- void **cmcmadd** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, float *repY, const int increpY, float *carY, const int inccarY)
- void didadd (const int fold, const double X, double_indexed *Y)

  Add double precision to indexed double precision (Y += X)
- void **dmdadd** (const int fold, const double X, double *repY, const int increpY, double *carY, const int inccarY)
- void zizadd (const int fold, const void *X, double_complex_indexed *Y)

  Add complex double precision to indexed complex double precision (Y += X)
- void **zmzadd** (const int fold, const void *X, double *repY, const int increpY, double *carY, const int inccarY)
- void sisadd (const int fold, const float X, float_indexed *Y)

  Add single precision to indexed single precision (Y += X)
- void **smsadd** (const int fold, const float X, float *repY, const int increpY, float *carY, const int inccarY)
- void cicadd (const int fold, const void *X, float_complex_indexed *Y)

  Add complex single precision to indexed complex single precision (Y += X)
- void **cmcadd** (const int fold, const void *X, float *repY, const int increpY, float *carY, const int inccarY)
- void didupdate (const int fold, const double X, double_indexed *Y)

  Update indexed double precision with double precision (X -> Y)
- void **dmdupdate** (const int fold, const double X, double *repY, const int increpY, double *carY, const int inccarY)
- void zizupdate (const int fold, const void *X, double_complex_indexed *Y)

  Update indexed complex double precision with complex double precision (X -> Y)
- void **zmzupdate** (const int fold, const void *X, double *repY, const int increpY, double *carY, const int inccarY)
- void zidupdate (const int fold, const double X, double_complex_indexed *Y)

  Update indexed complex double precision with double precision (X -> Y)
- void **zmdupdate** (const int fold, const double X, double *repY, const int increpY, double *carY, const int inccarY)
- void sisupdate (const int fold, const float X, float_indexed *Y)

  Update indexed single precision with single precision (X -> Y)
- void **smsupdate** (const int fold, const float X, float *repY, const int increpY, float *carY, const int inccarY)
- void cicupdate (const int fold, const void *X, float_complex_indexed *Y)

  Update indexed complex single precision with complex single precision (X -> Y)
- void **cmcupdate** (const int fold, const void *X, float *repY, const int increpY, float *carY, const int inccarY)
- void cisupdate (const int fold, const float X, float_complex_indexed *Y)

  Update indexed complex single precision with single precision (X -> Y)
- void **cmsupdate** (const int fold, const float X, float *repY, const int increpY, float *carY, const int inccarY)
- void diddeposit (const int fold, const double X, double_indexed *Y)

  Add double precision to suitably indexed indexed double precision (Y += X)
- void **dmddeposit** (const int fold, const double X, double *repY, const int increpY)
- void zizdeposit (const int fold, const void *X, double_complex_indexed *Y)

  Add complex double precision to suitably indexed manually specified indexed complex double precision (Y += X)
- void **zmzdeposit** (const int fold, const void *X, double *repY, const int increpY)
- void sisdeposit (const int fold, const float X, float_indexed *Y)

  Add single precision to suitably indexed indexed single precision (Y += X)
- void **smsdeposit** (const int fold, const float X, float *repY, const int increpY)
- void cicdeposit (const int fold, const void *X, float_complex_indexed *Y)

  Add complex single precision to suitably indexed manually specified indexed complex single precision (Y += X)
- void **cmcdeposit** (const int fold, const void *X, float *repY, const int increpY)
- void direnorm (const int fold, double_indexed *X)

  Renormalize indexed double precision.

- void **dmrenorm** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void zirenorm (const int fold, double_complex_indexed *X)

  Renormalize indexed complex double precision.
- void **zmrenorm** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void sirenorm (const int fold, float_indexed *X)

  Renormalize indexed single precision.
- void **smrenorm** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- void cirenorm (const int fold, float_complex_indexed *X)

  Renormalize indexed complex single precision.
- void **cmrenorm** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- void didconv (const int fold, const double X, double_indexed *Y)

  Convert double precision to indexed double precision (X -> Y)
- void **dmdconv** (const int fold, const double X, double *repY, const int increpY, double *carY, const int inccarY)
- void zizconv (const int fold, const void *X, double_complex_indexed *Y)

  Convert complex double precision to indexed complex double precision (X -> Y)
- void **zmzconv** (const int fold, const void *X, double *repY, const int increpY, double *carY, const int inccarY)
- void sisconv (const int fold, const float X, float_indexed *Y)

  Convert single precision to indexed single precision (X -> Y)
- void **smsconv** (const int fold, const float X, float *repY, const int increpY, float *carY, const int inccarY)
- void cicconv (const int fold, const void *X, float_complex_indexed *Y)

  Convert complex single precision to indexed complex single precision (X -> Y)
- void **cmcconv** (const int fold, const void *X, float *repY, const int increpY, float *carY, const int inccarY)
- double ddiconv (const int fold, const double_indexed *X)

  Convert indexed double precision to double precision (X -> Y)
- double **ddmconv** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX)
- void zziconv_sub (const int fold, const double_complex_indexed *X, void *conv)

  Convert indexed complex double precision to complex double precision (X -> Y)
- void **zzmconv_sub** (const int fold, const double *repX, const int increpX, const double *carX, const int inccarX, void *conv)
- float ssiconv (const int fold, const float_indexed *X)

  Convert indexed single precision to single precision (X -> Y)
- float **ssmconv** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX)
- void cciconv_sub (const int fold, const float_complex_indexed *X, void *conv)

  Convert indexed complex single precision to complex single precision (X -> Y)
- void **ccmconv_sub** (const int fold, const float *repX, const int increpX, const float *carX, const int inccarX, void *conv)
- void dinegate (const int fold, double_indexed *X)

  Negate indexed double precision (X = -X)
- void **dmnegate** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void zinegate (const int fold, double_complex_indexed *X)

  Negate indexed complex double precision (X = -X)
- void **zmnegate** (const int fold, double *repX, const int increpX, double *carX, const int inccarX)
- void sinegate (const int fold, float_indexed *X)

  Negate indexed single precision (X = -X)
- void **smnegate** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- void cinegate (const int fold, float_complex_indexed *X)

  Negate indexed complex single precision (X = -X)
- void **cmnegate** (const int fold, float *repX, const int increpX, float *carX, const int inccarX)
- double **ufp** (const double X)
- float **ufpf** (const float X)

4.1.1 Detailed Description

indexed.h defines the indexed types and the lower level functions associated with their use.

This header is modeled after cblas.h, and as such functions are prefixed with character sets describing the data types they operate upon. For example, the function `dfoo` would perform the function `foo` on `double` possibly returning a `double`.

If two character sets are prefixed, the first set of characters describes the output and the second the input type. For example, the function `dzbar` would perform the function `bar` on `double complex` and return a `double`.

Such character sets are listed as follows:

- d - double (`double`)
- z - complex double (`*void`)
- s - float (`float`)
- c - complex float (`*void`)
- di - indexed double (double_indexed)
- zi - indexed complex double (double_complex_indexed)
- si - indexed float (float_indexed)
- ci - indexed complex float (float_complex_indexed)
- dm - manually specified indexed double (`double`, `double`)
- zm - manually specified indexed complex double (`double`, `double`)
- sm - manually specified indexed float (`float`, `float`)
- cm - manually specified indexed complex float (`float`, `float`)

Throughout the library, complex types are specified via `*void` pointers. These routines will sometimes be suffixed by sub, to represent that a function has been made into a subroutine. This allows programmers to use whatever complex types they are already using, as long as the memory pointed to is of the form of two adjacent floating point types, the first and second representing real and imaginary components of the complex number.

The goal of using indexed types is to obtain either more accurate or reproducible summation of floating point numbers. Indexed types are composed of several adjacent bins...

The parameter `fold` describes how many bins are used in the indexed types supplied to a subroutine. The maximum value for this parameter can be set in config.h. If you are unsure of what value to use for , we recommend 3. Note that the `fold` of indexed types must be the same for all indexed types that interact with each other. Operations on more than one indexed type assume all indexed types being operated upon have the same `fold`. Note that the `fold` of an indexed type may not be changed once the type has been allocated. A common use case would be to set the value of `fold` as a global macro in your code and supply it to all indexed functions that you use.

4.1.2 Typedef Documentation

4.1.2.1 typedef double double_complex_indexed

The indexed complex double datatype.

To allocate a double_complex_indexed, call zialloc()

Warning

> A double_complex_indexed is, under the hood, an array of `double`. Therefore, if you have defined an array of double_complex_indexed, you must index it by multiplying the index into the array by the number of underlying `double` that make up the double_complex_indexed. This number can be obtained by a call to zinum()

4.1.2.2 typedef double double_indexed

The indexed double datatype.

To allocate a double_indexed, call dialloc()

Warning

A double_indexed is, under the hood, an array of `double`. Therefore, if you have defined an array of double_indexed, you must index it by multiplying the index into the array by the number of underlying `double` that make up the double_indexed. This number can be obtained by a call to dinum()

4.1.2.3 typedef float float_complex_indexed

The indexed complex float datatype.

To allocate a float_complex_indexed, call cialloc()

Warning

A float_complex_indexed is, under the hood, an array of `float`. Therefore, if you have defined an array of float_complex_indexed, you must index it by multiplying the index into the array by the number of underlying `float` that make up the float_complex_indexed. This number can be obtained by a call to cinum()

4.1.2.4 typedef float float_indexed

The indexed float datatype.

To allocate a float_indexed, call sialloc()

Warning

A float_indexed is, under the hood, an array of `float`. Therefore, if you have defined an array of float_indexed, you must index it by multiplying the index into the array by the number of underlying `float` that make up the float_indexed. This number can be obtained by a call to sinum()

4.1.3 Function Documentation

4.1.3.1 void cciconv_sub (const int *fold*, const float_complex_indexed * *X*, void * *conv*)

Convert indexed complex single precision to complex single precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	indexed scalar X
conv	scalar return

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.2 float_complex_indexed* cialloc (const int *fold*)

indexed complex single precision allocation

Parameters

fold	the fold of the indexed type

Returns

a freshly allocated indexed type. (free with `free()`)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.3 void cicadd (const int *fold*, const void * *X*, **float_complex_indexed** * *Y*)

Add complex single precision to indexed complex single precision (Y += X)

Performs the operation Y += X on an indexed type Y

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.4 void cicconv (const int *fold*, const void * *X*, **float_complex_indexed** * *Y*)

Convert complex single precision to indexed complex single precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.5 void cicdeposit (const int *fold*, const void * *X*, float_complex_indexed * *Y*)

Add complex single precision to suitably indexed manually specified indexed complex single precision (Y += X)

Performs the operation Y += X on an indexed type Y where the index of Y is larger than the index of X

Note

This routine was provided as a means of allowing the you to optimize your code. After you have called cicupdate() on Y with the maximum absolute value of any elements you wish to deposit in Y, you can call this method to deposit a maximum of sicapacity() elements into Y. After calling cicdeposit() on an indexed type, you must renormalize the indexed type with cirenorm().

Parameters

fold	the fold of the indexed types
X	scalar X
repY	Y's rep vector
increpY	stride within Y's rep vector (use every increpY'th element)

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.6 void ciciadd (const int *fold*, const float_complex_indexed * *X*, float_complex_indexed * *Y*)

Add indexed complex single precision (Y += X)

Performs the operation Y += X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.7 void ciciset (const int *fold*, const float_complex_indexed * *X*, float_complex_indexed * *Y*)

Set indexed complex single precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.8 void cicupdate (const int *fold*, const void * *X*, float_complex_indexed * *Y*)

Update indexed complex single precision with complex single precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value of real and imaginary components less than absolute value of real and imaginary components of X respectively.

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.9 void cinegate (const int *fold*, float_complex_indexed * *X*)

Negate indexed complex single precision (X = -X)

Performs the operation X = -X

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.10 int cinum (const int *fold*)

indexed complex single precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in `float`) of the indexed type

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.11 void ciprint (const int *fold*, const **float_complex_indexed** * *X*)

Print indexed complex single precision.

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.12 void cirenorm (const int *fold*, **float_complex_indexed** * *X*)

Renormalize indexed complex single precision.

Renormalization keeps the rep vector within the necessary bounds by shifting over to the carry vector

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.13 void cisetzero (const int *fold*, **float_complex_indexed** * *X*)

Set indexed single precision to 0 (X = 0)

Performs the operation X = 0

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.14 void cisiset (const int *fold*, const **float_indexed** * *X*, **float_complex_indexed** * *Y*)

Set indexed complex single precision to indexed single precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.15 size_t cisize (const int *fold*)

indexed complex single precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in bytes) of the indexed type

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.16 void cisupdate (const int *fold*, const float *X*, **float_complex_indexed** * *Y*)

Update indexed complex single precision with single precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value less than X

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.17 double dbound (const int *index*)

Get double precision bound corresponding to index.

Parameters

index	index

Returns

bound (bin)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.18 double ddiconv (const int *fold*, const double_indexed * *X*)

Convert indexed double precision to double precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Returns

scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.19 double_indexed* dialloc (const int *fold*)

indexed double precision allocation

Parameters

fold	the fold of the indexed type

Returns

a freshly allocated indexed type. (free with `free()`)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.20 int dicapacity ( )

Get indexed double precision deposit capacity.

The number of deposits that can be performed before a renorm is necessary. This function applies also to indexed complex double precision.

Returns

deposit capacity

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.21 void didadd (const int *fold*, const double *X*, double_indexed * *Y*)

Add double precision to indexed double precision (Y += X)

Performs the operation Y += X on an indexed type Y

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.22 void didconv (const int *fold*, const double *X*, double_indexed * *Y*)

Convert double precision to indexed double precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.23 void diddeposit (const int *fold*, const double *X*, double_indexed * *Y*)

Add double precision to suitably indexed indexed double precision (Y += X)

Performs the operation Y += X on an indexed type Y where the index of Y is larger than the index of X

Note

This routine was provided as a means of allowing the you to optimize your code. After you have called didupdate() on Y with the maximum absolute value of any elements you wish to deposit in Y, you can call this method to deposit a maximum of dicapacity() elements into Y. After calling diddeposit() on an indexed type, you must renormalize the indexed type with direnorm().

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.24 void didiadd (const int *fold*, const double_indexed * *X*, double_indexed * *Y*)

Add indexed double precision (Y += X)

Performs the operation Y += X

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.25 void didiset (const int *fold*, const double_indexed * *X*, double_indexed * *Y*)

Set indexed double precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.26 void didupdate (const int *fold*, const double *X*, double_indexed * *Y*)

Update indexed double precision with double precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value less than X

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.27 int dindex (const double *X*)

Get index of double precision.

The index of a non-indexed type is the smallest index an indexed type would need to have to sum it reproducibly. Higher indicies correspond to smaller bins.

Parameters

X	scalar X

Returns

X's index

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.28 void dinegate (const int *fold*, double_indexed * *X*)

Negate indexed double precision (X = -X)

Performs the operation X = -X

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.29 int dinum (const int *fold*)

indexed double precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in `double`) of the indexed type

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.30 void diprint (const int *fold*, const double_indexed * *X*)

Print indexed double precision.

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.31 void direnorm (const int *fold*, **double_indexed** * *X*)

Renormalize indexed double precision.

Renormalization keeps the rep vector within the necessary bounds by shifting over to the carry vector

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.32 void disetzero (const int *fold*, **double_indexed** * *X*)

Set indexed double precision to 0 (X = 0)

Performs the operation X = 0

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.33 size_t disize (const int *fold*)

indexed double precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in bytes) of the indexed type

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.34 int diwidth ( )

Get indexed double precision bin width.

Returns

bin width (in bits)

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.35 float sbound (const int *index*)

Get single precision bound corresponding to index.

Parameters

index	index

Returns

bound (bin)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.36 float_indexed* sialloc (const int *fold*)

indexed single precision allocation

Parameters

fold	the fold of the indexed type

Returns

a freshly allocated indexed type. (free with `free()`)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.37 int sicapacity ( )

Get indexed single precision deposit capacity.

The number of deposits that can be performed before a renorm is necessary. This function applies also to indexed complex single precision.

Returns

deposit capacity

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.38 int sindex (const float *X*)

Get index of single precision.

The index of a non-indexed type is the smallest index an indexed type would need to have to sum it reproducibly. Higher indicies correspond to smaller bins.

Parameters

X	scalar X

Returns

X's index

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.39 void sinegate (const int *fold,* float_indexed * *X*)

Negate indexed single precision (X = -X)

Performs the operation X = -X

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.40 int sinum (const int *fold*)

indexed single precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in `float`) of the indexed type

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.41 void siprint (const int *fold,* const float_indexed * *X*)

Print indexed single precision.

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.42 void sirenorm (const int *fold,* float_indexed * *X*)

Renormalize indexed single precision.

Renormalization keeps the rep vector within the necessary bounds by shifting over to the carry vector

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.43 void sisadd (const int *fold*, const float *X*, float_indexed * *Y*)

Add single precision to indexed single precision (Y += X)

Performs the operation Y += X on an indexed type Y

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.44 void sisconv (const int *fold*, const float *X*, float_indexed * *Y*)

Convert single precision to indexed single precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.45 void sisdeposit (const int *fold*, const float *X*, float_indexed * *Y*)

Add single precision to suitably indexed indexed single precision (Y += X)

Performs the operation Y += X on an indexed type Y where the index of Y is larger than the index of X

Note

This routine was provided as a means of allowing the you to optimize your code. After you have called sisupdate() on Y with the maximum absolute value of any elements you wish to deposit in Y, you can call this method to deposit a maximum of sicapacity() elements into Y. After calling sisdeposit() on an indexed type, you must renormalize the indexed type with sirenorm().

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.46 void sisetzero (const int *fold*, float_indexed * *X*)

Set indexed single precision to 0 (X = 0)

Performs the operation X = 0

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.47 void sisiadd (const int *fold*, const float_indexed * *X*, float_indexed * *Y*)

Add indexed single precision (Y += X)

Performs the operation Y += X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.48 void sisiset (const int *fold*, const float_indexed * *X*, float_indexed * *Y*)

Set indexed single precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.49 size_t sisize (const int *fold*)

indexed single precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in bytes) of the indexed type

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.50 void sisupdate (const int *fold*, const float *X*, float_indexed * *Y*)

Update indexed single precision with single precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value less than X

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.51 int siwidth ( )

Get indexed single precision bin width.

Returns

bin width (in bits)

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.52 float ssiconv (const int *fold,* const **float_indexed** * *X*)

Convert indexed single precision to single precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Returns

scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.53 **double_complex_indexed*** zialloc (const int *fold*)

indexed complex double precision allocation

Parameters

fold	the fold of the indexed type

Returns

a freshly allocated indexed type. (free with `free()`)

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.54 void zidiset (const int *fold*, const **double_indexed** * *X*, **double_complex_indexed** * *Y*)

Set indexed complex double precision to indexed double precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.55 void zidupdate (const int *fold*, const double *X*, **double_complex_indexed** * *Y*)

Update indexed complex double precision with double precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value less than X

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.56 void zinegate (const int *fold,* double_complex_indexed * *X*)

Negate indexed complex double precision (X = -X)

Performs the operation X = -X

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.57 int zinum (const int *fold*)

indexed complex double precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in `double`) of the indexed type

Author

Peter Ahrens

Date

27 Apr 2015

4.1.3.58 void ziprint (const int *fold,* const **double_complex_indexed** * *X*)

Print indexed complex double precision.

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.59 void zirenorm (const int *fold,* **double_complex_indexed** * *X*)

Renormalize indexed complex double precision.

Renormalization keeps the rep vector within the necessary bounds by shifting over to the carry vector

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.60 void zisetzero (const int *fold*, **double_complex_indexed** * *X*)

Set indexed double precision to 0 (X = 0)

Performs the operation X = 0

Parameters

fold	the fold of the indexed types
X	indexed scalar X

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.61 size_t zisize (const int *fold*)

indexed complex double precision size

Parameters

fold	the fold of the indexed type

Returns

the size (in bytes) of the indexed type

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.62 void zizadd (const int *fold*, const void * *X*, **double_complex_indexed** * *Y*)

Add complex double precision to indexed complex double precision (Y += X)

Performs the operation Y += X on an indexed type Y

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.63 void zizconv (const int *fold*, const void * *X*, double_complex_indexed * *Y*)

Convert complex double precision to indexed complex double precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.64 void zizdeposit (const int *fold*, const void * *X*, double_complex_indexed * *Y*)

Add complex double precision to suitably indexed manually specified indexed complex double precision (Y += X)

Performs the operation Y += X on an indexed type Y where the index of Y is larger than the index of X

Note

This routine was provided as a means of allowing the you to optimize your code. After you have called zizupdate() on Y with the maximum absolute value of any elements you wish to deposit in Y, you can call this method to deposit a maximum of dicapacity() elements into Y. After calling zizdeposit() on an indexed type, you must renormalize the indexed type with zirenorm().

Parameters

fold	the fold of the indexed types
X	scalar X
repY	Y's rep vector

increpY	stride within Y's rep vector (use every increpY'th element)

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.65 void ziziadd (const int *fold,* const **double_complex_indexed** * *X,* **double_complex_indexed** * *Y*)

Add indexed complex double precision (Y += X)

Performs the operation Y += X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.66 void ziziset (const int *fold,* const **double_complex_indexed** * *X,* **double_complex_indexed** * *Y*)

Set indexed complex double precision (Y = X)

Performs the operation Y = X

Parameters

fold	the fold of the indexed types
X	indexed scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.67 void zizupdate (const int *fold,* const void * *X,* **double_complex_indexed** * *Y*)

Update indexed complex double precision with complex double precision (X -> Y)

This method updates Y to an index suitable for adding numbers with absolute value of real and imaginary components less than absolute value of real and imaginary components of X respectively.

Parameters

fold	the fold of the indexed types
X	scalar X
Y	indexed scalar Y

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

4.1.3.68 void zziconv_sub (const int *fold*, const **double_complex_indexed** * *X*, void * *conv*)

Convert indexed complex double precision to complex double precision (X -> Y)

Parameters

fold	the fold of the indexed types
X	indexed scalar X
conv	scalar return

Author

Hong Diep Nguyen
Peter Ahrens

Date

27 Apr 2015

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