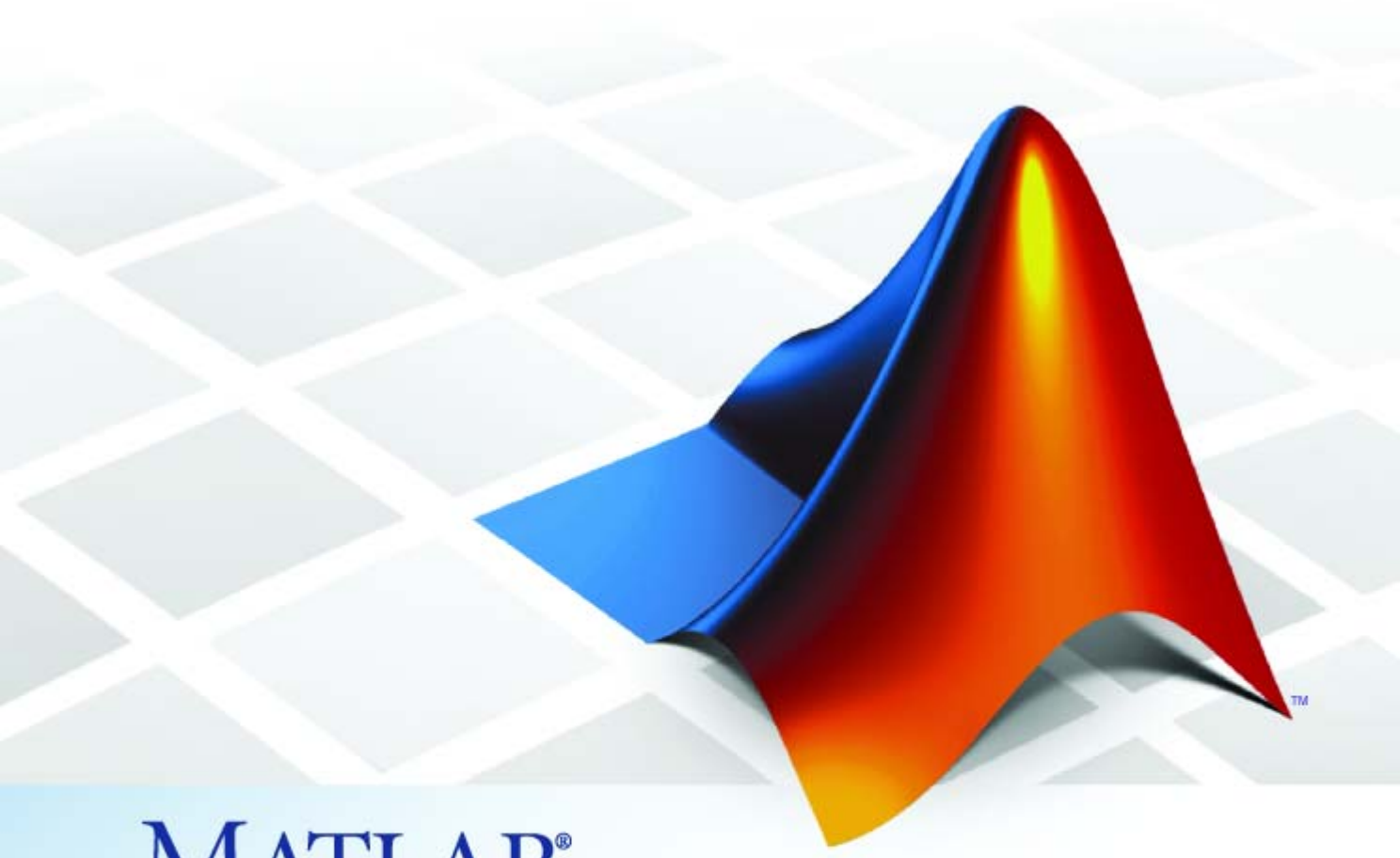
MATLAB® 7
C and Fortran API Reference



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MATLAB® C and Fortran API Reference

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Contents

1

API Reference

MAT-File Access (p. 1-2)	Incorporate and use MATLAB® data in C and Fortran programs
MX Array Manipulation (p. 1-2)	Create and manipulate MATLAB arrays from C and Fortran MEX and engine routines
MEX-Files (p. 1-10)	Perform operations in MATLAB environment from C and Fortran MEX-files
MATLAB Engine (p. 1-11)	Call MATLAB software from C and Fortran programs

See also “External Interfaces” in the MATLAB Function Reference for interfaces to DLLs, Sun™ Java™ programming language, Microsoft® Component Object Model (COM) and Microsoft® ActiveX® technologies, Web services, and serial port devices.

MAT-File Access

matClose (C and Fortran)	Close MAT-file
matDeleteVariable (C and Fortran)	Delete named mxArray from MAT-file
MATFile (C and Fortran)	Type for a MAT-file
matGetDir (C and Fortran)	Get directory of mxArrays in MAT-file
matGetFp (C)	Get file pointer to MAT-file
matGetNextVariable (C and Fortran)	Read next mxArray from MAT-file
matGetNextVariableInfo (C and Fortran)	Load array header information only
matGetVariable (C and Fortran)	Read mxArray from MAT-files
matGetVariableInfo (C and Fortran)	Load array header information only
matOpen (C and Fortran)	Open MAT-file
matPutVariable (C and Fortran)	Write mxArrays to MAT-files
matPutVariableAsGlobal (C and Fortran)	Put mxArrays into MAT-files as originating from global workspace

MX Array Manipulation

mwIndex (C and Fortran)	Type for index values
mwPointer (Fortran)	Declare appropriate pointer type for platform
mwSignedIndex (C and Fortran)	Signed integer type for size values
mwSize (C and Fortran)	Type for size values
mxAddField (C and Fortran)	Add field to structure array

`mxArray (C and Fortran)`	Type for a MATLAB array
`mxArrayToString (C)`	Convert array to string
`mxAssert (C)`	Check assertion value for debugging purposes
`mxAssertS (C)`	Check assertion value without printing assertion text
`mxCalcSingleSubscript (C and Fortran)`	Offset from first element to desired element
`mxCalloc (C and Fortran)`	Allocate dynamic memory for array using MATLAB memory manager
`mxChar (C)`	Type for string `mxArray`
`mxClassID (C)`	Enumerated value identifying class of `mxArray`
`mxClassIDFromClassName (Fortran)`	Identifier corresponding to class
`mxComplexity (C)`	Flag specifying whether `mxArray` has imaginary components
`mxCopyCharacterToPtr (Fortran)`	Copy `character` values from Fortran array to pointer array
`mxCopyComplex16ToPtr (Fortran)`	Copy `COMPLEX*16` values from Fortran array to pointer array
`mxCopyComplex8ToPtr (Fortran)`	Copy `COMPLEX*8` values from Fortran array to pointer array
`mxCopyInteger1ToPtr (Fortran)`	Copy `INTEGER*1` values from Fortran array to pointer array
`mxCopyInteger2ToPtr (Fortran)`	Copy `INTEGER*2` values from Fortran array to pointer array
`mxCopyInteger4ToPtr (Fortran)`	Copy `INTEGER*4` values from Fortran array to pointer array
`mxCopyPtrToCharacter (Fortran)`	Copy `character` values from pointer array to Fortran array

mxCopyPtrToComplex16 (Fortran)	Copy COMPLEX*16 values from pointer array to Fortran array
mxCopyPtrToComplex8 (Fortran)	Copy COMPLEX*8 values from pointer array to Fortran array
mxCopyPtrToInteger1 (Fortran)	Copy INTEGER*1 values from pointer array to Fortran array
mxCopyPtrToInteger2 (Fortran)	Copy INTEGER*2 values from pointer array to Fortran array
mxCopyPtrToInteger4 (Fortran)	Copy INTEGER*4 values from pointer array to Fortran array
mxCopyPtrToPtrArray (Fortran)	Copy pointer values from pointer array to Fortran array
mxCopyPtrToReal4 (Fortran)	Copy REAL*4 values from pointer array to Fortran array
mxCopyPtrToReal8 (Fortran)	Copy REAL*8 values from pointer array to Fortran array
mxCopyReal4ToPtr (Fortran)	Copy REAL*4 values from Fortran array to pointer array
mxCopyReal8ToPtr (Fortran)	Copy REAL*8 values from Fortran array to pointer array
mxCreateCellArray (C and Fortran)	Create unpopulated N-D cell mxArray
mxCreateCellMatrix (C and Fortran)	Create unpopulated 2-D cell mxArray
mxCreateCharArray (C and Fortran)	Create unpopulated N-D string mxArray
mxCreateCharMatrixFromStrings (C and Fortran)	Create populated 2-D string mxArray
mxCreateDoubleMatrix (C and Fortran)	Create 2-D, double-precision, floating-point mxArray initialized to 0
mxCreateDoubleScalar (C and Fortran)	Create scalar, double-precision array initialized to specified value

`mxCreateLogicalArray (C)`	Create N-D logical `mxArray` initialized to `false`
`mxCreateLogicalMatrix (C)`	Create 2-D, logical `mxArray` initialized to `false`
`mxCreateLogicalScalar (C)`	Create scalar, logical `mxArray`
`mxCreateNumericArray (C and Fortran)`	Create unpopulated N-D numeric `mxArray`
`mxCreateNumericMatrix (C and Fortran)`	Create numeric matrix and initialize data elements to 0
`mxCreateSparse (C and Fortran)`	Create 2-D unpopulated sparse `mxArray`
`mxCreateSparseLogicalMatrix (C)`	Create unpopulated 2-D, sparse, logical `mxArray`
`mxCreateString (C and Fortran)`	Create `1`-by-`N` string `mxArray` initialized to specified string
`mxCreateStructArray (C and Fortran)`	Create unpopulated N-D structure `mxArray`
`mxCreateStructMatrix (C and Fortran)`	Create unpopulated 2-D structure `mxArray`
`mxDestroyArray (C and Fortran)`	Free dynamic memory allocated by `mxCreate*` functions
`mxDuplicateArray (C and Fortran)`	Make deep copy of array
`mxFree (C and Fortran)`	Free dynamic memory allocated by `mxCalloc`, `mxMalloc`, or `mxRealloc`
`mxGetCell (C and Fortran)`	Get contents of `mxArray` cell
`mxGetChars (C)`	Get pointer to character array data
`mxGetClassID (C and Fortran)`	Get class of `mxArray`
`mxGetClassName (C and Fortran)`	Get class of `mxArray` as string
`mxGetData (C and Fortran)`	Get pointer to data

mxGetDimensions (C and Fortran)	Get pointer to dimensions array
mxGetElementSize (C and Fortran)	Get number of bytes required to store each data element
mxGetEps (C and Fortran)	Get value of eps
mxGetField (C and Fortran)	Get field value, given field name and index into structure array
mxGetFieldByNumber (C and Fortran)	Get field value, given field number and index into structure array
mxGetFieldNameByNumber (C and Fortran)	Get field name, given field number in structure array
mxGetFieldNumber (C and Fortran)	Get field number, given field name in structure array
mxGetImagData (C and Fortran)	Get pointer to imaginary data of mxArray
mxGetInf (C and Fortran)	Get value of infinity
mxGetIr (C and Fortran)	Get ir array of sparse matrix
mxGetJc (C and Fortran)	Get jc array of sparse matrix
mxGetLogicals (C)	Get pointer to logical array data
mxGetM (C and Fortran)	Get number of rows in mxArray
mxGetN (C and Fortran)	Get number of columns in mxArray
mxGetNaN (C and Fortran)	Get value of NaN (Not-a-Number)
mxGetNumberOfDimensions (C and Fortran)	Get number of dimensions in mxArray
mxGetNumberOfElements (C and Fortran)	Get number of elements in mxArray
mxGetNumberOfFields (C and Fortran)	Get number of fields in structure mxArray
mxGetNzmax (C and Fortran)	Get number of elements in ir, pr, and pi arrays

`mxGetPi (C and Fortran)`	Get imaginary data elements in `mxArray`
`mxGetPr (C and Fortran)`	Get real data elements in `mxArray`
`mxGetProperty (C and Fortran)`	Get value of public property of MATLAB object
`mxGetScalar (C and Fortran)`	Get real component of first data element in `mxArray`
`mxGetString (C and Fortran)`	Copy string `mxArray` to C-style string
`mxIsCell (C and Fortran)`	Determine whether input is cell `mxArray`
`mxIsChar (C and Fortran)`	Determine whether input is string `mxArray`
`mxIsClass (C and Fortran)`	Determine whether `mxArray` is member of specified class
`mxIsComplex (C and Fortran)`	Determine whether data is complex
`mxIsDouble (C and Fortran)`	Determine whether `mxArray` represents data as double-precision, floating-point numbers
`mxIsEmpty (C and Fortran)`	Determine whether `mxArray` is empty
`mxIsFinite (C and Fortran)`	Determine whether input is finite
`mxIsFromGlobalWS (C and Fortran)`	Determine whether `mxArray` was copied from MATLAB global workspace
`mxIsInf (C and Fortran)`	Determine whether input is infinite
`mxIsInt16 (C and Fortran)`	Determine whether `mxArray` represents data as signed 16-bit integers
`mxIsInt32 (C and Fortran)`	Determine whether `mxArray` represents data as signed 32-bit integers

`mxIsInt64 (C and Fortran)`	Determine whether `mxArray` represents data as signed 64-bit integers
`mxIsInt8 (C and Fortran)`	Determine whether `mxArray` represents data as signed 8-bit integers
`mxIsLogical (C and Fortran)`	Determine whether `mxArray` is of type `mxLogical`
`mxIsLogicalScalar (C)`	Determine whether scalar `mxArray` is of type `mxLogical`
`mxIsLogicalScalarTrue (C)`	Determine whether scalar `mxArray` of type `mxLogical` is `true`
`mxIsNaN (C and Fortran)`	Determine whether input is `NaN` (Not-a-Number)
`mxIsNumeric (C and Fortran)`	Determine whether `mxArray` is numeric
`mxIsSingle (C and Fortran)`	Determine whether `mxArray` represents data as single-precision, floating-point numbers
`mxIsSparse (C and Fortran)`	Determine whether input is sparse `mxArray`
`mxIsStruct (C and Fortran)`	Determine whether input is structure `mxArray`
`mxIsUint16 (C and Fortran)`	Determine whether `mxArray` represents data as unsigned 16-bit integers
`mxIsUint32 (C and Fortran)`	Determine whether `mxArray` represents data as unsigned 32-bit integers
`mxIsUint64 (C and Fortran)`	Determine whether `mxArray` represents data as unsigned 64-bit integers

`mxIsUint8 (C and Fortran)`	Determine whether `mxArray` represents data as unsigned 8-bit integers
`mxLogical (C)`	Type for logical `mxArray`
`mxMalloc (C and Fortran)`	Allocate dynamic memory using MATLAB memory manager
`mxRealloc (C and Fortran)`	Reallocate memory
`mxRemoveField (C and Fortran)`	Remove field from structure array
`mxSetCell (C and Fortran)`	Set value of one cell of `mxArray`
`mxSetClassName (C)`	Convert structure array to MATLAB object array
`mxSetData (C and Fortran)`	Set pointer to data
`mxSetDimensions (C and Fortran)`	Modify number of dimensions and size of each dimension
`mxSetField (C and Fortran)`	Set structure array field, given field name and index
`mxSetFieldByNumber (C and Fortran)`	Set structure array field, given field number and index
`mxSetImagData (C and Fortran)`	Set imaginary data pointer for `mxArray`
`mxSetIr (C and Fortran)`	Set `ir` array of sparse `mxArray`
`mxSetJc (C and Fortran)`	Set `jc` array of sparse `mxArray`
`mxSetM (C and Fortran)`	Set number of rows in `mxArray`
`mxSetN (C and Fortran)`	Set number of columns in `mxArray`
`mxSetNzmax (C and Fortran)`	Set storage space for nonzero elements
`mxSetPi (C and Fortran)`	Set new imaginary data for `mxArray`
`mxSetPr (C and Fortran)`	Set new real data for `mxArray`
`mxSetProperty (C and Fortran)`	Set value of public property of MATLAB object

MEX-Files

`mexAtExit (C and Fortran)`	Register function to call when MEX-function is cleared or MATLAB software terminates
`mexCallMATLAB (C and Fortran)`	Call MATLAB function or user-defined M-file or MEX-file
`mexCallMATLABWithTrap (C and Fortran)`	Call MATLAB function, user-defined M-file, or MEX-file and capture error information
`mexErrMsgIdAndTxt (C and Fortran)`	Issue error message with identifier and return to MATLAB prompt
`mexErrMsgTxt (C and Fortran)`	Issue error message and return to MATLAB prompt
`mexEvalString (C and Fortran)`	Execute MATLAB command in caller's workspace
`mexEvalStringWithTrap (C and Fortran)`	Execute MATLAB command in caller's workspace and capture error information
`mexFunction (C and Fortran)`	Entry point to C MEX-file
`mexFunctionName (C and Fortran)`	Name of current MEX-function
`mexGet (C)`	Get value of specified Handle Graphics® property
`mexGetVariable (C and Fortran)`	Get copy of variable from specified workspace
`mexGetVariablePtr (C and Fortran)`	Get read-only pointer to variable from another workspace
`mexIsGlobal (C and Fortran)`	Determine whether `mxArray` has global scope
`mexIsLocked (C and Fortran)`	Determine whether MEX-file is locked

`mexLock (C and Fortran)`	Prevent MEX-file from being cleared from memory
`mexMakeArrayPersistent (C and Fortran)`	Make `mxArray` persist after MEX-file completes
`mexMakeMemoryPersistent (C and Fortran)`	Make memory allocated by MATLAB software persist after MEX-function completes
`mexPrintf (C and Fortran)`	ANSI® C `printf`-style output routine
`mexPutVariable (C and Fortran)`	Copy `mxArray` from MEX-function into specified workspace
`mexSet (C)`	Set value of specified Handle Graphics property
`mexSetTrapFlag (C and Fortran)`	Control response of `mexCallMATLAB` to errors
`mexUnlock (C and Fortran)`	Allow MEX-file to be cleared from memory
`mexWarnMsgIdAndTxt (C and Fortran)`	Issue warning message with identifier
`mexWarnMsgTxt (C and Fortran)`	Issue warning message

MATLAB Engine

`engClose (C and Fortran)`	Quit MATLAB engine session
`engEvalString (C and Fortran)`	Evaluate expression in string
`engGetVariable (C and Fortran)`	Copy variable from MATLAB engine workspace
`engGetVisible (C)`	Determine visibility of MATLAB engine session
`Engine (C)`	Type for a MATLAB engine
`engOpen (C and Fortran)`	Start MATLAB engine session

`engOpenSingleUse (C)`	Start MATLAB engine session for single, nonshared use
`engOutputBuffer (C and Fortran)`	Specify buffer for MATLAB output
`engPutVariable (C and Fortran)`	Put variables into MATLAB engine workspace
`engSetVisible (C)`	Show or hide MATLAB engine session

2

API Reference

engClose (C and Fortran)

Purpose

Quit MATLAB engine session

C Syntax

```
#include "engine.h"
int engClose(Engine *ep);
```

Fortran Syntax

```
integer*4 engClose(ep)
mwPointer ep
```

Arguments

`ep`

Engine pointer

Returns

`0` on success, and `1` otherwise. Possible failure includes attempting to terminate a MATLAB engine session that was already terminated.

Description

This routine sends a quit command to the MATLAB engine session and closes the connection.

C Examples

UNIX®[1] Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Microsoft Windows® Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

Fortran Examples

See `fengdemo.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a Fortran program.

See Also

`engOpen`

1. UNIX is a registered trademark of The Open Group in the United States and other countries.

Purpose

Evaluate expression in string

C Syntax

```
#include "engine.h"
int engEvalString(Engine *ep,const char *string);
```

Fortran Syntax

```
integer*4 engEvalString(ep, string)
mwPointer ep
character*(*) string
```

Arguments

`ep`
: Engine pointer

`string`
: String to execute

Returns

`0` if the command was evaluated by the MATLAB engine session, and a nonzero value if unsuccessful. Possible reasons for failure include the engine session is no longer running or the engine pointer is invalid or `NULL`.

Error Handling

If `string` detects an error, MATLAB terminates and returns control to the MATLAB prompt.

Description

`engEvalString` evaluates the expression contained in `string` for the MATLAB engine session, `ep`, previously started by `engOpen`.

UNIX[2] Operating Systems

On UNIX systems, `engEvalString` sends commands to the MATLAB workspace by writing down a pipe connected to the MATLAB *`stdin`* process. Any output resulting from the command that ordinarily appears on the screen is read back from *`stdout`* into the buffer defined by `engOutputBuffer`.

To turn off output buffering in C, use:

```
engOutputBuffer(ep, NULL, 0);
```

To turn off output buffering in Fortran, use:

```
engOutputBuffer(ep, '')
```

Microsoft Windows Operating Systems

On a Windows system, `engEvalString` communicates with MATLAB software using a Component Object Model (COM) interface.

C Examples

UNIX Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Windows Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

Fortran Examples

See `fengdemo.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a Fortran program.

See Also

`engOpen`, `engOutputBuffer`

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Purpose

Copy variable from MATLAB engine workspace

C Syntax

```
#include "engine.h"
mxArray *engGetVariable(Engine *ep, const char *name);
```

Fortran Syntax

```
mwPointer engGetVariable(ep, name)
mwPointer ep
character*(*) name
```

Arguments

`ep`
: Engine pointer

`name`
: Name of `mxArray` to get from MATLAB workspace

Returns

A pointer to a newly allocated `mxArray` structure, or `NULL` if the attempt fails. `engGetVariable` fails if the named variable does not exist.

Description

`engGetVariable` reads the named `mxArray` from the MATLAB engine session associated with `ep`.

Use `mxDestroyArray` to destroy the `mxArray` created by this routine when you are finished with it.

C Examples

UNIX[3] Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Microsoft Windows Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

See Also

`engPutVariable`, `mxDestroyArray`

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Purpose

Determine visibility of MATLAB engine session

C Syntax

```
#include "engine.h"
int engGetVisible(Engine *ep, bool *value);
```

Arguments

`ep`
Engine pointer

`value`
Pointer to value returned from `engGetVisible`

Returns

Microsoft Windows Operating Systems Only

`0` on success, and `1` otherwise.

Description

`engGetVisible` returns the current visibility setting for MATLAB engine session, `ep`. A *visible* engine session runs in a window on the Windows desktop, thus making the engine available for user interaction. An invisible session is hidden from the user by removing it from the desktop.

Examples

The following code opens engine session `ep` and disables its visibility.

```
Engine *ep;
bool vis;

ep = engOpen(NULL);
engSetVisible(ep, 0);
```

To determine the current visibility setting, use:

```
engGetVisible(ep, &vis);
```

See Also

`engSetVisible`

Engine (C)

Purpose

Type for a MATLAB engine

Description

A handle to a MATLAB engine object.

`Engine` is a C language opaque type.

You can call MATLAB software as a computational engine by writing C and Fortran programs that use the MATLAB engine library, described in "MATLAB Engine" on page 1-11. `Engine` is the link between your program and the separate MATLAB engine process.

The header file containing this type is:

```
#include "engine.h"
```

Examples

The example `engwindemo.c` (in your *`matlabroot`*`/extern/examples/eng_mat` directory) shows how to plot position versus time for a falling object in a MATLAB figure window.

The `engOpen` function starts the MATLAB process, returning an `Engine` variable. You use this handle for all calls to the MATLAB workspace.

The `mxCreateDoubleMatrix` function creates an `mxArray` named `T`. The C function `memcpy` copies your `time` data (initialized in `engwindemo.c`) into `T`.

The `engPutVariable` function puts `T` into the MATLAB workspace. Now you can use this variable to calculate distance `D`. The `engEvalString` function evaluates the expression `D = .5.*(-9.8).*T.^2`.

Next, various MATLAB plot functions, like `plot(T,D)`, display the graph.

Calls to the `engClose` and `mxDestroyArray` functions complete the procedure.

Other sample programs, also found in your *`matlabroot`*`\extern\examples\eng_mat` directory, that show you how to use `Engine` are:

- `engdemo.c` shows how to call the MATLAB engine functions from a C program.
- `engwindemo.c` show how to call the MATLAB engine functions from a C program for Windows systems.
- `fengdemo.F` shows how to call the MATLAB engine functions from a Fortran program.

See Also

`engOpen`

engOpen (C and Fortran)

Purpose

Start MATLAB engine session

C Syntax

```
#include "engine.h"
Engine *engOpen(const char *startcmd);
```

Fortran Syntax

```
mwPointer engOpen(startcmd)
character*(*) startcmd
```

Arguments

`startcmd`
: String to start the MATLAB process. On Windows systems, the `startcmd` string must be `NULL`.

Returns

A pointer to an engine handle or `NULL` if the open fails.

Description

This routine allows you to start a MATLAB process for the purpose of using MATLAB software as a computational engine.

`engOpen` starts a MATLAB process using the command specified in the string `startcmd`, establishes a connection, and returns a unique engine identifier, or `NULL` if the open fails.

On UNIX[4] systems, if `startcmd` is `NULL` or the empty string, `engOpen` starts a MATLAB process on the current host using the command `matlab`. If `startcmd` is a `hostname`, `engOpen` starts a MATLAB process on the designated host by embedding the specified `hostname` string into the larger string:

```
"rsh hostname \"/bin/csh -c 'setenv DISPLAY\
 hostname:0; matlab'\""
```

If `startcmd` is any other string (has white space in it, or nonalphanumeric characters), the string is executed literally to start a MATLAB process.

On UNIX systems, `engOpen` performs the following steps:

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1. Creates two pipes.
2. Forks a new process and sets up the pipes to pass *stdin* and *stdout* from MATLAB (parent) software to two file descriptors in the engine program (child).
3. Executes a command to run MATLAB software (`rsh` for remote execution).

On Windows systems, `engOpen` opens a COM channel to MATLAB. This starts the MATLAB software that was registered during installation. If you did not register during installation, on the command line you can enter the command:

```
matlab /regserver
```

See "Introducing MATLAB COM Integration" for additional details.

C Examples

UNIX Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Microsoft Windows Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

Fortran Examples

See `fengdemo.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a Fortran program.

engOpenSingleUse (C)

Purpose

Start MATLAB engine session for single, nonshared use

C Syntax

```
#include "engine.h"
Engine *engOpenSingleUse(const char *startcmd, void *dcom,
  int *retstatus);
```

Arguments

`startcmd`
: String to start MATLAB process. On Microsoft Windows systems, the `startcmd` string must be `NULL`.

`dcom`
: Reserved for future use; must be `NULL`.

`retstatus`
: Return status; possible cause of failure.

Returns

Microsoft Windows Operating Systems Only

A pointer to an engine handle or `NULL` if the open fails.

UNIX[5] Operating Systems

This routine is not supported on UNIX systems and simply returns.

Description

This routine allows you to start multiple MATLAB processes for the purpose of using MATLAB software as a computational engine. `engOpenSingleUse` starts a MATLAB process, establishes a connection, and returns a unique engine identifier, or `NULL` if the open fails. `engOpenSingleUse` starts a new MATLAB process each time it is called.

`engOpenSingleUse` opens a COM channel to MATLAB. This starts the MATLAB software that was registered during installation. If you did not register during installation, on the command line you can enter the command:

```
matlab /regserver
```

5. UNIX is a registered trademark of The Open Group in the United States and other countries.

`engOpenSingleUse` allows single-use instances of a engine server. `engOpenSingleUse` differs from `engOpen`, which allows multiple users to use the same engine server.

See “Introducing MATLAB COM Integration” for additional details.

engOutputBuffer (C and Fortran)

Purpose

Specify buffer for MATLAB output

C Syntax

```
#include "engine.h"
int engOutputBuffer(Engine *ep, char *p, int n);
```

Fortran Syntax

```
integer*4 engOutputBuffer(ep, p)
mwPointer ep
character*n p
```

Arguments

`ep`
: Engine pointer

`p`
: Pointer to character buffer

`n`
: Length of buffer `p`

Returns

`1` if you pass it a NULL engine pointer. Otherwise, it returns `0`.

Description

`engOutputBuffer` defines a character buffer for `engEvalString` to return any output that ordinarily appears on the screen.

The default behavior of `engEvalString` is to discard any standard output caused by the command it is executing. A call to `engOutputBuffer` with a buffer of nonzero length tells any subsequent calls to `engEvalString` to save output in the character buffer pointed to by `p`.

To turn off output buffering in C, use:

```
engOutputBuffer(ep, NULL, 0);
```

To turn off output buffering in Fortran, use:

```
engOutputBuffer(ep, '')
```

Note The buffer returned by `engEvalString` is not guaranteed to be `NULL` terminated.

C Examples

UNIX[6] Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Microsoft Windows Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

Fortran Examples

See `fengdemo.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a Fortran program.

See Also

`engOpen`, `engEvalString`

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Purpose

Put variables into MATLAB engine workspace

C Syntax

```
#include "engine.h"
int engPutVariable(Engine *ep, const char *name, const mxArray
     *pm);
```

Fortran Syntax

```
integer*4 engPutVariable(ep, name, pm)
mwPointer ep, pm
character*(*) name
```

Arguments

`ep`
: Engine pointer

`name`
: Name given to the `mxArray` in the engine's workspace

`pm`
: `mxArray` pointer

Returns

`0` if successful and `1` if an error occurs.

Description

`engPutVariable` writes `mxArray` `pm` to the engine `ep`, giving it the variable name `name`. If the `mxArray` does not exist in the workspace, it is created. If an `mxArray` with the same name already exists in the workspace, the existing `mxArray` is replaced with the new `mxArray`.

The engine application owns the original `mxArray` and is responsible for freeing its memory. Although the `engPutVariable` function sends a copy of the `mxArray` to the MATLAB workspace, the engine application does not need to account for or free memory for the copy.

C Examples

UNIX[7] Operating Systems

See `engdemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program.

Microsoft Windows Operating Systems

See `engwindemo.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to call the MATLAB engine functions from a C program for Windows systems.

See Also

`engGetVariable`

7. UNIX is a registered trademark of The Open Group in the United States and other countries.

Purpose

Show or hide MATLAB engine session

C Syntax

```
#include "engine.h"
int engSetVisible(Engine *ep, bool value);
```

Arguments

`ep`

Engine pointer

`value`

Value to set the `Visible` property to. Set `value` to `1` to make the engine window visible, or to `0` to make it invisible.

Returns

Microsoft Windows Operating Systems Only

`0` on success, and `1` otherwise.

Description

`engSetVisible` makes the window for the MATLAB engine session, `ep`, either visible or invisible on the Windows desktop. You can use this function to enable or disable user interaction with the MATLAB engine session.

Examples

The following code opens engine session `ep` and disables its visibility.

```
Engine *ep;
bool vis;

ep = engOpen(NULL);
engSetVisible(ep, 0);
```

To determine the current visibility setting, use:

```
engGetVisible(ep, &vis);
```

See Also

`engGetVisible`

matClose (C and Fortran)

Purpose

Close MAT-file

C Syntax

```
#include "mat.h"
int matClose(MATFile *mfp);
```

Fortran Syntax

```
integer*4 matClose(mfp)
mwPointer mfp
```

Arguments

`mfp`
Pointer to MAT-file information

Returns

`EOF` in C (`-1` in Fortran) for a write error, and `0` if successful.

Description

`matClose` closes the MAT-file associated with `mfp`.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

Fortran Examples

See `matdemo1.F` and `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use this MAT-file routine in a Fortran program.

Purpose

Delete named mxArray from MAT-file

C Syntax

```
#include "mat.h"
int matDeleteVariable(MATFile *mfp, const char *name);
```

Fortran Syntax

```
integer*4 matDeleteVariable(mfp, name)
mwPointer mfp
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Name of `mxArray` to delete

Returns

`0` if successful, and nonzero otherwise.

Description

`matDeleteVariable` deletes the named `mxArray` from the MAT-file pointed to by `mfp`.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

MATFile (C and Fortran)

Purpose

Type for a MAT-file

Description

A handle to a MAT-file object. A MAT-file is the data file format MATLAB software uses for saving data to your disk.

`MATFile` is a C language opaque type.

The MAT-file interface library contains routines for reading and writing MAT-files. These routines are listed in "MAT-File Access" on page 1-2. You call these routines from your own C and Fortran programs, using `MATFile` to access your data file.

The header file containing this type is:

```
#include "mat.h"
```

Examples

The example `matcreat.c` in your *`matlabroot`*`/extern/examples/eng_mat` directory shows how to create and use a MAT-file.

The `matOpen` function creates the file `mattest.mat`.

The `mxCreateDoubleMatrix` and `mxCreateString` functions create `mxArrays` `pa1`, `pa2`, and `pa3`. `mxCreateString` also initializes `pa3` using the literal string `"MATLAB: the language of technical computing"`. The C function `memcpy` copies `data` (initialized in `matcreat.c`) into `pa2`.

The `matPutVariable` and `matPutVariableAsGlobal` functions write the data to `mattest.mat`.

Calls to the `matClose` and `mxDestroyArray` functions complete the procedure.

Other examples, also found in your *`matlabroot`*`\extern\examples\eng_mat` directory, that show you how to use `MATFile` are:

- `matdgns.c` shows how to use MAT-file routines in a C program.
- `matdemo1.F` and `matdemo2.F` show how to use MAT-file routines in a Fortran program.

See Also

matOpen, matClose, matPutVariable, matGetVariable, mxDestroyArray

matGetDir (C and Fortran)

Purpose

Get directory of mxArrays in MAT-file

C Syntax

```
#include "mat.h"
char **matGetDir(MATFile *mfp, int *num);
```

Fortran Syntax

```
mwPointer matGetDir(mfp, num)
mwPointer mfp
integer*4 num
```

Arguments

mfp
: Pointer to MAT-file information

num
: Address of the variable to contain the number of mxArrays in the MAT-file

Returns

A pointer to an internal array containing pointers to the names of the mxArrays in the MAT-file pointed to by mfp. In C, each name is a NULL-terminated string. The length of the internal array (number of mxArrays in the MAT-file) is placed into num. If num is zero, mfp contains no arrays.

matGetDir returns NULL in C (0 in Fortran) and sets num to a negative number if it fails.

Description

This routine allows you to get a list of the names of the mxArrays contained within a MAT-file.

The internal array of strings that matGetDir returns is allocated using a single mxCalloc and must be freed using mxFree when you are finished with it.

MATLAB variable names can be up to length mxMAXNAM, where mxMAXNAM is defined in the C header file matrix.h.

C Examples

See matcreat.c and matdgns.c in the eng_mat subdirectory of the examples directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

Fortran Examples

See `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use this MAT-file routine in a Fortran program.

matGetFp (C)

Purpose

Get file pointer to MAT-file

C Syntax

```
#include "mat.h"
FILE *matGetFp(MATFile *mfp);
```

Arguments

`mfp`
Pointer to MAT-file information

Returns

A C file handle to the MAT-file with handle `mfp`. Returns `NULL` if `mfp` is a handle to a MAT-file in HDF5-based format.

Description

Use `matGetFp` to obtain a C file handle to a MAT-file. This can be useful for using standard C library routines like `ferror` and `feof` to investigate error situations.

Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

Purpose

Read next mxArray from MAT-file

C Syntax

```
#include "mat.h"
mxArray *matGetNextVariable(MATFile *mfp, const char **name);
```

Fortran Syntax

```
mwPointer matGetNextVariable(mfp, name)
mwPointer mfp
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Address of the variable to contain the mxArray name

Returns

A pointer to a newly allocated mxArray structure representing the next mxArray from the MAT-file pointed to by mfp. The function returns the name of the mxArray in name.

matGetNextVariable returns NULL in C (0 in Fortran) when the end-of-file is reached or if there is an error condition. In C, use feof and ferror from the Standard C Library to determine status.

Description

matGetNextVariable allows you to step sequentially through a MAT-file and read all the mxArrays in a single pass. The function reads and returns the next mxArray from the MAT-file pointed to by mfp.

Use matGetNextVariable immediately after opening the MAT-file with matOpen and not in conjunction with other MAT-file routines. Otherwise, the concept of the *next* mxArray is undefined.

Use mxDestroyArray to destroy the mxArray created by this routine when you are finished with it.

The order of variables returned from successive calls to matGetNextVariable is not guaranteed to be the same order in which the variables were written.

C Examples

See `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use the MATLAB MAT-file routines in a C program.

See Also

`matGetNextVariableInfo`, `matGetVariable`, `mxDestroyArray`

Purpose

Load array header information only

C Syntax

```
#include "mat.h"
mxArray *matGetNextVariableInfo(MATFile *mfp, const char **name);
```

Fortran Syntax

```
mwPointer matGetNextVariableInfo(mfp, name)
mwPointer mfp
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Address of the variable to contain the `mxArray` name

Returns

A pointer to a newly allocated `mxArray` structure representing header information for the next `mxArray` from the MAT-file pointed to by `mfp`. The function returns the name of the `mxArray` in `name`.

`matGetNextVariableInfo` returns `NULL` in C (`0` in Fortran) when the end-of-file is reached or if there is an error condition. In C, use `feof` and `ferror` from the Standard C Library to determine status.

Description

`matGetNextVariableInfo` loads only the array header information, including everything except `pr`, `pi`, `ir`, and `jc`, from the file's current file offset.

If `pr`, `pi`, `ir`, and `jc` are set to nonzero values when loaded with `matGetVariable`, `matGetNextVariableInfo` sets them to `-1` instead. These headers are for informational use only and should *never* be passed back to the MATLAB workspace or saved to MAT-files.

Use `mxDestroyArray` to destroy the `mxArray` created by this routine when you are finished with it.

The order of variables returned from successive calls to `matGetNextVariableInfo` is not guaranteed to be the same order in which the variables were written.

C Examples

See `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use the MATLAB MAT-file routines in a C program.

See Also

`matGetNextVariable`, `matGetVariableInfo`

Purpose

Read mxArray from MAT-files

C Syntax

```
#include "mat.h"
mxArray *matGetVariable(MATFile *mfp, const char *name);
```

Fortran Syntax

```
mwPointer matGetVariable(mfp, name)
mwPointer mfp
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Name of `mxArray` to get from MAT-file

Returns

A pointer to a newly allocated `mxArray` structure representing the `mxArray` named by `name` from the MAT-file pointed to by `mfp`.

`matGetVariable` returns `NULL` in C (`0` in Fortran) if the attempt to return the `mxArray` named by `name` fails.

Description

This routine allows you to copy an `mxArray` out of a MAT-file.

Use `mxDestroyArray` to destroy the `mxArray` created by this routine when you are finished with it.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

See Also

`matPutVariable`, `mxDestroyArray`

matGetVariableInfo (C and Fortran)

Purpose

Load array header information only

C Syntax

```
#include "mat.h"
mxArray *matGetVariableInfo(MATFile *mfp, const char *name);
```

Fortran Syntax

```
mwPointer matGetVariableInfo(mfp, name);
mwPointer mfp
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Name of `mxArray` to get from MAT-file

Returns

A pointer to a newly allocated `mxArray` structure representing header information for the `mxArray` named by `name` from the MAT-file pointed to by `mfp`.

`matGetVariableInfo` returns `NULL` in C (`0` in Fortran) if the attempt to return header information for the `mxArray` named by `name` fails.

Description

`matGetVariableInfo` loads only the array header information, including everything except `pr`, `pi`, `ir`, and `jc`. It recursively creates the cells and structures through their leaf elements, but does not include `pr`, `pi`, `ir`, and `jc`.

If `pr`, `pi`, `ir`, and `jc` are set to nonzero values when loaded with `matGetVariable`, `matGetVariableInfo` sets them to `-1` instead. These headers are for informational use only and should *never* be passed back to the MATLAB workspace or saved to MAT-files.

Use `mxDestroyArray` to destroy the `mxArray` created by this routine when you are finished with it.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

See Also `matGetVariable`

matOpen (C and Fortran)

Purpose

Open MAT-file

C Syntax

```
#include "mat.h"
MATFile *matOpen(const char *filename, const char *mode);
```

Fortran Syntax

```
mwPointer matOpen(filename, mode)
character*(*) filename, mode
```

Arguments

`filename`

Name of file to open

`mode`

File opening mode. Valid values for `mode` are listed in the following table.

`r`	Opens file for reading only; determines the current version of the MAT-file by inspecting the files and preserves the current version.
`u`	Opens file for update, both reading and writing, but does not create the file if the file does not exist (equivalent to the `r+` mode of `fopen`); determines the current version of the MAT-file by inspecting the files and preserves the current version.
`w`	Opens file for writing only; deletes previous contents, if any.
`w4`	Creates a Level 4 MAT-file, compatible with MATLAB Versions 4 software and earlier.
`wL`	Opens file for writing character data using the default character set for your system. The resulting MAT-file can be read with MATLAB Version 6 or 6.5 software. If you do not use the `wL` mode switch, MATLAB writes character data to the MAT-file using Unicode® character encoding by default.

`wz`	Opens file for writing compressed data.
`w7.3`	Creates a MAT-file in an HDF5-based format that can store objects occupy more than 2 GB.

Returns

A file handle, or `NULL` in C (`0` in Fortran) if the open fails.

Description

This routine opens a MAT-file for reading and writing.

See "Writing Character Data" in the External Interfaces documentation for more information on how MATLAB uses character encodings.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

Fortran Examples

See `matdemo1.F` and `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a Fortran program.

matPutVariable (C and Fortran)

Purpose

Write mxArrays to MAT-files

C Syntax

```
#include "mat.h"
int matPutVariable(MATFile *mfp, const char *name, const mxArray
  *pm);
```

Fortran Syntax

```
integer*4 matPutVariable(mfp, name, pm)
mwPointer mfp, pm
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Name of `mxArray` to put into MAT-file

`pm`
: `mxArray` pointer

Returns

`0` if successful and nonzero if an error occurs. In C, use `feof` and `ferror` from the Standard C Library along with `matGetFp` to determine status.

Description

This routine allows you to put an `mxArray` into a MAT-file.

`matPutVariable` writes `mxArray pm` to the MAT-file `mfp`. If the `mxArray` does not exist in the MAT-file, it is appended to the end. If an `mxArray` with the same name already exists in the file, the existing `mxArray` is replaced with the new `mxArray` by rewriting the file. The size of the new `mxArray` can be different from the existing `mxArray`.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

See Also

`matGetVariable`

Purpose

Put mxArrays into MAT-files as originating from global workspace

C Syntax

```
#include "mat.h"
int matPutVariableAsGlobal(MATFile *mfp, const char *name, const
  mxArray *pm);
```

Fortran Syntax

```
integer*4 matPutVariableAsGlobal(mfp, name, pm)
mwPointer mfp, pm
character*(*) name
```

Arguments

`mfp`
: Pointer to MAT-file information

`name`
: Name of `mxArray` to put into MAT-file

`pm`
: `mxArray` pointer

Returns

`0` if successful and nonzero if an error occurs. In C, use `feof` and `ferror` from the Standard C Library with `matGetFp` to determine status.

Description

This routine puts an `mxArray` into a MAT-file. `matPutVariableAsGlobal` is similar to `matPutVariable`, except that the array, when loaded by MATLAB software, is placed into the global workspace and a reference to it is set in the local workspace. If you write to a MATLAB 4 format file, `matPutVariableAsGlobal` does not load it as global and has the same effect as `matPutVariable`.

`matPutVariableAsGlobal` writes `mxArray pm` to the MAT-file `mfp`. If the `mxArray` does not exist in the MAT-file, it is appended to the end. If an `mxArray` with the same name already exists in the file, the existing `mxArray` is replaced with the new `mxArray` by rewriting the file. The size of the new `mxArray` can be different from the existing `mxArray`.

C Examples

See `matcreat.c` and `matdgns.c` in the `eng_mat` subdirectory of the `examples` directory for sample programs that illustrate how to use the MATLAB MAT-file routines in a C program.

Purpose

Register function to call when MEX-function is cleared or MATLAB software terminates

C Syntax

```
#include "mex.h"
int mexAtExit(void (*ExitFcn)(void));
```

Fortran Syntax

```
integer*4 mexAtExit(ExitFcn)
subroutine ExitFcn()
```

Arguments

`ExitFcn`
Pointer to function you want to run on exit

Returns

Always returns `0`.

Description

Use `mexAtExit` to register a function to be called just before the MEX-function is cleared or MATLAB software is terminated. `mexAtExit` gives your MEX-function a chance to perform tasks such as freeing persistent memory and closing files. Typically, the named `ExitFcn` performs tasks like closing streams or sockets.

Each MEX-function can register only one active exit function at a time. If you call `mexAtExit` more than once, MATLAB uses the `ExitFcn` from the more recent `mexAtExit` call as the exit function.

If a MEX-function is locked, all attempts to clear the MEX-file will fail. Consequently, if a user attempts to clear a locked MEX-file, MATLAB does not call the `ExitFcn`.

In Fortran, you must declare the `ExitFcn` as `external` in the Fortran routine that calls `mexAtExit` if it is not within the scope of the file.

C Examples

See `mexatexit.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexLock`, `mexUnlock`, `mexSetTrapFlag`

mexCallMATLAB (C and Fortran)

Purpose

Call MATLAB function or user-defined M-file or MEX-file

C Syntax

```
#include "mex.h"
int mexCallMATLAB(int nlhs, mxArray *plhs[], int nrhs,
  mxArray *prhs[], const char *functionName);
```

Fortran Syntax

```
integer*4 mexCallMATLAB(nlhs, plhs, nrhs, prhs, functionName)
integer*4 nlhs, nrhs
mwPointer plhs(*), prhs(*)
character*(*) functionName
```

Arguments

`nlhs`
: Number of desired output arguments.

`plhs`
: Array of pointers to output arguments.

`nrhs`
: Number of input arguments.

`prhs`
: Array of pointers to input arguments.

`functionName`
: Character string containing the functionName of the MATLAB built-in, operator, M-file, or MEX-file that you are calling.

Returns

`0` if successful, and a nonzero value if unsuccessful.

Description

Call `mexCallMATLAB` to invoke internal MATLAB numeric functions, MATLAB operators, M-files, or other MEX-files. Both `mexCallMATLAB` and `mexEvalString` execute MATLAB commands. However, `mexCallMATLAB` provides a mechanism for returning results (left-hand side arguments) back to the MEX-file; `mexEvalString` provides no way for return values to be passed back to the MEX-file.

For a complete description of the input and output arguments passed to `functionName`, see `mexFunction`. When calling the `mexCallMATLAB`

function, the number of output arguments `nlhs` and input arguments `nrhs` must be less than or equal to 50.

MATLAB allocates dynamic memory to store the `mxArrays` in `plhs`. MATLAB automatically deallocates the dynamic memory when you clear the MEX-file. However, if heap space is at a premium, you may want to call `mxDestroyArray` when you are finished with the `mxArrays` `plhs` points to.

If `functionName` is an operator, place the operator inside a pair of single quotes, for example, `'+'`.

It is possible to generate an object of type `mxUNKNOWN_CLASS` using `mexCallMATLAB`. For example, if you create an M-file that returns two variables but assigns only one of them a value:

```
function [a,b]=foo(c)
a=2*c;
```

you get this warning message in MATLAB:

```
Warning: One or more output arguments not assigned
during call to 'foo'.
```

MATLAB assigns output `b` to an empty matrix. If you then call `foo` using `mexCallMATLAB`, the unassigned output variable is given type `mxUNKNOWN_CLASS`.

Error Handling

If `functionName` detects an error, MATLAB terminates the MEX-file and returns control to the MATLAB prompt. If you want to trap errors, use the `mexCallMATLABWithTrap` function.

C Examples

See `mexcallmatlab.c` in the `mex` subdirectory of the `examples` directory.

Additional examples:

- `sincall.c` in the `refbook` subdirectory of the `examples` directory

- `mexevalstring.c` and `mexsettrapflag.c` in the `mex` subdirectory of the `examples` directory
- `mxcreatecellmatrix.c` and `mxisclass.c` in the `mx` subdirectory of the `examples` directory

See Also

`mexFunction`, `mexCallMATLABWithTrap`, `mexEvalString`, `mxDestroyArray`

Purpose

Call MATLAB function, user-defined M-file, or MEX-file and capture error information

C Syntax

```
#include "mex.h"
mxArray *mexCallMATLABWithTrap(int nlhs, mxArray *plhs[], int nrhs,
  const mxArray *prhs[], const char *functionName);
```

Fortran Syntax

```
mwPointer mexCallMATLABWithTrap(nlhs, plhs, nrhs, prhs, functionName)
integer*4 nlhs, nrhs
mwPointer plhs(*), prhs(*)
character*(*) functionName
```

Arguments

For more information about arguments, see `mexCallMATLAB`.

`nlhs`
: Number of desired output arguments.

`plhs`
: Array of pointers to output arguments.

`nrhs`
: Number of input arguments.

`prhs`
: Array of pointers to input arguments.

`functionName`
: Character string containing the functionName of the MATLAB built-in, operator, M-file, or MEX-file that you are calling.

Returns

`NULL` if no error occurred; otherwise, a pointer to an `mxArray` of class `MException`.

Description

The `mexCallMATLABWithTrap` function performs the same function as `mexCallMATLAB`. However, if MATLAB detects an error when executing `functionName`, MATLAB returns control to the line in the MEX-file immediately following the call to `mexCallMATLABWithTrap`. For information about `MException`, see “Responding to an Exception”

See Also `mexCallMATLAB`, `MException`

Purpose

Issue error message with identifier and return to MATLAB prompt

C Syntax

```
#include "mex.h"
void mexErrMsgIdAndTxt(const char *errorid,
const char *errormsg, ...);
```

Fortran Syntax

```
mexErrMsgIdAndTxt(errorid, errormsg)
character*(*) errorid, errormsg
```

Arguments

`errorid`

String containing a MATLAB message identifier. For information on creating identifiers, see "Message Identifiers" in the MATLAB Programming Fundamentals documentation.

`errormsg`

String containing the error message to be displayed. In C, the string may include formatting conversion characters, such as those used with the ANSI C `sprintf` function.

`...`

In C, any additional arguments needed to translate formatting conversion characters used in `errormsg`. Each conversion character in `errormsg` is converted to one of these values.

Description

Call `mexErrMsgIdAndTxt` to write an error message and its corresponding identifier to the MATLAB window. After the error message prints, MATLAB terminates the MEX-file and returns control to the MATLAB prompt.

Calling `mexErrMsgIdAndTxt` does not clear the MEX-file from memory. Consequently, `mexErrMsgIdAndTxt` does not invoke the function registered through `mexAtExit`.

If your application called `mxCalloc` or one of the `mxCreate*` routines to allocate memory, `mexErrMsgIdAndTxt` automatically frees the allocated memory.

Note If you get warnings when using `mexErrMsgIdAndTxt`, you may have a memory management compatibility problem. For more information, see "Memory Management Issues" in the External Interfaces documentation.

Remarks

In addition to the `errorid` and `errormsg`, the `mexerrmsgtxt` function determines where the error occurred, and displays the following information. For example, in the function `foo`, `mexerrmsgtxt` displays:

```
??? Error using ==> foo
```

See Also

`mexErrMsgTxt`, `mexWarnMsgIdAndTxt`, `mexWarnMsgTxt`

Purpose

Issue error message and return to MATLAB prompt

C Syntax

```
#include "mex.h"
void mexErrMsgTxt(const char *errormsg);
```

Fortran Syntax

```
mexErrMsgTxt(errormsg)
character*(*) errormsg
```

Arguments

`errormsg`
: String containing the error message to be displayed

Description

Call `mexErrMsgTxt` to write an error message to the MATLAB window. After the error message prints, MATLAB terminates the MEX-file and returns control to the MATLAB prompt.

Calling `mexErrMsgTxt` does not clear the MEX-file from memory. Consequently, `mexErrMsgTxt` does not invoke the function registered through `mexAtExit`.

If your application called `mxCalloc` or one of the `mxCreate*` routines to allocate memory, `mexErrMsgTxt` automatically frees the allocated memory.

Note If you get warnings when using `mexErrMsgTxt`, you may have a memory management compatibility problem. For more information, see "Memory Management Issues".

Remarks

In addition to the `errormsg`, the `mexerrmsgtxt` function determines where the error occurred, and displays the following information. If an error labeled `Print my error message` occurs in the function `foo`, `mexerrmsgtxt` displays:

```
??? Error using ==> foo
Print my error message
```

C Examples

See `xtimesy.c` in the `refbook` subdirectory of the `examples` directory.

For additional examples, see `convec.c`, `findnz.c`, `fulltosparse.c`, `phonebook.c`, `revord.c`, and `timestwo.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mexErrMsgIdAndTxt`, `mexWarnMsgIdAndTxt`, `mexWarnMsgTxt`

Purpose

Execute MATLAB command in caller's workspace

C Syntax

```
#include "mex.h"
int mexEvalString(const char *command);
```

Fortran Syntax

```
integer*4 mexEvalString(command)
character*(*) command
```

Arguments

`command`
A string containing the MATLAB command to execute

Returns

`0` if successful, and a nonzero value if unsuccessful.

Description

Call `mexEvalString` to invoke a MATLAB `command` in the workspace of the caller.

`mexEvalString` and `mexCallMATLAB` both execute MATLAB commands. However, `mexCallMATLAB` provides a mechanism for returning results (left-hand side arguments) back to the MEX-file; `mexEvalString` provides no way for return values to be passed back to the MEX-file.

All arguments that appear to the right of an equal sign in the `command` string must already be current variables of the caller's workspace.

Error Handling

If `command` detects an error, MATLAB terminates the MEX-file and returns control to the MATLAB prompt. If you want to trap errors, use the `mexEvalStringWithTrap` function.

Examples

See `mexevalstring.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexCallMATLAB`, `mexEvalStringWithTrap`

mexEvalStringWithTrap (C and Fortran)

Purpose

Execute MATLAB command in caller's workspace and capture error information

C Syntax

```
#include "mex.h"
mxArray *mexEvalStringWithTrap(const char *command);
```

Fortran Syntax

```
mwPointer mexEvalStringWithTrap(command)
character*(*) command
```

Arguments

`command`

A string containing the MATLAB command to execute

Returns

an object `ME` of class MException

Description

The `mexEvalStringWithTrap` function performs the same function as `mexEvalString`. However, if MATLAB detects an error when executing `command`, MATLAB returns control to the line in the MEX-file immediately following the call to `mexEvalStringWithTrap`.

See Also

`mexEvalString`, `MException`, `mexCallMATLAB`

Purpose

Entry point to C MEX-file

C Syntax

```
#include "mex.h"
void mexFunction(int nlhs, mxArray *plhs[], int nrhs,
     const mxArray *prhs[]);
```

Fortran Syntax

```
mexFunction(nlhs, plhs, nrhs, prhs)
integer*4 nlhs, nrhs
mwPointer plhs(*), prhs(*)
```

Arguments

`nlhs`
: The number of expected output `mxArray`s

`plhs`
: Array of pointers to the expected output `mxArray`s

`nrhs`
: The number of input `mxArray`s

`prhs`
: Array of pointers to the input `mxArray`s. These `mxArray`s are read only and should not be modified by your MEX-file. Changing the data in these `mxArray`s may produce undesired side effects.

Description

`mexFunction` is not a routine you call. Rather, `mexFunction` is the name of a function in C (subroutine in Fortran) that you must write in every MEX-file. When you invoke a MEX-function, MATLAB software finds and loads the corresponding MEX-file of the same name. MATLAB then searches for a symbol named `mexFunction` within the MEX-file. If it finds one, it calls the MEX-function using the address of the `mexFunction` symbol. If MATLAB cannot find a routine named `mexFunction` inside the MEX-file, it issues an error message.

When you invoke a MEX-file, MATLAB automatically seeds `nlhs`, `plhs`, `nrhs`, and `prhs` with the caller's information. In the syntax of the MATLAB language, functions have the general form:

```
[a,b,c,...] = fun(d,e,f,...)
```

where the `...` denotes more items of the same format. The `a,b,c...` are left-hand side arguments, and the `d,e,f...` are right-hand side arguments. The arguments `nlhs` and `nrhs` contain the number of left-hand side and right-hand side arguments, respectively, with which the MEX-function is called. `prhs` is an array of `mxArray` pointers whose length is `nrhs`. `plhs` is an array whose length is `nlhs`, where your function must set pointers for the returned left-hand side `mxArray`s.

C Examples

See `mexfunction.c` in the `mex` subdirectory of the `examples` directory.

Purpose

Name of current MEX-function

C Syntax

```
#include "mex.h"
const char *mexFunctionName(void);
```

Fortran Syntax

```
character*(*) mexFunctionName()
```

Returns

The name of the current MEX-function.

Description

`mexFunctionName` returns the name of the current MEX-function.

C Examples

See `mexgetarray.c` in the `mex` subdirectory of the `examples` directory.

mexGet (C)

Purpose

Get value of specified Handle Graphics property

C Syntax

```
#include "mex.h"
const mxArray *mexGet(double handle, const char *property);
```

Arguments

`handle`
Handle to a particular graphics object

`property`
A Handle Graphics property

Returns

The value of the specified property in the specified graphics object on success. Returns `NULL` on failure. The return argument from `mexGet` is declared as `constant`, meaning that it is read only and should not be modified. Changing the data in these `mxArray`s may produce undesired side effects.

Description

Call `mexGet` to get the value of the property of a certain graphics object. `mexGet` is the API equivalent of the MATLAB `get` function. To set a graphics property value, call `mexSet`.

Examples

See `mexget.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexSet`

Purpose

Get copy of variable from specified workspace

C Syntax

```
#include "mex.h"
mxArray *mexGetVariable(const char *workspace, const char
  *varname);
```

Fortran Syntax

```
mwPointer mexGetVariable(workspace, varname)
character*(*) workspace, varname
```

Arguments

`workspace`

Specifies where `mexGetVariable` should search in order to find array `varname`. The possible values are

`base`	Search for the variable in the base workspace.
`caller`	Search for the variable in the caller's workspace.
`global`	Search for the variable in the global workspace.

`varname`

Name of the variable to copy

Returns

A copy of the variable on success. Returns `NULL` in C (`0` on Fortran) on failure. A common cause of failure is specifying a variable that is not currently in the workspace. Perhaps the variable was in the workspace at one time but has since been cleared.

Description

Call `mexGetVariable` to get a copy of the specified variable. The returned `mxArray` contains a copy of all the data and characteristics that the variable had in the other workspace. Modifications to the returned `mxArray` do not affect the variable in the workspace unless you write the copy back to the workspace with `mexPutVariable`.

Use `mxDestroyArray` to destroy the `mxArray` created by this routine when you are finished with it.

C Examples

See `mexgetarray.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexGetVariablePtr`, `mexPutVariable`, `mxDestroyArray`

Purpose

Get read-only pointer to variable from another workspace

C Syntax

```
#include "mex.h"
const mxArray *mexGetVariablePtr(const char *workspace,
  const char *varname);
```

Fortran Syntax

```
mwPointer mexGetVariablePtr(workspace, varname)
character*(*) workspace, varname
```

Arguments

`workspace`

Specifies which workspace you want `mexGetVariablePtr` to search. The possible values are

`base`	Search for the variable in the base workspace.
`caller`	Search for the variable in the caller's workspace.
`global`	Search for the variable in the global workspace.

`varname`

Name of a variable in another workspace. This is a variable name, not an `mxArray` pointer.

Returns

A read-only pointer to the `mxArray` on success. Returns `NULL` in C (`0` in Fortran) on failure.

Description

Call `mexGetVariablePtr` to get a read-only pointer to the specified variable, `varname`, into your MEX-file's workspace. This command is useful for examining an `mxArray`'s data and characteristics. If you need to change data or characteristics, use `mexGetVariable` (along with `mexPutVariable`) instead of `mexGetVariablePtr`.

If you simply need to examine data or characteristics, `mexGetVariablePtr` offers superior performance because the caller needs to pass only a pointer to the array.

C Examples

See `mxislogical.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mexGetVariable`

Purpose

Determine whether mxArray has global scope

C Syntax

```
#include "matrix.h"
bool mexIsGlobal(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mexIsGlobal(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray has global scope, and logical 0 (false) otherwise.

Description

Use mexIsGlobal to determine whether the specified mxArray has global scope.

C Examples

See mxislogical.c in the mx subdirectory of the examples directory.

See Also

mexGetVariable, mexGetVariablePtr, mexPutVariable, global

mexIsLocked (C and Fortran)

Purpose

Determine whether MEX-file is locked

C Syntax

```
#include "mex.h"
bool mexIsLocked(void);
```

Fortran Syntax

```
integer*4 mexIsLocked()
```

Returns

Logical `1` (`true`) if the MEX-file is locked; logical `0` (`false`) if the file is unlocked.

Description

Call `mexIsLocked` to determine whether the MEX-file is locked. By default, MEX-files are unlocked, meaning that users can clear the MEX-file at any time.

To unlock a MEX-file, call `mexUnlock`.

C Examples

See `mexlock.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexLock`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mexUnlock`

Purpose

Prevent MEX-file from being cleared from memory

C Syntax

```
#include "mex.h"
void mexLock(void);
```

Fortran Syntax

```
mexLock()
```

Description

By default, MEX-files are unlocked, meaning that a user can clear them at any time. Call `mexLock` to prohibit a MEX-file from being cleared.

To unlock a MEX-file, you must call `mexUnlock`. Do not use the `munlock` function.

`mexLock` increments a lock count. If you call `mexLock` `n` times, you must call `mexUnlock` `n` times to unlock your MEX-file.

C Examples

See `mexlock.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexIsLocked`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mexUnlock`

mexMakeArrayPersistent (C and Fortran)

Purpose

Make mxArray persist after MEX-file completes

C Syntax

```
#include "mex.h"
void mexMakeArrayPersistent(mxArray *pm);
```

Fortran Syntax

```
mexMakeArrayPersistent(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray created by an mxCreate* function

Description

By default, an mxArrayallocated by an mxCreate* function is not persistent. The MATLAB memory management facility automatically frees a nonpersistent mxArray when the MEX-function finishes. If you want the mxArray to persist through multiple invocations of the MEX-function, you must call the mexMakeArrayPersistent function.

Note If you create a persistent mxArray, you are responsible for destroying it using mxDestroyArray when the MEX-file is cleared. If you do not destroy a persistent mxArray, MATLAB leaks memory. See mexAtExit to see how to register a function that gets called when the MEX-file is cleared. See mexLock to see how to lock your MEX-file so that it is never cleared.

See Also

mexAtExit, mxDestroyArray, mexLock, mexMakeMemoryPersistent, and the mxCreate* functions

Purpose

Make memory allocated by MATLAB software persist after MEX-function completes

C Syntax

```
#include "mex.h"
void mexMakeMemoryPersistent(void *ptr);
```

Fortran Syntax

```
mexMakeMemoryPersistent(ptr)
mwPointer ptr
```

Arguments

`ptr`

Pointer to the beginning of memory allocated by one of the MATLAB memory allocation routines

Description

By default, memory allocated by MATLAB software is nonpersistent, so it is freed automatically when the MEX-function finishes. If you want the memory to persist, you must call `mexMakeMemoryPersistent`.

Note If you create persistent memory, you are responsible for freeing it when the MEX-function is cleared. If you do not free the memory, MATLAB leaks memory. To free memory, use `mxFree`. See `mexAtExit` to see how to register a function that gets called when the MEX-function is cleared. See `mexLock` to see how to lock your MEX-function so that it is never cleared.

See Also

`mexAtExit`, `mexLock`, `mexMakeArrayPersistent`, `mxCalloc`, `mxFree`, `mxMalloc`, `mxRealloc`

mexPrintf (C and Fortran)

Purpose

ANSI C `printf`-style output routine

C Syntax

```
#include "mex.h"
int mexPrintf(const char *message, ...);
```

Fortran Syntax

```
integer*4 mexPrintf(message)
character*(*) message
```

Arguments

`message`
: String to be displayed. In C, the string may include formatting conversion characters, such as those used with the ANSI C `printf` function.

`...`
: In C, any additional arguments needed to translate formatting conversion characters used in `message`. Each conversion character in `message` is converted to one of these values.

Returns

The number of characters printed. This includes characters specified with backslash codes, such as `\n` and `\b`.

Description

This routine prints a string on the screen and in the diary (if the diary is in use). It provides a callback to the standard C `printf` routine already linked inside MATLAB software, and avoids linking the entire `stdio` library into your MEX-file.

In a C MEX-file, you must call `mexPrintf` instead of `printf` to display a string.

Note If you want the literal `%` in your message, you must use `%%` in your message string since `%` has special meaning to `mexPrintf`. Failing to do so causes unpredictable results.

C Examples

See

- `mexfunction.c` in the `mex` subdirectory of the `examples` directory
- `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mexErrMsgIdAndTxt`, `mexErrMsgTxt`, `mexWarnMsgIdAndTxt`, `mexWarnMsgTxt`

mexPutVariable (C and Fortran)

Purpose

Copy mxArray from MEX-function into specified workspace

C Syntax

```
#include "mex.h"
int mexPutVariable(const char *workspace, const char *varname,
  const mxArray *pm);
```

Fortran Syntax

```
integer*4 mexPutVariable(workspace, varname, pm)
character*(*) workspace, varname
mwPointer pm
```

Arguments

workspace
: Specifies the scope of the array that you are copying. The possible values are

base	Copy mxArray to the base workspace.
caller	Copy mxArray to the caller's workspace.
global	Copy mxArray to the list of global variables.

varname
: Name given to the mxArray in the workspace

pm
: Pointer to the mxArray

Returns

0 on success; 1 on failure. A possible cause of failure is that pm is NULL in C (0 in Fortran).

Description

Call mexPutVariable to copy the mxArray, at pointer pm, from your MEX-function into the specified workspace. MATLAB software gives the name, varname, to the copied mxArray in the receiving workspace.

mexPutVariable makes the array accessible to other entities, such as MATLAB, M-files, or other MEX-functions.

If a variable of the same name already exists in the specified workspace, mexPutVariable overwrites the previous contents of the variable with

the contents of the new `mxArray`. For example, suppose the MATLAB workspace defines variable `Peaches` as:

```
Peaches
1     2     3     4
```

and you call `mexPutVariable` to copy `Peaches` into the same workspace:

```
mexPutVariable("base", "Peaches", pm)
```

Then the old value of `Peaches` disappears and is replaced by the value passed in by `mexPutVariable`.

C Examples

See `mexgetarray.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexGetVariable`

mexSet (C)

Purpose

Set value of specified Handle Graphics property

C Syntax

```
#include "mex.h"
int mexSet(double handle, const char *property,
           mxArray *value);
```

Arguments

`handle`
Handle to a particular graphics object

`property`
String naming a Handle Graphics property

`value`
Pointer to an `mxArray` holding the new value to assign to the property

Returns

`0` on success; `1` on failure. Possible causes of failure include:

- Specifying a nonexistent property.
- Specifying an illegal value for that property, for example, specifying a string value for a numerical property.

Description

Call `mexSet` to set the value of the property of a certain graphics object. `mexSet` is the API equivalent of the MATLAB `set` function. To get the value of a graphics property, call `mexGet`.

Examples

See `mexget.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexGet`

Purpose

Control response of `mexCallMATLAB` to errors

C Syntax

```
#include "mex.h"
void mexSetTrapFlag(int trapflag);
```

Note The `mexsettrapflag` function will be removed in a future version of MATLAB software.

Fortran Syntax

```
mexSetTrapFlag(trapflag)
integer*4 trapflag
```

Arguments

`trapflag`

Control flag. Possible values are:

`0`	On error, control returns to the MATLAB prompt.
`1`	On error, control returns to your MEX-file.

Description

Call `mexSetTrapFlag` to control the MATLAB response to errors in `mexCallMATLAB`.

If you do not call `mexSetTrapFlag`, then whenever MATLAB detects an error in a call to `mexCallMATLAB`, MATLAB automatically terminates the MEX-file and returns control to the MATLAB prompt. Calling `mexSetTrapFlag` with `trapflag` set to `0` is equivalent to not calling `mexSetTrapFlag` at all.

If you call `mexSetTrapFlag` and set the `trapflag` to `1`, then whenever MATLAB detects an error in a call to `mexCallMATLAB`, MATLAB does not automatically terminate the MEX-file. Rather, MATLAB returns control to the line in the MEX-file immediately following the call to `mexCallMATLAB`. The MEX-file is then responsible for taking an appropriate response to the error.

If you call `mexSetTrapFlag`, the value of the `trapflag` you set remains in effect until the next call to `mexSetTrapFlag` within that MEX-file or,

if there are no more calls to `mexSetTrapFlag`, until the MEX-file exits. If a routine defined in a MEX-file calls another MEX-file,

1. The current value of the `trapflag` in the first MEX-file is saved.
2. The second MEX-file is called with the `trapflag` initialized to `0` within that file.
3. When the second MEX-file exits, the saved value of the `trapflag` in the first MEX-file is restored within that file.

C Examples

See `mexsettrapflag.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexCallMATLAB`, `mexCallMATLABWithTrap`, `mexAtExit`, `mexErrMsgTxt`

Purpose

Allow MEX-file to be cleared from memory

C Syntax

```
#include "mex.h"
void mexUnlock(void);
```

Fortran Syntax

```
mexUnlock()
```

Description

By default, MEX-files are unlocked, meaning that a user can clear them at any time. Calling `mexLock` locks a MEX-file so that it cannot be cleared. Calling `mexUnlock` removes the lock so that the MEX-file can be cleared.

`mexLock` increments a lock count. If you called `mexLock n` times, you must call `mexUnlock n` times to unlock your MEX-file.

C Examples

See `mexlock.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mexIsLocked`, `mexLock`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`

mexWarnMsgIdAndTxt (C and Fortran)

Purpose

Issue warning message with identifier

C Syntax

```
#include "mex.h"
void mexWarnMsgIdAndTxt(const char *warningid,
  const char *warningmsg, ...);
```

Fortran Syntax

```
mexWarnMsgIdAndTxt(warningid, warningmsg)
character*(*) warningid, warningmsg
```

Arguments

`warningid`
: String containing a MATLAB message identifier. For information on creating identifiers, see "Message Identifiers" in the MATLAB Programming Fundamentals documentation.

`warningmsg`
: String containing the warning message to be displayed. In C, the string may include formatting conversion characters, such as those used with the ANSI C `sprintf` function.

`...`
: In C, any additional arguments needed to translate formatting conversion characters used in `warningmsg`. Each conversion character in `warningmsg` is converted to one of these values.

Description

Call `mexWarnMsgIdAndTxt` to write a warning message and its corresponding identifier to the MATLAB window.

Unlike `mexErrMsgIdAndTxt`, `mexWarnMsgIdAndTxt` does not cause the MEX-file to terminate.

See Also

`mexErrMsgTxt`, `mexErrMsgIdAndTxt`, `mexWarnMsgTxt`

Purpose

Issue warning message

C Syntax

```
#include "mex.h"
void mexWarnMsgTxt(const char *warningmsg);
```

Fortran Syntax

```
mexWarnMsgTxt(warningmsg)
character*(*) warningmsg
```

Arguments

`warningmsg`
String containing the warning message to be displayed

Description

`mexWarnMsgTxt` causes MATLAB software to display the contents of `warningmsg`.

Unlike `mexErrMsgTxt`, `mexWarnMsgTxt` does not cause the MEX-file to terminate.

C Examples

See `yprime.c` in the `mex` subdirectory of the `examples` directory.

Additional examples:

- `explore.c` in the `mex` subdirectory of the `examples` directory
- `fulltosparse.c` in the `refbook` subdirectory of the `examples` directory
- `mxisfinite.c` and `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory

See Also

`mexErrMsgTxt`, `mexErrMsgIdAndTxt`, `mexWarnMsgIdAndTxt`

mwIndex (C and Fortran)

Purpose

Type for index values

Description

`mwIndex` is a type that represents index values, such as indices into arrays. This function is provided for purposes of cross-platform flexibility. By default, `mwIndex` is equivalent to `int` in C. When using the mex `-largeArrayDims` switch, `mwIndex` is equivalent to `size_t` in C. In Fortran, `mwIndex` is similarly equivalent to `INTEGER*4` or `INTEGER*8`, based on platform and compilation flags.

The C header file containing this type is:

```
#include "matrix.h"
```

In Fortran, `mwIndex` is implemented as a preprocessor macro. The Fortran header file containing this type is:

```
#include "fintrf.h"
```

See Also

`mex`, `mwSize`, `mwSignedIndex`

Purpose

Declare appropriate pointer type for platform

Description

`mwPointer` is a preprocessor macro that declares the appropriate Fortran type representing a pointer to an `mxArray` or to other data that is not of a native Fortran type, such as memory allocated by `mxMalloc`. On 32-bit platforms, the Fortran type that represents a pointer is `INTEGER*4`; on 64-bit platforms, it is `INTEGER*8`. The Fortran preprocessor translates `mwPointer` to the Fortran declaration that is appropriate for the platform on which you compile your file.

If your Fortran compiler supports preprocessing, you can use `mwPointer` to declare functions, arguments, and variables that represent pointers. If you cannot use `mwPointer`, you must ensure that your declarations have the correct size for the platform on which you are compiling Fortran code.

The Fortran header file containing this type is:

```
#include "fintrf.h"
```

Examples

This example declares the arguments for `mexFunction` in a Fortran MEX-file:

```
SUBROUTINE MEXFUNCTION(NLHS, PLHS, NRHS, PRHS)
MWPOINTER PLHS(*), PRHS(*)
INTEGER NLHS, NRHS
```

For additional examples, see the Fortran files with names ending in `.F` in the *`matlabroot`*`/extern/examples` directory.

mwSignedIndex (C and Fortran)

Purpose

Signed integer type for size values

Description

`mwSignedIndex` is a signed integer type that represents size values, such as array dimensions. This function is provided for purposes of cross-platform flexibility. By default, `mwSignedIndex` is equivalent to `ptrdiff_t` in C++. In Fortran, `mwSignedIndex` is similarly equivalent to `INTEGER*4` or `INTEGER*8`, based on platform and compilation flags.

The C header file containing this type is:

```
#include "matrix.h"
```

The Fortran header file containing this type is:

```
#include "fintrf.h"
```

See Also

`mwSize`

Purpose

Type for size values

Description

`mwSize` is a type that represents size values, such as array dimensions. This function is provided for purposes of cross-platform flexibility. By default, `mwSize` is equivalent to `int` in C. When using the mex `-largeArrayDims` switch, `mwSize` is equivalent to `size_t` in C. In Fortran, `mwSize` is similarly equivalent to `INTEGER*4` or `INTEGER*8`, based on platform and compilation flags.

The C header file containing this type is:

```
#include "matrix.h"
```

In Fortran, `mwSize` is implemented as a preprocessor macro. The Fortran header file containing this type is:

```
#include "fintrf.h"
```

See Also

`mex`, `mwIndex`, `mwSignedIndex`

mxAddField (C and Fortran)

Purpose

Add field to structure array

C Syntax

```
#include "matrix.h"
extern int mxAddField(mxArray *pm, const char *fieldname);
```

Fortran Syntax

```
integer*4 mxAddField(pm, fieldname)
mwPointer pm
character*(*) fieldname
```

Arguments

`pm`
: Pointer to a structure `mxArray`

`fieldname`
: Name of the field you want to add

Returns

Field number on success or `-1` if inputs are invalid or an out-of-memory condition occurs.

Description

Call `mxAddField` to add a field to a structure array. You must then create the values with the `mxCreate*` functions and use `mxSetFieldByNumber` to set the individual values for the field.

See Also

`mxRemoveField`, `mxSetFieldByNumber`

Purpose

Type for a MATLAB array

Description

The fundamental type underlying MATLAB data. For information on how the MATLAB array works with MATLAB-supported variables, see "MATLAB Data" in the External Interfaces documentation.

`mxArray` is a C language opaque type.

All C and Fortran MEX-files start with a gateway routine, called `mexFunction`, which requires `mxArray` for both input and output parameters. A C MEX-file gateway routine is described in "C Source MEX-Files". The Fortran version is described in "Fortran Source MEX-Files".

Once you have MATLAB data in your MEX-file, you can use the array access library routines (listed in "MX Array Manipulation" on page 1-2) to manipulate the data, and the MEX library routines (listed in "MEX-Files" on page 1-10) to perform operations in the MATLAB environment. You use `mxArray` to pass data to and from these functions.

Use any of the `mxCreate*` functions when you need to create data, and the corresponding `mxDestroyArray` function to free memory.

The header file containing this type is:

```
#include "matrix.h"
```

Example

See `mxcreatecharmatrixfromstr.c` in your *`matlabroot`*`/extern/examples/mx` directory.

The input argument `prhs` contains two or more strings, defined as `mxArray`. Use the `mxIsChar` function to validate the input. Create a C variable `str` of type `char` using the `mxArrayToString` function. Now you can manipulate your data in C.

To set the return values in `plhs`, use the `mxCreateCharMatrixFromStrings` function.

Before you exit your routine, be sure to free memory using the `mxFree` function on `str`.

See Also

mexFunction, mxClassID, mxCreateDoubleMatrix, mxCreateNumericArray, mxCreateString, mxDestroyArray, mxGetData, mxSetData

Purpose

Convert array to string

C Syntax

```
#include "matrix.h"
char *mxArrayToString(const mxArray *array_ptr);
```

Arguments

`array_ptr`
Pointer to a string `mxArray`; that is, a pointer to an `mxArray` having the `mxCHAR_CLASS` class.

Returns

A C-style string. Returns NULL on failure. Possible reasons for failure include out of memory and specifying an `mxArray` that is not a string `mxArray`.

Description

Call `mxArrayToString` to copy the character data of a string `mxArray` into a C-style string. The C-style string is always terminated with a `NULL` character.

If the string array contains several rows, they are copied, one column at a time, into one long string array. This function is similar to `mxGetString`, except that

- It does not require the length of the string as an input.
- It supports multibyte character sets.

`mxArrayToString` does not free the dynamic memory that the `char` pointer points to. Consequently, you should typically free the string (using `mxFree`) immediately after you have finished using it.

Examples

See `mexatexit.c` in the `mex` subdirectory of the `examples` directory.

For additional examples, see `mxcreatecharmatrixfromstr.c` and `mxislogical.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateCharArray`, `mxCreateCharMatrixFromStrings`, `mxCreateString`, `mxGetString`

mxAssert (C)

Purpose

Check assertion value for debugging purposes

C Syntax

```
#include "matrix.h"
void mxAssert(int expr, char *error_message);
```

Arguments

`expr`
: Value of assertion

`error_message`
: Description of why assertion failed

Description

Similar to the ANSI C `assert` macro, `mxAssert` checks the value of an assertion, and continues execution only if the assertion holds. If `expr` evaluates to logical `1` (`true`), `mxAssert` does nothing. If `expr` evaluates to logical `0` (`false`), `mxAssert` prints an error to the MATLAB command window consisting of the failed assertion's expression, the filename and line number where the failed assertion occurred, and the `error_message` string. The `error_message` string allows you to specify a better description of why the assertion failed. Use an empty string if you don't want a description to follow the failed assertion message.

For information about MATLAB behavior after a failed assertion, see "Abnormal Termination" in the Desktop Tools and Development Environment documentation.

The `mex` script turns off these assertions when building optimized MEX-functions, so use this for debugging purposes only. Build the MEX-file using the syntax `mex -g filename` in order to use `mxAssert`.

Assertions are a way of maintaining internal consistency of logic. Use them to keep yourself from misusing your own code and to prevent logical errors from propagating before they are caught; do not use assertions to prevent users of your code from misusing it.

Assertions can be taken out of your code by the C preprocessor. You can use these checks during development and then remove them when the code works properly, letting you use them for troubleshooting during development without slowing down the final product.

Purpose

Check assertion value without printing assertion text

C Syntax

```
#include "matrix.h"
void mxAssertS(int expr, char *error_message);
```

Arguments

`expr`
: Value of assertion

`error_message`
: Description of why assertion failed

Description

`mxAssertS` is similar to `mxAssert`, except `mxAssertS` does not print the text of the failed assertion.

mxCalcSingleSubscript (C and Fortran)

Purpose

Offset from first element to desired element

C Syntax

```
#include "matrix.h"
mwIndex mxCalcSingleSubscript(const mxArray *pm, mwSize nsubs,
    mwIndex *subs);
```

Fortran Syntax

```
mwIndex mxCalcSingleSubscript(pm, nsubs, subs)
mwPointer pm
mwSize nsubs
mwIndex subs
```

Arguments

`pm`

Pointer to an `mxArray`

`nsubs`

The number of elements in the `subs` array. Typically, you set `nsubs` equal to the number of dimensions in the `mxArray` that `pm` points to.

subs

An array of integers. Each value in the array should specify that dimension's subscript. In C syntax, the value in `subs[0]` specifies the row subscript, and the value in `subs[1]` specifies the column subscript. Use zero-based indexing for subscripts. For example, to express the starting element of a two-dimensional `mxArray` in `subs`, set `subs[0]` to `0` and `subs[1]` to `0`.

In Fortran syntax, the value in `subs(1)` specifies the row subscript, and the value in `subs(2)` specifies the column subscript. Use 1-based indexing for subscripts. For example, to express the starting element of a two-dimensional `mxArray` in `subs`, set `subs(1)` to `1` and `subs(2)` to `1`.

Returns

The number of elements between the start of the `mxArray` and the specified subscript. This returned number is called an *index*; many `mx` routines (for example, `mxGetField`) require an index as an argument.

If `subs` describes the starting element of an `mxArray`, `mxCalcSingleSubscript` returns 0. If `subs` describes the final element of an `mxArray`, `mxCalcSingleSubscript` returns `N-1` (where `N` is the total number of elements).

Description

Call `mxCalcSingleSubscript` to determine how many elements there are between the beginning of the `mxArray` and a given element of that `mxArray`. For example, given a subscript like `(5,7)`, `mxCalcSingleSubscript` returns the distance from the first element of the array to the `(5,7)` element. Remember that the `mxArray` data type internally represents all data elements in a one-dimensional array no matter how many dimensions the MATLAB `mxArray` appears to have.

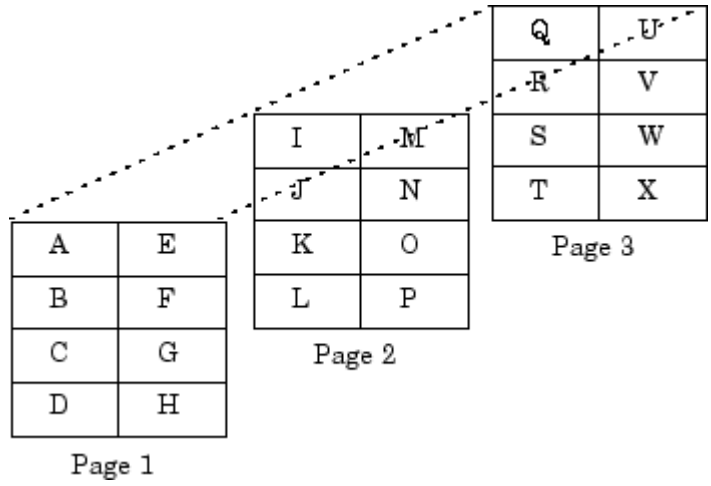
MATLAB uses a column-major numbering scheme to represent data elements internally. That means that MATLAB internally stores data elements from the first column first, then data elements from the second column second, and so on through the last column. For example, suppose you create a `4-by-2` variable. It is helpful to visualize the data as follows.

A	E
B	F
C	G
D	H

In fact, though, MATLAB internally represents the data as the following:

A	B	C	D	E	F	G	H
Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7

If an `mxArray` is N-dimensional, MATLAB represents the data in N-major order. For example, consider a three-dimensional array having dimensions `4-by-2-by-3`. Although you can visualize the data as



MATLAB internally represents the data for this three-dimensional array in the following order:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Avoid using `mxCalcSingleSubscript` to traverse the elements of an array. In C, it is more efficient to do this by finding the array's starting address and then using pointer autoincrementing to access successive elements. For example, to find the starting address of a numerical array, call `mxGetPr` or `mxGetPi`.

C Examples

See `mxcalcsinglesubscript.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetCell`, `mxSetCell`

Purpose

Allocate dynamic memory for array using MATLAB memory manager

C Syntax

```
#include "matrix.h"
#include <stdlib.h>
void *mxCalloc(mwSize n, mwSize size);
```

Fortran Syntax

```
mwPointer mxCalloc(n, size)
mwSize n, size
```

Arguments

`n`

Number of elements to allocate. This must be a nonnegative number.

`size`

Number of bytes per element. (The C `sizeof` operator calculates the number of bytes per element.)

Returns

A pointer to the start of the allocated dynamic memory, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCalloc` returns `NULL` in C (`0` in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt.

`mxCalloc` is unsuccessful when there is insufficient free heap space.

Description

MATLAB applications should always call `mxCalloc` rather than the ANSI C `calloc` function to allocate memory. In stand alone applications, such as the MATLAB engine, `mxCalloc` calls the `calloc` function. In MEX-files, `mxCalloc` automatically:

- Allocates enough contiguous heap space to hold `n` elements.
- Initializes all `n` elements to `0`.
- Registers the returned heap space with the MATLAB memory manager.

How you manage the memory created by this function depends on the purpose of the data assigned to it. If you assign it to an output argument

in `plhs[]` using the `mxSetPr` function, MATLAB is responsible for freeing the memory.

If you use the data internally, the MATLAB memory manager maintains a list of all memory allocated by the function and automatically frees (deallocates) the memory when control returns to the MATLAB prompt. In general, we recommend that MEX-file functions destroy their own temporary arrays and free their own dynamically allocated memory. It is more efficient to perform this cleanup in the source MEX-file than to rely on the automatic mechanism. Therefore, when you finish using the memory allocated by this function, call `mxFree` to deallocate the memory.

If you do not assign this data to an output argument, and you want it to persist after the MEX-file completes, call `mexMakeMemoryPersistent` after calling this function. If you write a MEX-file with persistent memory, be sure to register a `mexAtExit` function to free allocated memory in the event your MEX-file is cleared.

C Examples

See

- `explore.c` in the `mex` subdirectory of the `examples` directory
- `phonebook.c` and `revord.c` in the `refbook` subdirectory of the `examples` directory

For additional examples, see `mxcalcsinglesubscript.c` and `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mexAtExit`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mxDestroyArray`, `mxFree`, `mxMalloc`, `mxRealloc`

Purpose

Type for string mxArray

Description

A string mxArray stores its data elements as mxChar rather than as char.

The header file containing this type is:

```
#include "matrix.h"
```

Examples

See mxmalloc.c in the mx subdirectory of the examples directory.

Additional examples:

- explore.c in the mex subdirectory of the examples directory
- mxcreatecharmatrixfromstr.c in the mx subdirectory of the examples directory

See Also

mxCreateCharArray

mxClassID (C)

Purpose

Enumerated value identifying class of `mxArray`

C Syntax

```
typedef enum {
        mxUNKNOWN_CLASS,
        mxCELL_CLASS,
        mxSTRUCT_CLASS,
        mxLOGICAL_CLASS,
        mxCHAR_CLASS,
        mxDOUBLE_CLASS,
        mxSINGLE_CLASS,
        mxINT8_CLASS,
        mxUINT8_CLASS,
        mxINT16_CLASS,
        mxUINT16_CLASS,
        mxINT32_CLASS,
        mxUINT32_CLASS,
        mxINT64_CLASS,
        mxUINT64_CLASS,
        mxFUNCTION_CLASS
} mxClassID;
```

Constants

`mxUNKNOWN_CLASS`
: The class cannot be determined. You cannot specify this category for an `mxArray`; however, `mxGetClassID` can return this value if it cannot identify the class.

`mxCELL_CLASS`
: Identifies a cell `mxArray`.

`mxSTRUCT_CLASS`
: Identifies a structure `mxArray`.

`mxLOGICAL_CLASS`
: Identifies a logical `mxArray`, an `mxArray` whose data is represented as `mxLogical`.

`mxCHAR_CLASS`
: Identifies a string `mxArray`, an `mxArray` whose data is represented as `mxChar`.

`mxDOUBLE_CLASS`
: Identifies a numeric `mxArray` whose data is stored as double-precision, floating-point numbers.

`mxSINGLE_CLASS`
: Identifies a numeric `mxArray` whose data is stored as single-precision, floating-point numbers.

`mxINT8_CLASS`
: Identifies a numeric `mxArray` whose data is stored as signed 8-bit integers.

`mxUINT8_CLASS`
: Identifies a numeric `mxArray` whose data is stored as unsigned 8-bit integers.

`mxINT16_CLASS`
: Identifies a numeric `mxArray` whose data is stored as signed 16-bit integers.

`mxUINT16_CLASS`
: Identifies a numeric `mxArray` whose data is stored as unsigned 16-bit integers.

`mxINT32_CLASS`
: Identifies a numeric `mxArray` whose data is stored as signed 32-bit integers.

`mxUINT32_CLASS`
: Identifies a numeric `mxArray` whose data is stored as unsigned 32-bit integers.

`mxINT64_CLASS`
: Identifies a numeric `mxArray` whose data is stored as signed 64-bit integers.

`mxUINT64_CLASS`
: Identifies a numeric `mxArray` whose data is stored as unsigned 64-bit integers.

`mxFUNCTION_CLASS`
: Identifies a function handle `mxArray`.

mxClassID (C)

Description

Various `mx*` calls require or return an `mxClassID` argument. `mxClassID` identifies the way in which the `mxArray` represents its data elements.

Examples

See `explore.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mxGetClassID` , `mxCreateNumericArray`

Purpose

Identifier corresponding to class

Fortran Syntax

```
integer*4 mxClassIDFromClassName(classname)
character*(*) classname
```

Arguments

`classname`

A `character` array specifying a MATLAB class name. Use one of the strings from the following table.

Returns

A numeric identifier used internally by MATLAB software to represent the MATLAB class, `classname`. Returns `unknown` if `classname` is not a recognized MATLAB class.

Description

Use `mxClassIDFromClassName` to obtain an identifier for any class that is recognized by MATLAB software. This function is most commonly used to provide a `classid` argument to `mxCreateNumericArray` and `mxCreateNumericMatrix`.

Valid choices for `classname` are listed in the `mxIsClass` reference page.

See Also

`mxGetClassName`, `mxCreateNumericArray`, `mxCreateNumericMatrix`, `mxIsClass`

mxComplexity (C)

Purpose

Flag specifying whether `mxArray` has imaginary components

C Syntax

```
typedef enum mxComplexity {mxREAL=0, mxCOMPLEX};
```

Constants

`mxREAL`
: Identifies an `mxArray` with no imaginary components.

`mxCOMPLEX`
: Identifies an `mxArray` with imaginary components.

Description

Various `mx*` calls require an `mxComplexity` argument. You can set an `mxComplex` argument to either `mxREAL` or `mxCOMPLEX`.

Examples

See `mxcalcsinglesubscript.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateNumericArray`, `mxCreateDoubleMatrix`, `mxCreateSparse`

Purpose

Copy `character` values from Fortran array to pointer array

Fortran Syntax

```
mxCopyCharacterToPtr(y, px, n)
character*(*) y
mwPointer px
mwSize n
```

Arguments

`y`
: `character` Fortran array

`px`
: Pointer to `character` or `name` array

`n`
: Number of elements to copy

Description

`mxCopyCharacterToPtr` copies `n` `character` values from the Fortran `character` array `y` into the MATLAB string array pointed to by `px`. This subroutine is essential for copying character data between MATLAB pointer arrays and ordinary Fortran `character` arrays.

See Also

`mxCopyPtrToCharacter`, `mxCreateCharArray`, `mxCreateString`, `mxCreateCharMatrixFromStrings`

mxCopyComplex16ToPtr (Fortran)

Purpose

Copy `COMPLEX*16` values from Fortran array to pointer array

Fortran Syntax

```
mxCopyComplex16ToPtr(y, pr, pi, n)
complex*16 y(n)
mwPointer pr, pi
mwSize n
```

Arguments

`y`
: `COMPLEX*16` Fortran array

`pr`
: Pointer to the real data of a double-precision MATLAB array

`pi`
: Pointer to the imaginary data of a double-precision MATLAB array

`n`
: Number of elements to copy

Description

`mxCopyComplex16ToPtr` copies `n` `COMPLEX*16` values from the Fortran `COMPLEX*16` array `y` into the MATLAB arrays pointed to by `pr` and `pi`. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyPtrToComplex16`, `mxCreateNumericArray`, `mxCreateNumericMatrix`, `mxGetData`, `mxGetImagData`

Purpose

Copy COMPLEX*8 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyComplex8ToPtr(y, pr, pi, n)
complex*8 y(n)
mwPointer pr, pi
mwSize n
```

Arguments

`y`
: `COMPLEX*8` Fortran array

`pr`
: Pointer to the real data of a single-precision MATLAB array

`pi`
: Pointer to the imaginary data of a single-precision MATLAB array

`n`
: Number of elements to copy

Description

`mxCopyComplex8ToPtr` copies `n` `COMPLEX*8` values from the Fortran `COMPLEX*8` array `y` into the MATLAB arrays pointed to by `pr` and `pi`. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyPtrToComplex8`, `mxCreateNumericArray`, `mxCreateNumericMatrix`, `mxGetData`, `mxGetImagData`

mxCopyInteger1ToPtr (Fortran)

Purpose

Copy INTEGER*1 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyInteger1ToPtr(y, px, n)
integer*1 y(n)
mwPointer px
mwSize n
```

Arguments

`y`
: INTEGER*1 Fortran array

`px`
: Pointer to the real or imaginary data of the array

`n`
: Number of elements to copy

Description

`mxCopyInteger1ToPtr` copies `n` INTEGER*1 values from the Fortran INTEGER*1 array `y` into the MATLAB array pointed to by `px`, either a real or an imaginary array. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyPtrToInteger1`, `mxCreateNumericArray`, `mxCreateNumericMatrix`

Purpose

Copy INTEGER*2 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyInteger2ToPtr(y, px, n)
integer*2 y(n)
mwPointer px
mwSize n
```

Arguments

`y`
: INTEGER*2 Fortran array

`px`
: Pointer to the real or imaginary data of the array

`n`
: Number of elements to copy

Description

`mxCopyInteger2ToPtr` copies `n` INTEGER*2 values from the Fortran INTEGER*2 array `y` into the MATLAB array pointed to by `px`, either a real or an imaginary array. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyPtrToInteger2`, `mxCreateNumericArray`, `mxCreateNumericMatrix`

mxCopyInteger4ToPtr (Fortran)

Purpose

Copy INTEGER*4 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyInteger4ToPtr(y, px, n)
integer*4 y(n)
mwPointer px
mwSize n
```

Arguments

`y`
: INTEGER*4 Fortran array

`px`
: Pointer to the real or imaginary data of the array

`n`
: Number of elements to copy

Description

`mxCopyInteger4ToPtr` copies `n` INTEGER*4 values from the Fortran INTEGER*4 array `y` into the MATLAB array pointed to by `px`, either a real or an imaginary array. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyPtrToInteger4`, `mxCreateNumericArray`, `mxCreateNumericMatrix`

Purpose

Copy `character` values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToCharacter(px, y, n)
mwPointer px
character*(*) y
mwSize n
```

Arguments

`px`
: Pointer to `character` or `name` array

`y`
: `character` Fortran array

`n`
: Number of elements to copy

Description

`mxCopyPtrToCharacter` copies `n` `character` values from the MATLAB array pointed to by `px` into the Fortran `character` array `y`. This subroutine is essential for copying character data from MATLAB pointer arrays into ordinary Fortran `character` arrays.

Examples

See `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

`mxCopyCharacterToPtr`, `mxCreateCharArray`, `mxCreateString`, `mxCreateCharMatrixFromStrings`

mxCopyPtrToComplex16 (Fortran)

Purpose

Copy `COMPLEX*16` values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToComplex16(pr, pi, y, n)
mwPointer pr, pi
complex*16 y(n)
mwSize n
```

Arguments

`pr`
: Pointer to the real data of a double-precision MATLAB array

`pi`
: Pointer to the imaginary data of a double-precision MATLAB array

`y`
: `COMPLEX*16` Fortran array

`n`
: Number of elements to copy

Description

`mxCopyPtrToComplex16` copies `n` `COMPLEX*16` values from the MATLAB arrays pointed to by `pr` and `pi` into the Fortran `COMPLEX*16` array `y`. This subroutine is essential for use with Fortran compilers that do not support the `%VAL` construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

`mxCopyComplex16ToPtr`, `mxCreateNumericArray`, `mxCreateNumericMatrix`, `mxGetData`, `mxGetImagData`

Purpose

Copy COMPLEX*8 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToComplex8(pr, pi, y, n)
mwPointer pr, pi
complex*8 y(n)
mwSize n
```

Arguments

`pr`
: Pointer to the real data of a single-precision MATLAB array

`pi`
: Pointer to the imaginary data of a single-precision MATLAB array

`y`
: COMPLEX*8 Fortran array

`n`
: Number of elements to copy

Description

mxCopyPtrToComplex8 copies n COMPLEX*8 values from the MATLAB arrays pointed to by pr and pi into the Fortran COMPLEX*8 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyComplex8ToPtr, mxCreateNumericArray, mxCreateNumericMatrix, mxGetData, mxGetImagData

mxCopyPtrToInteger1 (Fortran)

Purpose

Copy INTEGER*1 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToInteger1(px, y, n)
mwPointer px
integer*1 y(n)
mwSize n
```

Arguments

px
: Pointer to the real or imaginary data of the array

y
: INTEGER*1 Fortran array

n
: Number of elements to copy

Description

mxCopyPtrToInteger1 copies n INTEGER*1 values from the MATLAB array pointed to by px, either a real or imaginary array, into the Fortran INTEGER*1 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyInteger1ToPtr, mxCreateNumericArray, mxCreateNumericMatrix

Purpose

Copy INTEGER*2 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToInteger2(px, y, n)
mwPointer px
integer*2 y(n)
mwSize n
```

Arguments

px
: Pointer to the real or imaginary data of the array

y
: INTEGER*2 Fortran array

n
: Number of elements to copy

Description

mxCopyPtrToInteger2 copies n INTEGER*2 values from the MATLAB array pointed to by px, either a real or an imaginary array, into the Fortran INTEGER*2 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyInteger2ToPtr, mxCreateNumericArray, mxCreateNumericMatrix

mxCopyPtrToInteger4 (Fortran)

Purpose

Copy INTEGER*4 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToInteger4(px, y, n)
mwPointer px
integer*4 y(n)
mwSize n
```

Arguments

px
: Pointer to the real or imaginary data of the array

y
: INTEGER*4 Fortran array

n
: Number of elements to copy

Description

mxCopyPtrToInteger4 copies n INTEGER*4 values from the MATLAB array pointed to by px, either a real or an imaginary array, into the Fortran INTEGER*4 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyInteger4ToPtr, mxCreateNumericArray, mxCreateNumericMatrix

Purpose

Copy pointer values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToPtrArray(px, y, n)
mwPointer px
mwPointer y(n)
mwSize n
```

Arguments

`px`
: Pointer to pointer array

`y`
: Fortran array of `mwPointer` values

`n`
: Number of pointers to copy

Description

`mxCopyPtrToPtrArray` copies `n` pointers from the MATLAB array pointed to by `px` into the Fortran array `y`. This subroutine is essential for copying the output of `matGetDir` into an array of pointers. After calling this function, each element of `y` contains a pointer to a string. You can convert these strings to Fortran character arrays by passing each element of `y` as the first argument to `mxCopyPtrToCharacter`.

Examples

See `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

`matGetDir`, `mxCopyPtrToCharacter`

mxCopyPtrToReal4 (Fortran)

Purpose

Copy REAL*4 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToReal4(px, y, n)
mwPointer px
real*4 y(n)
mwSize n
```

Arguments

px
: Pointer to the real or imaginary data of a single-precision MATLAB array

y
: REAL*4 Fortran array

n
: Number of elements to copy

Description

mxCopyPtrToReal4 copies n REAL*4 values from the MATLAB array pointed to by px, either a pr or pi array, into the Fortran REAL*4 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyReal4ToPtr, mxCreateNumericArray, mxCreateNumericMatrix, mxGetData, mxGetImagData

Purpose

Copy REAL*8 values from pointer array to Fortran array

Fortran Syntax

```
mxCopyPtrToReal8(px, y, n)
mwPointer px
real*8 y(n)
mwSize n
```

Arguments

px
: Pointer to the real or imaginary data of a double-precision MATLAB array

y
: REAL*8 Fortran array

n
: Number of elements to copy

Description

mxCopyPtrToReal8 copies n REAL*8 values from the MATLAB array pointed to by px, either a pr or pi array, into the Fortran REAL*8 array y. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

Examples

See fengdemo.F in the eng_mat subdirectory of the examples directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

mxCopyReal8ToPtr, mxCreateNumericArray, mxCreateNumericMatrix, mxGetData, mxGetImagData

mxCopyReal4ToPtr (Fortran)

Purpose

Copy REAL*4 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyReal4ToPtr(y, px, n)
real*4 y(n)
mwPointer px
mwSize n
```

Arguments

y
: REAL*4 Fortran array

px
: Pointer to the real or imaginary data of a single-precision MATLAB array

n
: Number of elements to copy

Description

mxCopyReal4ToPtr copies n REAL*4 values from the Fortran REAL*4 array y into the MATLAB array pointed to by px, either a pr or pi array. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

See Also

mxCopyPtrToReal4, mxCreateNumericArray, mxCreateNumericMatrix, mxGetData, mxGetImagData

Purpose

Copy REAL*8 values from Fortran array to pointer array

Fortran Syntax

```
mxCopyReal8ToPtr(y, px, n)
real*8 y(n)
mwPointer px
mwSize n
```

Arguments

y
: REAL*8 Fortran array

px
: Pointer to the real or imaginary data of a double-precision MATLAB array

n
: Number of elements to copy

Description

mxCopyReal8ToPtr copies n REAL*8 values from the Fortran REAL*8 array y into the MATLAB array pointed to by px, either a pr or pi array. This subroutine is essential for use with Fortran compilers that do not support the %VAL construct in order to set up standard Fortran arrays for passing as arguments to the computation routine of a MEX-file.

Examples

See matdemo1.F and fengdemo.F in the eng_mat subdirectory of the examples directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

mxCopyPtrToReal8, mxCreateNumericArray, mxCreateNumericMatrix, mxGetData, mxGetImagData

mxCreateCellArray (C and Fortran)

Purpose

Create unpopulated N-D cell mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateCellArray(mwSize ndim, const mwSize *dims);
```

Fortran Syntax

```
mwPointer mxCreateCellArray(ndim, dims)
mwSize ndim, dims
```

Arguments

`ndim`

The desired number of dimensions in the created cell. For example, to create a three-dimensional cell `mxArray`, set `ndim` to 3.

`dims`

The dimensions array. Each element in the dimensions array contains the size of the `mxArray` in that dimension. For example, in C, setting `dims[0]` to `5` and `dims[1]` to `7` establishes a `5`-by-`7` `mxArray`. In Fortran, setting `dims(1)` to `5` and `dims(2)` to `7` establishes a `5`-by-`7` `mxArray`. In most cases, there should be `ndim` elements in the `dims` array.

Returns

A pointer to the created cell `mxArray`, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCreateCellArray` returns `NULL` in C (`0` in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. The most common cause of failure is insufficient free heap space.

Description

Use `mxCreateCellArray` to create a cell `mxArray` whose size is defined by `ndim` and `dims`. For example, in C, to establish a three-dimensional cell `mxArray` having dimensions `4`-by-`8`-by-`7`, set:

```
ndim = 3;
dims[0] = 4; dims[1] = 8; dims[2] = 7;
```

In Fortran, to establish a three-dimensional cell `mxArray` having dimensions `4`-by-`8`-by-`7`, set:

```
ndim = 3;
```

```
dims(1) = 4; dims(2) = 8; dims(3) = 7;
```

The created cell `mxArray` is unpopulated; `mxCreateCellArray` initializes each cell to `NULL`. To put data into a cell, call `mxSetCell`.

Any trailing singleton dimensions specified in the `dims` argument are automatically removed from the resulting array. For example, if `ndim` equals `5` and `dims` equals `[4 1 7 1 1]`, the resulting array is given the dimensions `4`-by-`1`-by-`7`.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mxCreateCellMatrix`, `mxGetCell`, `mxSetCell`, `mxIsCell`

mxCreateCellMatrix (C and Fortran)

Purpose

Create unpopulated 2-D cell mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateCellMatrix(mwSize m, mwSize n);
```

Fortran Syntax

```
mwPointer mxCreateCellMatrix(m, n)
mwSize m, n
```

Arguments

m
: The desired number of rows

n
: The desired number of columns

Returns

A pointer to the created cell mxArray, if successful. If unsuccessful in a stand alone (non-MEX-file) application, mxCreateCellMatrix returns NULL in C (0 in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. Insufficient free heap space is the only reason for mxCreateCellMatrix to be unsuccessful.

Description

Use mxCreateCellMatrix to create an m-by-n two-dimensional cell mxArray. The created cell mxArray is unpopulated; mxCreateCellMatrix initializes each cell to NULL in C (0 in Fortran). To put data into cells, call mxSetCell.

mxCreateCellMatrix is identical to mxCreateCellArray except that mxCreateCellMatrix can create two-dimensional mxArrays only, but mxCreateCellArray can create mxArrays having any number of dimensions greater than 1.

C Examples

See mxcreatecellmatrix.c in the mx subdirectory of the examples directory.

See Also

mxCreateCellArray

Purpose

Create unpopulated N-D string mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateCharArray(mwSize ndim, const mwSize *dims);
```

Fortran Syntax

```
mwPointer mxCreateCharArray(ndim, dims)
mwSize ndim, dims
```

Arguments

`ndim`

The desired number of dimensions in the string mxArray. You must specify a positive number. If you specify 0, 1, or 2, mxCreateCharArray creates a two-dimensional mxArray.

`dims`

The dimensions array. Each element in the dimensions array contains the size of the array in that dimension. For example, in C, setting dims[0] to 5 and dims[1] to 7 establishes a 5-by-7 mxArray. In Fortran, setting dims(1) to 5 and dims(2) to 7 establishes a 5-by-7 character mxArray. The dims array must have at least ndim elements.

Returns

A pointer to the created string mxArray, if successful. If unsuccessful in a stand alone (non-MEX-file) application, mxCreateCharArray returns NULL in C (0 in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. Insufficient free heap space is the only reason for mxCreateCharArray to be unsuccessful.

Description

Call mxCreateCharArray to create an N-dimensional string mxArray. The created mxArray is unpopulated; that is, mxCreateCharArray initializes each cell to NULL in C (0 in Fortran).

Any trailing singleton dimensions specified in the dims argument are automatically removed from the resulting array. For example, if ndim equals 5 and dims equals [4 1 7 1 1], the resulting array is given the dimensions 4-by-1-by-7.

C Examples

See `mxcreatecharmatrixfromstr.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateCharMatrixFromStrings`, `mxCreateString`

Purpose

Create populated 2-D string mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateCharMatrixFromStrings(mwSize m, const char **str);
```

Fortran Syntax

```
mwPointer mxCreateCharMatrixFromStrings(m, str)
mwSize m
character*(*) str(m)
```

Arguments

`m`

The desired number of rows in the created string mxArray. The value you specify for m should equal the number of strings in str.

`str`

In C, an array of strings containing at least m strings. In Fortran, a character*n array of size m, where each element of the array is n bytes.

Returns

A pointer to the created string mxArray, if successful. If unsuccessful in a stand alone (non-MEX-file) application, mxCreateCharMatrixFromStrings returns NULL in C (0 in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. Insufficient free heap space is the primary reason for mxCreateCharMatrixFromStrings to be unsuccessful. Another possible reason for failure is that str contains fewer than m strings.

Description

Use mxCreateCharMatrixFromStrings to create a two-dimensional string mxArray, where each row is initialized to a string from str. In C, the created mxArray has dimensions m-by-max, where max is the length of the longest string in str. In Fortran, the created mxArray has dimensions m-by-n, where n is the number of characters in str(i).

Note that string mxArrays represent their data elements as mxChar rather than as C char.

C Examples

See `mxcreatecharmatrixfromstr.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateCharArray`, `mxCreateString`, `mxGetString`

Purpose

Create 2-D, double-precision, floating-point mxArray initialized to 0

C Syntax

```
#include "matrix.h"
mxArray *mxCreateDoubleMatrix(mwSize m, mwSize n,
  mxComplexity ComplexFlag);
```

Fortran Syntax

```
mwPointer mxCreateDoubleMatrix(m, n, ComplexFlag)
mwSize m, n
integer*4 ComplexFlag
```

Arguments

m
: The desired number of rows

n
: The desired number of columns

ComplexFlag
: Specify either mxREAL or mxCOMPLEX. If the data you plan to put into the mxArray has no imaginary components, specify mxREAL in C (0 in Fortran). If the data has some imaginary components, specify mxCOMPLEX in C (1 in Fortran).

Returns

A pointer to the created mxArray, if successful. If unsuccessful in a stand alone (non-MEX-file) application, mxCreateDoubleMatrix returns NULL in C (0 in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. mxCreateDoubleMatrix is unsuccessful when there is not enough free heap space to create the mxArray.

Description

Use mxCreateDoubleMatrix to create an m-by-n mxArray. mxCreateDoubleMatrix initializes each element in the pr array to 0. If you set ComplexFlag to mxCOMPLEX in C (1 in Fortran), mxCreateDoubleMatrix also initializes each element in the pi array to 0.

If you set ComplexFlag to mxREAL in C (0 in Fortran), mxCreateDoubleMatrix allocates enough memory to hold m-by-n real elements. If you set ComplexFlag to mxCOMPLEX in C (1 in Fortran),

mxCreateDoubleMatrix allocates enough memory to hold m-by-n real elements and m-by-n imaginary elements.

Call mxDestroyArray when you finish using the mxArray. mxDestroyArray deallocates the mxArray and its associated real and complex elements.

C Examples

See convec.c, findnz.c, sincall.c, timestwo.c, timestwoalt.c, and xtimesy.c in the refbook subdirectory of the examples directory.

See Also

mxCreateNumericArray

Purpose

Create scalar, double-precision array initialized to specified value

C Syntax

```
#include "matrix.h"
mxArray *mxCreateDoubleScalar(double value);
```

Fortran Syntax

```
mwPointer mxCreateDoubleScalar(value)
real*8 value
```

Arguments

`value`

The desired value to which you want to initialize the array

Returns

A pointer to the created `mxArray`, if successful. `mxCreateDoubleScalar` is unsuccessful if there is not enough free heap space to create the `mxArray`. If `mxCreateDoubleScalar` is unsuccessful in a MEX-file, the MEX-file prints an "Out of Memory" message, terminates, and control returns to the MATLAB prompt. If `mxCreateDoubleScalar` is unsuccessful in a stand alone (non-MEX-file) application, `mxCreateDoubleScalar` returns `NULL` in C (`0` in Fortran).

Description

Call `mxCreateDoubleScalar` to create a scalar double `mxArray`. `mxCreateDoubleScalar` is a convenience function that can be used in place of the following C code:

```
pa = mxCreateDoubleMatrix(1, 1, mxREAL);
*mxGetPr(pa) = value;
```

`mxCreateDoubleScalar` can be used in place of the following Fortran code:

```
pm = mxCreateDoubleMatrix(1, 1, 0)
mxCopyReal8ToPtr(value, mxGetPr(pm), 1)
```

When you finish using the `mxArray`, call `mxDestroyArray` to destroy it.

See Also

`mxGetPr`, `mxCreateDoubleMatrix`

mxCreateLogicalArray (C)

Purpose

Create N-D logical `mxArray` initialized to `false`

C Syntax

```
#include "matrix.h"
mxArray *mxCreateLogicalArray(mwSize ndim, const mwSize *dims);
```

Arguments

`ndim`

Number of dimensions. If you specify a value for `ndim` that is less than 2, `mxCreateLogicalArray` automatically sets the number of dimensions to 2.

`dims`

The dimensions array. Each element in the dimensions array contains the size of the array in that dimension. For example, setting `dims[0]` to `5` and `dims[1]` to `7` establishes a `5`-by-`7` `mxArray`. There should be `ndim` elements in the `dims` array.

Returns

A pointer to the created `mxArray`, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCreateLogicalArray` returns `NULL`. If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. `mxCreateLogicalArray` is unsuccessful when there is not enough free heap space to create the `mxArray`.

Description

Call `mxCreateLogicalArray` to create an N-dimensional `mxArray` of `mxLogical` elements. After creating the `mxArray`, `mxCreateLogicalArray` initializes all its elements to logical `0`. `mxCreateLogicalArray` differs from `mxCreateLogicalMatrix` in that the latter can create two-dimensional arrays only.

`mxCreateLogicalArray` allocates dynamic memory to store the created `mxArray`. When you finish with the created `mxArray`, call `mxDestroyArray` to deallocate its memory.

Any trailing singleton dimensions specified in the `dims` argument are automatically removed from the resulting array. For example, if `ndim` equals `5` and `dims` equals `[4 1 7 1 1]`, the resulting array is given the dimensions `4`-by-`1`-by-`7`.

See Also

mxCreateLogicalMatrix, mxCreateSparseLogicalMatrix, mxCreateLogicalScalar

mxCreateLogicalMatrix (C)

Purpose

Create 2-D, logical `mxArray` initialized to `false`

C Syntax

```
#include "matrix.h"
mxArray *mxCreateLogicalMatrix(mwSize m, mwSize n);
```

Arguments

`m`
: The desired number of rows

`n`
: The desired number of columns

Returns

A pointer to the created `mxArray`, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCreateLogicalMatrix` returns `NULL`. If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. `mxCreateLogicalMatrix` is unsuccessful when there is not enough free heap space to create the `mxArray`.

Description

Use `mxCreateLogicalMatrix` to create an `m`-by-`n` `mxArray` of `mxLogical` elements. `mxCreateLogicalMatrix` initializes each element in the array to logical `0`.

Call `mxDestroyArray` when you finish using the `mxArray`. `mxDestroyArray` deallocates the `mxArray`.

See Also

`mxCreateLogicalArray`, `mxCreateSparseLogicalMatrix`, `mxCreateLogicalScalar`

Purpose

Create scalar, logical `mxArray`

C Syntax

```
#include "matrix.h"
mxArray *mxCreateLogicalScalar(mxLogical value);
```

Arguments

`value`
The desired logical value to which you want to initialize the array

Returns

A pointer to the created `mxArray`, if successful. `mxCreateLogicalScalar` is unsuccessful if there is not enough free heap space to create the `mxArray`. If `mxCreateLogicalScalar` is unsuccessful in a MEX-file, the MEX-file prints an "Out of Memory" message, terminates, and returns control to the MATLAB prompt. If `mxCreateLogicalScalar` is unsuccessful in a stand alone (non-MEX-file) application, the function returns `NULL`.

Description

Call `mxCreateLogicalScalar` to create a scalar logical `mxArray`. `mxCreateLogicalScalar` is a convenience function that can be used in place of the following code:

```
pa = mxCreateLogicalMatrix(1, 1);
*mxGetLogicals(pa) = value;
```

When you finish using the `mxArray`, call `mxDestroyArray` to destroy it.

See Also

`mxCreateLogicalArray`, `mxCreateLogicalMatrix`, `mxIsLogicalScalar`, `mxIsLogicalScalarTrue`, `mxGetLogicals`, `mxDestroyArray`

mxCreateNumericArray (C and Fortran)

Purpose

Create unpopulated N-D numeric mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateNumericArray(mwSize ndim, const mwSize *dims,
         mxClassID classid, mxComplexity ComplexFlag);
```

Fortran Syntax

```
mwPointer mxCreateNumericArray(ndim, dims, classid,
  ComplexFlag)
mwSize ndim, dims
integer*4 classid, ComplexFlag
```

Arguments

`ndim`

Number of dimensions. If you specify a value for `ndim` that is less than 2, `mxCreateNumericArray` automatically sets the number of dimensions to 2.

`dims`

The dimensions array. Each element in the dimensions array contains the size of the array in that dimension. For example, in C, setting `dims[0]` to 5 and `dims[1]` to 7 establishes a 5-by-7 `mxArray`. In Fortran, setting `dims(1)` to `5` and `dims(2)` to `7` establishes a 5-by-7 `mxArray`. In most cases, there should be `ndim` elements in the `dims` array.

`classid`

An identifier for the class of the array, which determines the way the numerical data is represented in memory. For example, specifying `mxINT16_CLASS` in C causes each piece of numerical data in the `mxArray` to be represented as a 16-bit signed integer. In Fortran, use the function `mxClassIDFromClassName` to derive the `classid` value from a MATLAB class name. See the Description section for more information.

`ComplexFlag`

If the data you plan to put into the `mxArray` has no imaginary components, specify `mxREAL` in C (`0` in Fortran). If the data has some imaginary components, specify `mxCOMPLEX` in C (`1` in Fortran).

Returns

A pointer to the created `mxArray`, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCreateNumericArray` returns `NULL` in C (`0` in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. `mxCreateNumericArray` is unsuccessful when there is not enough free heap space to create the `mxArray`.

Description

Call `mxCreateNumericArray` to create an N-dimensional `mxArray` in which all data elements have the numeric data type specified by `classid`. After creating the `mxArray`, `mxCreateNumericArray` initializes all its real data elements to 0. If `ComplexFlag` equals `mxCOMPLEX` in C (`1` in Fortran), `mxCreateNumericArray` also initializes all its imaginary data elements to 0. `mxCreateNumericArray` differs from `mxCreateDoubleMatrix` in two important respects:

- All data elements in `mxCreateDoubleMatrix` are double-precision, floating-point numbers. The data elements in `mxCreateNumericArray` could be any numerical type, including different integer precisions.
- `mxCreateDoubleMatrix` can create two-dimensional arrays only; `mxCreateNumericArray` can create arrays of two or more dimensions.

`mxCreateNumericArray` allocates dynamic memory to store the created `mxArray`. When you finish with the created `mxArray`, call `mxDestroyArray` to deallocate its memory.

Any trailing singleton dimensions specified in the `dims` argument are automatically removed from the resulting array. For example, if `ndim` equals `5` and `dims` equals `[4 1 7 1 1]`, the resulting array is given the dimensions `4`-by-`1`-by-`7`.

The following table shows the C `classid` values and the Fortran data types that are equivalent to MATLAB classes.

MATLAB Class Name	C `classid` Value	Fortran Type
`int8`	`mxINT8_CLASS`	`BYTE`

MATLAB Class Name	C `classid` Value	Fortran Type
uint8	mxUINT8_CLASS	
int16	mxINT16_CLASS	INTEGER*2
uint16	mxUINT16_CLASS	
int32	mxINT32_CLASS	INTEGER*4
uint32	mxUINT32_CLASS	
int64	mxINT64_CLASS	INTEGER*8
uint64	mxUINT64_CLASS	
single	mxSINGLE_CLASS	REAL*4
double	mxDOUBLE_CLASS	REAL*8
single, with imaginary components	mxSINGLE_CLASS	COMPLEX*8
double, with imaginary components	mxDOUBLE_CLASS	COMPLEX*16

C Examples

See `phonebook.c` and `doubleelement.c` in the `refbook` subdirectory of the `examples` directory. For an additional example, see `mxisfinite.c` in the `mx` subdirectory of the examples directory.

Fortran Examples

To create a 4-by-4-by-2 array of `REAL*8` elements having no imaginary components, use:

```
C       Create 4x4x2 mxArray of REAL*8
        data dims / 4, 4, 2 /
        mxCreateNumericArray(3, dims,
     +                mxClassIDFromClassName('double'), 0)
```

See Also

`mxClassId`, `mxClassIdFromClassName`, `mxComplexity`, `mxCreateNumericMatrix`

Purpose

Create numeric matrix and initialize data elements to 0

C Syntax

```
#include "matrix.h"
mxArray *mxCreateNumericMatrix(mwSize m, mwSize n,
  mxClassID classid, mxComplexity ComplexFlag);
```

Fortran Syntax

```
mwPointer mxCreateNumericMatrix(m, n, classid,
  ComplexFlag)
mwSize m, n
integer*4 classid, ComplexFlag
```

Arguments

`m`
: The desired number of rows.

`n`
: The desired number of columns.

`classid`
: An identifier for the class of the array, which determines the way the numerical data is represented in memory. For example, specifying `mxINT16_CLASS` in C causes each piece of numerical data in the `mxArray` to be represented as a 16-bit signed integer. In Fortran, use the function `mxClassIDFromClassName` to derive the `classid` value from a MATLAB class name. See the Description section for more information.

`ComplexFlag`
: If the data you plan to put into the `mxArray` has no imaginary components, specify `mxREAL` in C (`0` in Fortran). If the data has some imaginary components, specify `mxCOMPLEX` in C (`1` in Fortran).

Returns

A pointer to the created `mxArray`, if successful. `mxCreateNumericMatrix` is unsuccessful if there is not enough free heap space to create the `mxArray`. If `mxCreateNumericMatrix` is unsuccessful in a MEX-file, the MEX-file prints an "Out of Memory" message, terminates, and control returns to the MATLAB prompt. If `mxCreateNumericMatrix`

is unsuccessful in a stand alone (non-MEX-file) application, `mxCreateNumericMatrix` returns `NULL` in C (`0` in Fortran).

Description

Call `mxCreateNumericMatrix` to create a 2-D `mxArray` in which all data elements have the numeric data type specified by `classid`. After creating the `mxArray`, `mxCreateNumericMatrix` initializes all its real data elements to 0. If `ComplexFlag` equals `mxCOMPLEX` in C (`1` in Fortran), `mxCreateNumericMatrix` also initializes all its imaginary data elements to 0. `mxCreateNumericMatrix` allocates dynamic memory to store the created `mxArray`. When you finish using the `mxArray`, call `mxDestroyArray` to destroy it.

The following table shows the C `classid` values and the Fortran data types that are equivalent to MATLAB classes.

MATLAB Class Name	C `classid` Value	Fortran Type
int8	mxINT8_CLASS	BYTE
uint8	mxUINT8_CLASS	
int16	mxINT16_CLASS	INTEGER*2
uint16	mxUINT16_CLASS	
int32	mxINT32_CLASS	INTEGER*4
uint32	mxUINT32_CLASS	
int64	mxINT64_CLASS	INTEGER*8
uint64	mxUINT64_CLASS	
single	mxSINGLE_CLASS	REAL*4
double	mxDOUBLE_CLASS	REAL*8

MATLAB Class Name	C classid Value	Fortran Type
single, with imaginary components	mxSINGLE_CLASS	COMPLEX*8
double, with imaginary components	mxDOUBLE_CLASS	COMPLEX*16

Fortran Examples

To create a 4-by-3 matrix of REAL*4 elements having no imaginary components, use:

```
C       Create 4x3 mxArray of REAL*4
        mxCreateNumericMatrix(4, 3,
     +                mxClassIDFromClassName('single'), 0)
```

See Also

mxClassId, mxClassIdFromClassName, mxComplexity, mxCreateNumericArray

mxCreateSparse (C and Fortran)

Purpose

Create 2-D unpopulated sparse mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateSparse(mwSize m, mwSize n, mwSize nzmax,
         mxComplexity ComplexFlag);
```

Fortran Syntax

```
mwPointer mxCreateSparse(m, n, nzmax, ComplexFlag)
mwSize m, n, nzmax
integer*4 ComplexFlag
```

Arguments

m
: The desired number of rows

n
: The desired number of columns

nzmax
: The number of elements that mxCreateSparse should allocate to hold the pr, ir, and, if ComplexFlag is mxCOMPLEX in C (1 in Fortran), pi arrays. Set the value of nzmax to be greater than or equal to the number of nonzero elements you plan to put into the mxArray, but make sure that nzmax is less than or equal to m*n.

ComplexFlag
: If the mxArray you are creating is to contain imaginary data, set ComplexFlag to mxCOMPLEX in C (1 in Fortran). Otherwise, set ComplexFlag to mxREAL in C (0 in Fortran).

Returns

A pointer to the created sparse double mxArray if successful, and NULL in C (0 in Fortran) otherwise. The most likely reason for failure is insufficient free heap space. If that happens, try reducing nzmax, m, or n.

Description

Call mxCreateSparse to create an unpopulated sparse double mxArray. The returned sparse mxArray contains no sparse information and cannot be passed as an argument to any MATLAB sparse functions. To make the returned sparse mxArray useful, you must initialize the pr, ir, jc, and (if it exists) pi arrays.

mxCreateSparse allocates space for

- A pr array of length nzmax.
- A pi array of length nzmax, but only if ComplexFlag is mxCOMPLEX in C (1 in Fortran).
- An ir array of length nzmax.
- A jc array of length n+1.

When you finish using the sparse mxArray, call mxDestroyArray to reclaim all its heap space.

C Examples

See fulltosparse.c in the refbook subdirectory of the examples directory.

See Also

mxDestroyArray, mxSetNzmax, mxSetPr, mxSetPi, mxSetIr, mxSetJc, mxComplexity

mxCreateSparseLogicalMatrix (C)

Purpose

Create unpopulated 2-D, sparse, logical `mxArray`

C Syntax

```
#include "matrix.h"
mxArray *mxCreateSparseLogicalMatrix(mwSize m, mwSize n,
  mwSize nzmax);
```

Arguments

`m`
: The desired number of rows

`n`
: The desired number of columns

`nzmax`
: The number of elements that `mxCreateSparseLogicalMatrix` should allocate to hold the data. Set the value of `nzmax` to be greater than or equal to the number of nonzero elements you plan to put into the `mxArray`, but make sure that `nzmax` is less than or equal to `m*n`.

Returns

A pointer to the created `mxArray`, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxCreateSparseLogicalMatrix` returns `NULL`. If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt. `mxCreateSparseLogicalMatrix` is unsuccessful when there is not enough free heap space to create the `mxArray`.

Description

Use `mxCreateSparseLogicalMatrix` to create an `m`-by-`n` `mxArray` of `mxLogical` elements. `mxCreateSparseLogicalMatrix` initializes each element in the array to logical `0`.

Call `mxDestroyArray` when you finish using the `mxArray`. `mxDestroyArray` deallocates the `mxArray` and its elements.

See Also

`mxCreateLogicalArray`, `mxCreateLogicalMatrix`, `mxCreateLogicalScalar`, `mxCreateSparse`, `mxIsLogical`

Purpose

Create 1-by-N string mxArray initialized to specified string

C Syntax

```
#include "matrix.h"
mxArray *mxCreateString(const char *str);
```

Fortran Syntax

```
mwPointer mxCreateString(str)
character*(*) str
```

Arguments

`str`

The string that is to serve as the mxArray's initial data

Returns

A pointer to the created string mxArray if successful, and NULL in C (0 in Fortran) otherwise. The most likely cause of failure is insufficient free heap space.

Description

Use mxCreateString to create a string mxArray initialized to str. Many MATLAB functions (for example, strcmp and upper) require string array inputs.

Free the string mxArray when you are finished using it. To free a string mxArray, call mxDestroyArray.

C Examples

See revord.c in the refbook subdirectory of the examples directory.

For additional examples, see mxcreatestructarray.c and mxisclass.c in the mx subdirectory of the examples directory.

Fortran Examples

See matdemo1.F in the eng_mat subdirectory of the examples directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

mxCreateCharMatrixFromStrings, mxCreateCharArray

mxCreateStructArray (C and Fortran)

Purpose

Create unpopulated N-D structure mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateStructArray(mwSize ndim, const mwSize *dims,
  int nfields, const char **fieldnames);
```

Fortran Syntax

```
mwPointer mxCreateStructArray(ndim, dims, nfields,
  fieldnames)
mwSize ndim, dims
integer*4 nfields
character*(*) fieldnames(nfields)
```

Arguments

`ndim`
: Number of dimensions. If you set `ndim` to be less than `2`, `mxCreateStructArray` creates a two-dimensional `mxArray`.

`dims`
: The dimensions array. Each element in the dimensions array contains the size of the array in that dimension. For example, in C, setting `dims[0]` to `5` and `dims[1]` to `7` establishes a `5`-by-`7` `mxArray`. In Fortran, setting `dims(1)` to `5` and `dims(2)` to `7` establishes a `5`-by-`7` `mxArray`. Typically, the `dims` array should have `ndim` elements.

`nfields`
: The desired number of fields in each element

`fieldnames`
: The desired list of field names

Each structure field name must begin with a letter and is case sensitive. The rest of the name may contain letters, numerals, and underscore characters. Use the `namelengthmax` function to determine the maximum length of a field name.

Returns

A pointer to the created structure `mxArray` if successful, and `NULL` in C (`0` in Fortran) otherwise. The most likely cause of failure is insufficient heap space to hold the returned `mxArray`.

Description

Call `mxCreateStructArray` to create an unpopulated structure `mxArray`. Each element of a structure `mxArray` contains the same number of fields (specified in `nfields`). Each field has a name; the list of names is specified in `fieldnames`. A MATLAB structure `mxArray` is conceptually identical to an array of `structs` in the C language.

Each field holds one `mxArray` pointer. `mxCreateStructArray` initializes each field to `NULL` in C (`0` in Fortran). Call `mxSetField` or `mxSetFieldByNumber` to place a non-`NULL` `mxArray` pointer in a field.

When you finish using the returned structure `mxArray`, call `mxDestroyArray` to reclaim its space.

Any trailing singleton dimensions specified in the `dims` argument are automatically removed from the resulting array. For example, if `ndim` equals `5` and `dims` equals `[4 1 7 1 1]`, the resulting array is given the dimensions 4-by-1-by-7.

C Examples

See `mxcreatestructarray.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxDestroyArray`, `mxAddField`, `mxRemoveField`, `mxSetField`, `mxSetFieldByNumber`

mxCreateStructMatrix (C and Fortran)

Purpose

Create unpopulated 2-D structure mxArray

C Syntax

```
#include "matrix.h"
mxArray *mxCreateStructMatrix(mwSize m, mwSize n, int nfields,
         const char **fieldnames);
```

Fortran Syntax

```
mwPointer mxCreateStructMatrix(m, n, nfields, fieldnames)
mwSize m, n
integer*4 nfields
character*(*) fieldnames(nfields)
```

Arguments

m
: The desired number of rows. This must be a positive integer.

n
: The desired number of columns. This must be a positive integer.

nfields
: The desired number of fields in each element.

fieldnames
: The desired list of field names.

Each structure field name must begin with a letter and is case sensitive. The rest of the name may contain letters, numerals, and underscore characters. Use the namelengthmax function to determine the maximum length of a field name.

Returns

A pointer to the created structure mxArray if successful, and NULL in C (0 in Fortran) otherwise. The most likely cause of failure is insufficient heap space to hold the returned mxArray.

Description

mxCreateStructMatrix and mxCreateStructArray are almost identical. The only difference is that mxCreateStructMatrix can create only two-dimensional mxArrays, while mxCreateStructArray can create mxArrays having two or more dimensions.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mxCreateStructArray`

mxDestroyArray (C and Fortran)

Purpose

Free dynamic memory allocated by `mxCreate*` functions

C Syntax

```
#include "matrix.h"
void mxDestroyArray(mxArray *pm);
```

Fortran Syntax

```
mxDestroyArray(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to the `mxArray` you want to free

Description

`mxDestroyArray` deallocates the memory occupied by the specified `mxArray`. `mxDestroyArray` not only deallocates the memory occupied by the `mxArray`'s characteristics fields (such as `m` and `n`), but also deallocates all the `mxArray`'s associated data arrays, such as `pr` and `pi` for complex arrays, `ir` and `jc` for sparse arrays, fields of structure arrays, and cells of cell arrays. Do not call `mxDestroyArray` on an `mxArray` you are returning on the left-hand side.

C Examples

See `sincall.c` in the `refbook` subdirectory of the `examples` directory.

Additional examples:

- `mexcallmatlab.c` and `mexgetarray.c` in the `mex` subdirectory of the `examples` directory
- `mxisclass.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxCalloc`, `mxMalloc`, `mxFree`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`

Purpose

Make deep copy of array

C Syntax

```
#include "matrix.h"
mxArray *mxDuplicateArray(const mxArray *in);
```

Fortran Syntax

```
mwPointer mxDuplicateArray(in)
mwPointer in
```

Arguments

`in`

Pointer to the `mxArray` you want to copy

Returns

Pointer to a copy of the array.

Description

`mxDuplicateArray` makes a deep copy of an array, and returns a pointer to the copy. A deep copy refers to a copy in which all levels of data are copied. For example, a deep copy of a cell array copies each cell and the contents of each cell (if any), and so on.

C Examples

See

- `mexget.c` in the `mex` subdirectory of the `examples` directory
- `phonebook.c` in the `refbook` subdirectory of the `examples` directory

For additional examples, see `mxcreatecellmatrix.c`, `mxgetinf.c`, and `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory.

mxFree (C and Fortran)

Purpose

Free dynamic memory allocated by `mxCalloc`, `mxMalloc`, or `mxRealloc`

C Syntax

```
#include "matrix.h"
void mxFree(void *ptr);
```

Fortran Syntax

```
mxFree(ptr)
mwPointer ptr
```

Arguments

`ptr`

Pointer to the beginning of any memory parcel allocated by `mxCalloc`, `mxMalloc`, or `mxRealloc`.

Description

`mxFree` deallocates heap space using the MATLAB memory management facility. This ensures correct memory management in error and abort (**Ctrl+C**) conditions.

To deallocate heap space, MATLAB applications in C should always call `mxFree` rather than the ANSI C `free` function.

The memory management facility maintains a list of all memory allocated by `mxCalloc`, `mxMalloc`, and `mxRealloc`. The memory management facility automatically deallocates all of a MEX-file's managed parcels when the MEX-file completes and control returns to the MATLAB prompt.

When `mxFree` appears in a stand alone MATLAB application, `mxFree` simply deallocates the contiguous heap space that begins at address `ptr`. In a MEX-file, `mxFree` also removes the memory parcel from the memory management facility's list of memory parcels.

In a MEX-file, your use of `mxFree` depends on whether the specified memory parcel is persistent or nonpersistent. By default, memory parcels created by `mxCalloc`, `mxMalloc`, and `mxRealloc` are nonpersistent. The memory management facility automatically frees all nonpersistent memory whenever a MEX-file completes. Thus, even if you do not call `mxFree`, MATLAB takes care of freeing the memory for you. Nevertheless, it is good programming practice to deallocate

memory as soon as you are through using it. Doing so generally makes the entire system run more efficiently.

If an application calls `mexMakeMemoryPersistent`, the specified memory parcel becomes persistent. When a MEX-file completes, the memory management facility does not free persistent memory parcels. Therefore, the only way to free a persistent memory parcel is to call `mxFree`. Typically, MEX-files call `mexAtExit` to register a cleanup handler. The cleanup handler calls `mxFree`.

C Examples

See `mxcalcsinglesubscript.c` in the `mx` subdirectory of the `examples` directory.

Additional examples:

- `phonebook.c` in the `refbook` subdirectory of the `examples` directory
- `explore.c` and `mexatexit.c` in the `mex` subdirectory of the `examples` directory
- `mxcreatecharmatrixfromstr.c`, `mxisfinite.c`, `mxmalloc.c`, and `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory

See Also

`mexAtExit`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mxCalloc`, `mxDestroyArray`, `mxMalloc`, `mxRealloc`

mxGetCell (C and Fortran)

Purpose

Get contents of `mxArray` cell

C Syntax

```
#include "matrix.h"
mxArray *mxGetCell(const mxArray *pm, mwIndex index);
```

Fortran Syntax

```
mwPointer mxGetCell(pm, index)
mwPointer pm
mwIndex index
```

Arguments

`pm`
: Pointer to a cell `mxArray`

`index`
: The number of elements in the cell `mxArray` between the first element and the desired one. See `mxCalcSingleSubscript` for details on calculating an index in a multidimensional cell array.

Returns

A pointer to the `i`th cell `mxArray` if successful, and `NULL` in C (`0` in Fortran) otherwise. Causes of failure include

- Specifying the index of a cell array element that has not been populated.
- Specifying a `pm` that does not point to a cell `mxArray`.
- Specifying an `index` greater than the number of elements in the cell.
- Insufficient free heap space to hold the returned cell `mxArray`.

Description

Call `mxGetCell` to get a pointer to the `mxArray` held in the indexed element of the cell `mxArray`.

Note Inputs to a MEX-file are constant read-only `mxArray`s and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

C Examples

See `explore.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mxCreateCellArray`, `mxIsCell`, `mxSetCell`

mxGetChars (C)

Purpose

Get pointer to character array data

C Syntax

```
#include "matrix.h"
mxChar *mxGetChars(const mxArray *array_ptr);
```

Arguments

`array_ptr`
Pointer to an `mxArray`

Returns

The address of the first character in the `mxArray`. Returns `NULL` if the specified array is not a character array.

Description

Call `mxGetChars` to determine the address of the first character in the `mxArray` that `array_ptr` points to. Once you have the starting address, you can access any other element in the `mxArray`.

See Also

`mxGetString`

Purpose

Get class of mxArray

C Syntax

```
#include "matrix.h"
mxClassID mxGetClassID(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxGetClassID(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

A numeric identifier of the class (category) of the mxArray that pm points to. The C-language class identifiers are listed in the mxClassID reference page.

Description

Use mxGetClassId to determine the class of an mxArray. The class of an mxArray identifies the kind of data the mxArray is holding. For example, if pm points to a logical mxArray, then mxGetClassId returns mxLOGICAL_CLASS (in C).

mxGetClassId is similar to mxGetClassName, except that the former returns the class as an integer identifier and the latter returns the class as a string.

C Examples

See

- phonebook.c in the refbook subdirectory of the examples directory
- explore.c in the mex subdirectory of the examples directory

See Also

mxClassID, mxGetClassName

mxGetClassName (C and Fortran)

Purpose

Get class of mxArray as string

C Syntax

```
#include "matrix.h"
const char *mxGetClassName(const mxArray *pm);
```

Fortran Syntax

```
character*(*) mxGetClassName(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

The class (as a string) of the mxArray pointed to by pm.

Description

Call mxGetClassName to determine the class of an mxArray. The class of an mxArray identifies the kind of data the mxArray is holding. For example, if pm points to a logical mxArray, mxGetClassName returns logical.

mxGetClassID is similar to mxGetClassName, except that the former returns the class as an integer identifier, as listed in the mxClassID reference page, and the latter returns the class as a string, as listed in the mxIsClass reference page.

C Examples

See mexfunction.c in the mex subdirectory of the examples directory. For an additional example, see mxisclass.c in the mx subdirectory of the examples directory.

See Also

mxGetClassID, mxIsClass

Purpose

Get pointer to data

C Syntax

```
#include "matrix.h"
void *mxGetData(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetData(pm)
mwPointer pm
```

Arguments

`pm`
Pointer to an `mxArray`

Returns

The address of the first element of the real data. Returns `NULL` in C (`0` in Fortran) if there is no real data.

Description

Similar to `mxGetPr`, except that in C, `mxGetData` returns a `void *`.

To copy values from the returned pointer to Fortran, use one of the `mxCopyPtrTo*` functions in the following manner:

```
C      Get the data in mxArray, pm
       mxCopyPtrToReal8(mxGetData(pm), data,
     +                      mxGetNumberOfElements(pm))
```

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

For additional examples, see `mxcreatecharmatrixfromstr.c` and `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetImagData`, `mxGetPr`

mxGetDimensions (C and Fortran)

Purpose

Get pointer to dimensions array

C Syntax

```
#include "matrix.h"
const mwSize *mxGetDimensions(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetDimensions(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`.

Returns

The address of the first element in the dimensions array. Each integer in the dimensions array represents the number of elements in a particular dimension. The array is not `NULL` terminated.

Description

Use `mxGetDimensions` to determine how many elements are in each dimension of the `mxArray` that `pm` points to. Call `mxGetNumberOfDimensions` to get the number of dimensions in the `mxArray`.

To copy the values to Fortran, use `mxCopyPtrToInteger4` in the following manner:

```
C      Get dimensions of mxArray, pm
       mxCopyPtrToInteger4(mxGetDimensions(pm), dims,
     +                     mxGetNumberOfDimensions(pm))
```

C Examples

See `mxcalcsinglesubscript.c` in the `mx` subdirectory of the `examples` directory.

Additional examples:

- `findnz.c` and `phonebook.c` in the `refbook` subdirectory of the `examples` directory
- `explore.c` in the `mex` subdirectory of the `examples` directory

- `mxgeteps.c` and `mxisfinite.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxGetNumberOfDimensions`

mxGetElementSize (C and Fortran)

Purpose

Get number of bytes required to store each data element

C Syntax

```
#include "matrix.h"
mwSize mxGetElementSize(const mxArray *pm);
```

Fortran Syntax

```
mwSize mxGetElementSize(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

The number of bytes required to store one element of the specified `mxArray`, if successful. Returns 0 on failure. The primary reason for failure is that `pm` points to an `mxArray` having an unrecognized class. If `pm` points to a cell `mxArray` or a structure `mxArray`, `mxGetElementSize` returns the size of a pointer (not the size of all the elements in each cell or structure field).

Description

Call `mxGetElementSize` to determine the number of bytes in each data element of the `mxArray`. For example, if the MATLAB class of an `mxArray` is `int16`, the `mxArray` stores each data element as a 16-bit (2-byte) signed integer. Thus, `mxGetElementSize` returns `2`.

`mxGetElementSize` is particularly helpful when using a non-MATLAB routine to manipulate data elements. For example, the C function `memcpy` requires (for its third argument) the size of the elements you intend to copy.

C Examples

See `doubleelement.c` and `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mxGetM`, `mxGetN`

Purpose

Get value of `eps`

C Syntax

```
#include "matrix.h"
double mxGetEps(void);
```

Fortran Syntax

```
real*8 mxGetEps
```

Returns

The value of the MATLAB `eps` variable

Description

Call `mxGetEps` to return the value of the MATLAB `eps` variable. This variable holds the distance from 1.0 to the next largest floating-point number. As such, it is a measure of floating-point accuracy. The MATLAB `pinv` and `rank` functions use `eps` as a default tolerance.

C Examples

See `mxgeteps.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetInf`, `mxGetNan`

mxGetField (C and Fortran)

Purpose

Get field value, given field name and index into structure array

C Syntax

```
#include "matrix.h"
mxArray *mxGetField(const mxArray *pm, mwIndex index,
         const char *fieldname);
```

Fortran Syntax

```
mwPointer mxGetField(pm, index, fieldname)
mwPointer pm
mwIndex index
character*(*) fieldname
```

Arguments

`pm`

Pointer to a structure `mxArray`

`index`

Index of the desired element.

In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

`fieldname`

The name of the field whose value you want to extract.

Returns

A pointer to the `mxArray` in the specified field at the specified `fieldname`, on success. Returns `NULL` in C (`0` in Fortran) if passed an invalid argument or if there is no value assigned to the specified field. Common causes of failure include:

- Specifying an array pointer `pm` that does not point to a structure `mxArray`. To determine whether `pm` points to a structure `mxArray`, call `mxIsStruct`.

- Specifying an `index` to an element outside the bounds of the `mxArray`. For example, given a structure `mxArray` that contains 10 elements, you cannot specify an `index` greater than `9` in C (`10` in Fortran).
- Specifying a nonexistent `fieldname`. Call `mxGetFieldNameByNumber` or `mxGetFieldNumber` to get existing field names.
- Insufficient heap space to hold the returned `mxArray`.

Description

Call `mxGetField` to get the value held in the specified element of the specified field. In pseudo-C terminology, `mxGetField` returns the value at:

```
pm[index].fieldname
```

`mxGetFieldByNumber` is similar to `mxGetField`. Both functions return the same value. The only difference is in the way you specify the field. `mxGetFieldByNumber` takes a field number as its third argument, and `mxGetField` takes a field name as its third argument.

Note Inputs to a MEX-file are constant read-only `mxArray`s and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

In C, calling:

```
mxGetField(pa, index, "field_name");
```

is equivalent to calling:

```
field_num = mxGetFieldNumber(pa, "field_name");
mxGetFieldByNumber(pa, index, field_num);
```

where `index` is `0` if you have a `1`-by-`1` structure.

In Fortran, calling:

```
mxGetField(pm, index, 'fieldname')
```

is equivalent to calling:

```
fieldnum = mxGetFieldNumber(pm, 'fieldname')
mxGetFieldByNumber(pm, index, fieldnum)
```

where `index` is `1` if you have a `1`-by-`1` structure.

See Also

`mxGetFieldByNumber`, `mxGetFieldNameByNumber`, `mxGetFieldNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetField`, `mxSetFieldByNumber`

Purpose

Get field value, given field number and index into structure array

C Syntax

```
#include "matrix.h"
mxArray *mxGetFieldByNumber(const mxArray *pm, mwIndex index,
         int fieldnumber);
```

Fortran Syntax

```
mwPointer mxGetFieldByNumber(pm, index, fieldnumber)
mwPointer pm
mwIndex index
integer*4 fieldnumber
```

Arguments

`pm`

Pointer to a structure `mxArray`

`index`

Index of the desired element.

In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

See `mxCalcSingleSubscript` for more details on calculating an `index`.

`fieldnumber`

The position of the field whose value you want to extract

In C, the first field within each element has a field number of `0`, the second field has a field number of `1`, and so on. The last field has a field number of `N-1`, where `N` is the number of fields.

In Fortran, the first field within each element has a field number of `1`, the second field has a field number of `2`, and so on. The last field has a field number of `N`, where `N` is the number of fields.

Returns

A pointer to the `mxArray` in the specified field for the desired element, on success. Returns `NULL` in C (`0` in Fortran) if passed an invalid argument or if there is no value assigned to the specified field. Common causes of failure include:

- Specifying an array pointer `pm` that does not point to a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` points to a structure `mxArray`.
- Specifying an `index` to an element outside the bounds of the `mxArray`. For example, given a structure `mxArray` that contains 10 elements, you cannot specify an `index` greater than `9` in C (`10` in Fortran).
- Specifying a nonexistent field number. Call `mxGetFieldNumber` to determine the field number that corresponds to a given field name.

Description

Call `mxGetFieldByNumber` to get the value held in the specified `fieldnumber` at the indexed element.

Note Inputs to a MEX-file are constant read-only `mxArray`s and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

In C, calling:

```
mxGetField(pa, index, "field_name");
```

is equivalent to calling:

```
field_num = mxGetFieldNumber(pa, "field_name");
mxGetFieldByNumber(pa, index, field_num);
```

where `index` is `0` if you have a `1`-by-`1` structure.

In Fortran, calling:

```
mxGetField(pm, index, 'fieldname')
```

is equivalent to calling:

```
fieldnum = mxGetFieldNumber(pm, 'fieldname')
mxGetFieldByNumber(pm, index, fieldnum)
```

where `index` is `1` if you have a `1`-by-`1` structure.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

Additional examples:

- `mxisclass.c` in the `mx` subdirectory of the `examples` directory
- `explore.c` in the `mex` subdirectory of the `examples` directory

See Also

`mxGetField`, `mxGetFieldNameByNumber`, `mxGetFieldNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetField`, `mxSetFieldByNumber`

mxGetFieldNameByNumber (C and Fortran)

Purpose

Get field name, given field number in structure array

C Syntax

```
#include "matrix.h"
const char *mxGetFieldNameByNumber(const mxArray *pm,
            int fieldnumber);
```

Fortran Syntax

```
character*(*) mxGetFieldNameByNumber(pm, fieldnumber)
mwPointer pm
integer*4 fieldnumber
```

Arguments

`pm`

Pointer to a structure `mxArray`

`fieldnumber`

The position of the desired field. For instance, in C, to get the name of the first field, set `fieldnumber` to 0; to get the name of the second field, set `fieldnumber` to 1; and so on. In Fortran, to get the name of the first field, set `fieldnumber` to `1`; to get the name of the second field, set `fieldnumber` to `2`; and so on.

Returns

A pointer to the nth field name, on success. Returns `NULL` in C (`0` in Fortran) on failure. Common causes of failure include

- Specifying an array pointer `pm` that does not point to a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` points to a structure `mxArray`.
- Specifying a value of `fieldnumber` outside the bounds of the number of fields in the structure `mxArray`. In C, `fieldnumber` 0 represents the first field, and `fieldnumber` `N-1` represents the last field, where `N` is the number of fields in the structure `mxArray`. In Fortran, `fieldnumber` `1` represents the first field, and `fieldnumber` `N` represents the last field.

Description

Call `mxGetFieldNameByNumber` to get the name of a field in the given structure `mxArray`. A typical use of `mxGetFieldNameByNumber` is to

call it inside a loop in order to get the names of all the fields in a given `mxArray`.

Consider a MATLAB structure initialized to:

```
patient.name = 'John Doe';
patient.billing = 127.00;
patient.test = [79 75 73; 180 178 177.5; 220 210 205];
```

In C, the field number `0` represents the field `name`; field number `1` represents field `billing`; field number `2` represents field `test`. A field number other than `0`, `1`, or `2` causes `mxGetFieldNameByNumber` to return `NULL`.

In Fortran, the field number `1` represents the field `name`; field number `2` represents field `billing`; field number `3` represents field `test`. A field number other than `1`, `2`, or `3` causes `mxGetFieldNameByNumber` to return `0`.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

Additional examples:

- `mxisclass.c` in the `mx` subdirectory of the `examples` directory
- `explore.c` in the `mex` subdirectory of the `examples` directory

See Also

`mxGetField`, `mxGetFieldByNumber`, `mxGetFieldNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetField`, `mxSetFieldByNumber`

mxGetFieldNumber (C and Fortran)

Purpose

Get field number, given field name in structure array

C Syntax

```
#include "matrix.h"
int mxGetFieldNumber(const mxArray *pm,
    const char *fieldname);
```

Fortran Syntax

```
integer*4 mxGetFieldNumber(pm, fieldname)
mwPointer pm
character*(*) fieldname
```

Arguments

`pm`
Pointer to a structure `mxArray`.

`fieldname`
The name of a field in the structure `mxArray`.

Returns

The field number of the specified `fieldname`, on success. In C, the first field has a field number of `0`, the second field has a field number of `1`, and so on. In Fortran, the first field has a field number of `1`, the second field has a field number of `2`, and so on. Returns `-1` in C (`0` in Fortran) on failure. Common causes of failure include

- Specifying an array pointer `pm` that does not point to a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` points to a structure `mxArray`.
- Specifying the `fieldname` of a nonexistent field.

Description

If you know the name of a field but do not know its field number, call `mxGetFieldNumber`. Conversely, if you know the field number but do not know its field name, call `mxGetFieldNameByNumber`.

For example, consider a MATLAB structure initialized to:

```
patient.name = 'John Doe';
patient.billing = 127.00;
patient.test = [79 75 73; 180 178 177.5; 220 210 205];
```

In C, the field `name` has a field number of `0`; the field `billing` has a field number of `1`; and the field `test` has a field number of `2`. If you call `mxGetFieldNumber` and specify a field name of anything other than `name`, `billing`, or `test`, `mxGetFieldNumber` returns `-1`.

Calling:

```
mxGetField(pa, index, "field_name");
```

is equivalent to calling:

```
field_num = mxGetFieldNumber(pa, "field_name");
mxGetFieldByNumber(pa, index, field_num);
```

where `index` is `0` if you have a `1`-by-`1` structure.

In Fortran, the field `name` has a field number of `1`; the field `billing` has a field number of `2`; and the field `test` has a field number of `3`. If you call `mxGetFieldNumber` and specify a field name of anything other than `name`, `billing`, or `test`, `mxGetFieldNumber` returns `0`.

Calling:

```
mxGetField(pm, index, 'fieldname');
```

is equivalent to calling:

```
fieldnum = mxGetFieldNumber(pm, 'fieldname');
mxGetFieldByNumber(pm, index, fieldnum);
```

where `index` is `1` if you have a `1`-by-`1` structure.

C Examples

See `mxcreatestructarray.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetField`, `mxGetFieldByNumber`, `mxGetFieldNameByNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetField`, `mxSetFieldByNumber`

mxGetImagData (C and Fortran)

Purpose

Get pointer to imaginary data of `mxArray`

C Syntax

```
#include "matrix.h"
void *mxGetImagData(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetImagData(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

The address of the first element of the imaginary data, on success. Returns `NULL` in C (`0` in Fortran) if there is no imaginary data or if there is an error.

Description

This function is similar to `mxGetPi`, except that in C it returns a `void *`.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetData`, `mxGetPi`

Purpose

Get value of infinity

C Syntax

```
#include "matrix.h"
double mxGetInf(void);
```

Fortran Syntax

```
real*8 mxGetInf
```

Returns

The value of infinity on your system.

Description

Call `mxGetInf` to return the value of the MATLAB internal `inf` variable. `inf` is a permanent variable representing IEEE® arithmetic positive infinity. The value of `inf` is built into the system; you cannot modify it.

Operations that return infinity include

- Division by 0. For example, 5/0 returns infinity.
- Operations resulting in overflow. For example, `exp(10000)` returns infinity because the result is too large to be represented on your machine.

C Examples

See `mxgetinf.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetEps`, `mxGetNaN`

mxGetIr (C and Fortran)

Purpose

Get ir array of sparse matrix

C Syntax

```
#include "matrix.h"
mwIndex *mxGetIr(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetIr(pm)
mwPointer pm
```

Arguments

pm

Pointer to a sparse mxArray

Returns

A pointer to the first element in the ir array, if successful, and NULL in C (0 in Fortran) otherwise. Possible causes of failure include

- Specifying a full (nonsparse) mxArray.
- Specifying a value for pm that is NULL in C (0 in Fortran). This usually means that an earlier call to mxCreateSparse failed.

Description

Use mxGetIr to obtain the starting address of the ir array. The ir array is an array of integers; the length of the ir array is typically nzmax values. For example, if nzmax equals 100, the ir array should contain 100 integers.

Each value in an ir array indicates a row (offset by 1) at which a nonzero element can be found. (The jc array is an index that indirectly specifies a column where nonzero elements can be found.)

For details on the ir and jc arrays, see mxSetIr and mxSetJc.

C Examples

See fulltosparse.c in the refbook subdirectory of the examples directory.

Additional examples:

- explore.c in the mex subdirectory of the examples directory

- `mxsetdimensions.c` and `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxGetJc`, `mxGetNzmax`, `mxSetIr`, `mxSetJc`, `mxSetNzmax`

mxGetJc (C and Fortran)

Purpose

Get jc array of sparse matrix

C Syntax

```
#include "matrix.h"
mwIndex *mxGetJc(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetJc(pm)
mwPointer pm
```

Arguments

pm

Pointer to a sparse mxArray

Returns

A pointer to the first element in the jc array, if successful, and NULL in C (0 in Fortran) otherwise. Possible causes of failure include

- Specifying a full (nonsparse) mxArray.
- Specifying a value for pm that is NULL in C (0 in Fortran). This usually means that an earlier call to mxCreateSparse failed.

Description

Use mxGetJc to obtain the starting address of the jc array. The jc array is an integer array having n+1 elements, where n is the number of columns in the sparse mxArray. The values in the jc array indirectly indicate columns containing nonzero elements. For a detailed explanation of the jc array, see mxSetJc.

C Examples

See fulltosparse.c in the refbook subdirectory of the examples directory.

Additional examples:

- explore.c in the mex subdirectory of the examples directory
- mxgetnzmax.c, mxsetdimensions.c, and mxsetnzmax.c in the mx subdirectory of the examples directory

See Also

mxGetIr, mxGetNzmax, mxSetIr, mxSetJc, mxSetNzmax

Purpose

Get pointer to logical array data

C Syntax

```
#include "matrix.h"
mxLogical *mxGetLogicals(const mxArray *array_ptr);
```

Arguments

`array_ptr`
Pointer to an `mxArray`

Returns

The address of the first logical element in the `mxArray`. The result is unspecified if the `mxArray` is not a logical array.

Description

Call `mxGetLogicals` to determine the address of the first logical element in the `mxArray` that `array_ptr` points to. Once you have the starting address, you can access any other element in the `mxArray`.

See Also

`mxCreateLogicalArray`, `mxCreateLogicalMatrix`, `mxCreateLogicalScalar`, `mxIsLogical`, `mxIsLogicalScalar`, `mxIsLogicalScalarTrue`

mxGetM (C and Fortran)

Purpose

Get number of rows in mxArray

C Syntax

```
#include "matrix.h"
size_t mxGetM(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetM(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

The number of rows in the mxArray to which pm points.

Description

mxGetM returns the number of rows in the specified array. The term *rows* always means the first dimension of the array, no matter how many dimensions the array has. For example, if pm points to a four-dimensional array having dimensions 8-by-9-by-5-by-3, mxGetM returns 8.

Note Fortran does not have an equivalent of size_t. mwPointer is a preprocessor macro that provides the appropriate Fortran type. The value returned by this function, however, is not a pointer.

C Examples

See convec.c in the refbook subdirectory of the examples directory.

Additional examples:

- fulltosparse.c, revord.c, timestwo.c, and xtimesy.c in the refbook subdirectory of the examples directory
- explore.c, mexget.c, mexlock.c, mexsettrapflag.c and yprime.c in the mex subdirectory of the examples directory
- mxmalloc.c, mxsetdimensions.c, mxgetnzmax.c, and mxsetnzmax.c in the mx subdirectory of the examples directory

Fortran Examples

See `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

`mxGetN`, `mxSetM`, `mxSetN`

mxGetN (C and Fortran)

Purpose

Get number of columns in mxArray

C Syntax

```
#include "matrix.h"
size_t mxGetN(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetN(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

The number of columns in the mxArray.

Description

Call mxGetN to determine the number of columns in the specified mxArray.

If pm is an N-dimensional mxArray, mxGetN is the product of dimensions 2 through N. For example, if pm points to a four-dimensional mxArray having dimensions 13-by-5-by-4-by-6, mxGetN returns the value 120 (5 × 4 × 6). If the specified mxArray has more than two dimensions and you need to know exactly how many elements are in each dimension, call mxGetDimensions.

If pm points to a sparse mxArray, mxGetN still returns the number of columns, not the number of occupied columns.

Note Fortran does not have an equivalent of size_t. mwPointer is a preprocessor macro that provides the appropriate Fortran type. The value returned by this function, however, is not a pointer.

C Examples

See convec.c in the refbook subdirectory of the examples directory.

Additional examples:

- `fulltosparse.c`, `revord.c`, `timestwo.c`, and `xtimesy.c` in the `refbook` subdirectory of the `examples` directory
- `explore.c`, `mexget.c`, `mexlock.c`, `mexsettrapflag.c` and `yprime.c` in the `mex` subdirectory of the `examples` directory
- `mxmalloc.c`, `mxsetdimensions.c`, `mxgetnzmax.c`, and `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory

Fortran Examples

See `matdemo2.F` in the `eng_mat` subdirectory of the `examples` directory for a sample program that illustrates how to use this routine in a Fortran program.

See Also

`mxGetM`, `mxGetDimensions`, `mxSetM`, `mxSetN`

mxGetNaN (C and Fortran)

Purpose

Get value of `NaN` (Not-a-Number)

C Syntax

```
#include "matrix.h"
double mxGetNaN(void);
```

Fortran Syntax

```
real*8 mxGetNaN
```

Returns

The value of `NaN` (Not-a-Number) on your system

Description

Call `mxGetNaN` to return the value of `NaN` for your system. `NaN` is the IEEE arithmetic representation for Not-a-Number. Certain mathematical operations return `NaN` as a result, for example,

- `0.0/0.0`
- `Inf-Inf`

The value of Not-a-Number is built in to the system. You cannot modify it.

C Examples

See `mxgetinf.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetEps`, `mxGetInf`

Purpose

Get number of dimensions in `mxArray`

C Syntax

```
#include "matrix.h"
mwSize mxGetNumberOfDimensions(const mxArray *pm);
```

Fortran Syntax

```
mwSize mxGetNumberOfDimensions(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

The number of dimensions in the specified `mxArray`. The returned value is always `2` or greater.

Description

Use `mxGetNumberOfDimensions` to determine how many dimensions are in the specified array. To determine how many elements are in each dimension, call `mxGetDimensions`.

C Examples

See `explore.c` in the `mex` subdirectory of the `examples` directory.

Additional examples:

- `findnz.c`, `fulltosparse.c`, and `phonebook.c` in the `refbook` subdirectory of the `examples` directory
- `mxcalcsinglesubscript.c`, `mxgeteps.c`, and `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxSetM`, `mxSetN`, `mxGetDimensions`

mxGetNumberOfElements (C and Fortran)

Purpose

Get number of elements in mxArray

C Syntax

```
#include "matrix.h"
mwSize mxGetNumberOfElements(const mxArray *pm);
```

Fortran Syntax

```
mwSize mxGetNumberOfElements(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Number of elements in the specified mxArray

Description

mxGetNumberOfElements tells you how many elements an array has. For example, if the dimensions of an array are 3-by-5-by-10, mxGetNumberOfElements returns the number 150.

C Examples

See findnz.c and phonebook.c in the refbook subdirectory of the examples directory.

Additional examples:

- explore.c in the mex subdirectory of the examples directory
- mxcalcsinglesubscript.c, mxgeteps.c, mxgetinf.c, mxisfinite.c, and mxsetdimensions.c in the mx subdirectory of the examples directory

See Also

mxGetDimensions, mxGetM, mxGetN, mxGetClassID, mxGetClassName

Purpose

Get number of fields in structure `mxArray`

C Syntax

```
#include "matrix.h"
int mxGetNumberOfFields(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxGetNumberOfFields(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to a structure `mxArray`

Returns

The number of fields, on success. Returns `0` on failure. The most common cause of failure is that `pm` is not a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` is a structure.

Description

Call `mxGetNumberOfFields` to determine how many fields are in the specified structure `mxArray`.

Once you know the number of fields in a structure, you can loop through every field in order to set or to get field values.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

Additional examples:

- `mxisclass.c` in the `mx` subdirectory of the `examples` directory
- `explore.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mxGetField`, `mxIsStruct`, `mxSetField`

mxGetNzmax (C and Fortran)

Purpose

Get number of elements in `ir`, `pr`, and `pi` arrays

C Syntax

```
#include "matrix.h"
mwSize mxGetNzmax(const mxArray *pm);
```

Fortran Syntax

```
mwSize mxGetNzmax(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to a sparse `mxArray`

Returns

The number of elements allocated to hold nonzero entries in the specified sparse `mxArray`, on success. Returns an indeterminate value on error. The most likely cause of failure is that `pm` points to a full (nonsparse) `mxArray`.

Description

Use `mxGetNzmax` to get the value of the `nzmax` field. The `nzmax` field holds an integer value that signifies the number of elements in the `ir`, `pr`, and, if it exists, the `pi` arrays. The value of `nzmax` is always greater than or equal to the number of nonzero elements in a sparse `mxArray`. In addition, the value of `nzmax` is always less than or equal to the number of rows times the number of columns.

As you adjust the number of nonzero elements in a sparse `mxArray`, MATLAB software often adjusts the value of the `nzmax` field. MATLAB adjusts `nzmax` in order to reduce the number of costly reallocations and in order to optimize its use of heap space.

C Examples

See `mxgetnzmax.c` and `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxSetNzmax`

Purpose

Get imaginary data elements in mxArray

C Syntax

```
#include "matrix.h"
double *mxGetPi(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetPi(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

The imaginary data elements of the specified mxArray, on success. Returns NULL in C (0 in Fortran) if there is no imaginary data or if there is an error.

Description

The pi field points to an array containing the imaginary data of the mxArray. Call mxGetPi to get the contents of the pi field, that is, to get the starting address of this imaginary data.

The best way to determine whether an mxArray is purely real is to call mxIsComplex.

The imaginary parts of all input matrices to a MATLAB function are allocated if any of the input matrices are complex.

C Examples

See convec.c, findnz.c, and fulltosparse.c in the refbook subdirectory of the examples directory.

Additional examples:

- explore.c and mexcallmatlab.c in the mex subdirectory of the examples directory
- mxcalcsinglesubscript.c, mxgetinf.c, mxisfinite.c, and mxsetnzmax.c in the mx subdirectory of the examples directory

See Also

mxGetPr, mxSetPi, mxSetPr

mxGetPr (C and Fortran)

Purpose

Get real data elements in mxArray

C Syntax

```
#include "matrix.h"
double *mxGetPr(const mxArray *pm);
```

Fortran Syntax

```
mwPointer mxGetPr(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

The address of the first element of the real data. Returns NULL in C (0 in Fortran) if there is no real data.

Description

Call mxGetPr to determine the starting address of the real data in the mxArray that pm points to. Once you have the starting address, you can access any other element in the mxArray.

C Examples

See convec.c, doubleelement.c, findnz.c, fulltosparse.c, sincall.c, timestwo.c, timestwoalt.c, and xtimesy.c in the refbook subdirectory of the examples directory.

See Also

mxGetPi, mxSetPi, mxSetPr

Purpose

Get value of public property of MATLAB object

C Syntax

```
#include "matrix.h"
mxArray *mxGetProperty(const mxArray *pa, mwIndex index,
          const char *propname);
```

Fortran Syntax

```
mwPointer mxGetProperty(pa, index, propname)
mwPointer pa
mwIndex index
character*(*) propname
```

Arguments

`pa`

Pointer to an `mxArray` which is an object.

`index`

Index of the desired element of the object array.

In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

`propname`

Name of the property whose value you want to extract.

Returns

A pointer to the `mxArray` of the specified `propname` on success. Returns `NULL` in C (`0` in Fortran) if unsuccessful. Common causes of failure include:

- Specifying a nonexistent `propname`.
- Specifying a nonpublic `propname`.
- Specifying a COM or Java object.

- Specifying an `index` to an element outside the bounds of the `mxArray`. Use `mxGetNumberOfElements` or `mxGetM` and `mxGetN` to test the index value.
- Insufficient memory (in the heap) to hold the returned `mxArray`.

Description

Call `mxGetProperty` to get the value held in the specified element. In pseudo-C terminology, `mxGetProperty` returns the value at:

```
pa[index].propname
```

See Also

`mxSetProperty`, `mxGetNumberOfElements`, `mxGetM`, `mxGetN`

Purpose

Get real component of first data element in mxArray

C Syntax

```
#include "matrix.h"
double mxGetScalar(const mxArray *pm);
```

Fortran Syntax

```
real*8 mxGetScalar(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray; cannot be a cell mxArray, a structure mxArray, or an empty mxArray.

Returns

The value of the first real (nonimaginary) element of the mxArray.

In C, mxGetScalar returns a double. If real elements in the mxArray are stored as something other than double, mxGetScalar automatically converts the scalar value into a double. To preserve the original data representation of the scalar, you must cast the return value to the desired data type.

mxGetScalar should only be called when pm points to a nonempty numeric, logical, or char mxArray. Use mx functions such as mxIsEmpty, mxIsLogical, mxIsNumeric, or mxIsChar to test for this condition before calling mxGetScalar.

If pm points to a sparse mxArray, mxGetScalar returns the value of the first nonzero real element in the mxArray. If there are no nonzero elements, mxGetScalar returns 0.

Description

Call mxGetScalar to get the value of the first real (nonimaginary) element of the mxArray.

In most cases, you call mxGetScalar when pm points to an mxArray containing only one element (a scalar). However, pm can point to an mxArray containing many elements. If pm points to an mxArray containing multiple elements, mxGetScalar returns the value of the first real element. If pm points to a two-dimensional mxArray, mxGetScalar returns the value of the (1,1) element; if pm points to

a three-dimensional `mxArray`, `mxGetScalar` returns the value of the `(1,1,1)` element; and so on.

C Examples

See `timestwoalt.c` and `xtimesy.c` in the `refbook` subdirectory of the `examples` directory.

Additional examples:

- `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory
- `mexlock.c` and `mexsettrapflag.c` in the `mex` subdirectory of the `examples` directory

See Also

`mxGetM`, `mxGetN`

Purpose

Copy string mxArray to C-style string

C Syntax

```
#include "matrix.h"
int mxGetString(const mxArray *pm, char *str, mwSize strlen);
```

Fortran Syntax

```
integer*4 mxGetString(pm, str, strlen)
mwPointer pm
character*(*) str
mwSize strlen
```

Arguments

pm
: Pointer to a string mxArray; that is, a pointer to an mxArray having the mxCHAR_CLASS class.

str
: The starting location into which the string should be written. mxGetString writes the character data into str and then, in C, terminates the string with a NULL character (in the manner of C strings). str can point to either dynamic or static memory.

strlen
: Maximum number of characters to read into str. Typically, in C, you set strlen to 1 plus the number of elements in the string mxArray to which pm points. See the mxGetM and mxGetN reference pages to find out how to get the number of elements.

Returns

0 on success, and 1 on failure. Possible reasons for failure include

- Specifying an mxArray that is not a string mxArray.
- Specifying strlen with less than the number of characters needed to store the entire mxArray pointed to by pm. If this is the case, 1 is returned and the string is truncated.

Description

Call mxGetString to copy the character data of a string mxArray into a C-style string in C or a character array in Fortran. The copied string starts at str and contains no more than strlen-1 characters in C (no

more than `strlen` characters in Fortran). In C, the C-style string is always terminated with a `NULL` character.

If the string array contains several rows, they are copied—one column at a time—into one long string array.

Multibyte Character Sets

This function is for use only with strings that represent single-byte character sets. For strings that represent multibyte character sets, use the C function `mxArrayToString`. Fortran users must allocate sufficient space for the return string to avoid possible truncation.

```
strlen = (mxGetM(prhs[0]) * mxGetN(prhs[0]) * sizeof(mxChar)) + 1
```

C Examples

Examples:

- `explore.c` in the `mex` subdirectory of the `examples` directory
- `mxmalloc.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxArrayToString`, `mxCreateCharArray`, `mxCreateCharMatrixFromStrings`, `mxCreateString`

Purpose

Determine whether input is cell mxArray

C Syntax

```
#include "matrix.h"
bool mxIsCell(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsCell(pm)
mwPointer pm
```

Arguments

pm
: Pointer to an mxArray

Returns

Logical 1 (true) if pm points to an array having the class mxCELL_CLASS, and logical 0 (false) otherwise.

Description

Use mxIsCell to determine whether the specified array is a cell array.

In C, calling mxIsCell is equivalent to calling:

```
mxGetClassID(pm) == mxCELL_CLASS
```

In Fortran, calling mxIsCell is equivalent to calling:

```
mxGetClassName(pm) .eq. 'cell'
```

Note mxIsCell does not answer the question "Is this mxArray a cell of a cell array?" An individual cell of a cell array can be of any type.

See Also

mxIsClass

mxIsChar (C and Fortran)

Purpose

Determine whether input is string mxArray

C Syntax

```
#include "matrix.h"
bool mxIsChar(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsChar(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if pm points to an array having the class mxCHAR_CLASS, and logical 0 (false) otherwise.

Description

Use mxIsChar to determine whether pm points to string mxArray.

In C, calling mxIsChar is equivalent to calling:

```
mxGetClassID(pm) == mxCHAR_CLASS
```

In Fortran, calling mxIsChar is equivalent to calling:

```
mxGetClassName(pm) .eq. 'char'
```

C Examples

See phonebook.c and revord.c in the refbook subdirectory of the examples directory.

For additional examples, see mxcreatecharmatrixfromstr.c, mxislogical.c, and mxmalloc.c in the mx subdirectory of the examples directory.

See Also

mxIsClass, mxGetClassID

Purpose

Determine whether `mxArray` is member of specified class

C Syntax

```
#include "matrix.h"
bool mxIsClass(const mxArray *pm, const char *classname);
```

Fortran Syntax

```
integer*4 mxIsClass(pm, classname)
mwPointer pm
character*(*) classname
```

Arguments

`pm`

Pointer to an `mxArray`

`classname`

The array category that you are testing. Specify `classname` as a string (not as an integer identifier). You can specify any one of the following predefined constants:

Value of classname	Corresponding Class
`cell`	`mxCELL_CLASS`
`char`	`mxCHAR_CLASS`
`double`	`mxDOUBLE_CLASS`
`function_handle`	`mxFUNCTION_CLASS`
`int8`	`mxINT8_CLASS`
`int16`	`mxINT16_CLASS`
`int32`	`mxINT32_CLASS`
`int64`	`mxINT64_CLASS`
`logical`	`mxLOGICAL_CLASS`
`single`	`mxSINGLE_CLASS`
`struct`	`mxSTRUCT_CLASS`
`uint8`	`mxUINT8_CLASS`

Value of classname	Corresponding Class
uint16	mxUINT16_CLASS
uint32	mxUINT32_CLASS
uint64	mxUINT64_CLASS
<class_name>	*<class_id>*
unknown	mxUNKNOWN_CLASS

In the table, *<class_name>* represents the name of a specific MATLAB custom object. You can also specify one of your own class names.

Returns

Logical `1` (`true`) if `pm` points to an array having category `classname`, and logical `0` (`false`) otherwise.

Description

Each `mxArray` is tagged as being a certain type. Call `mxIsClass` to determine whether the specified `mxArray` has this type.

In C:

```
mxIsClass(pm, "double");
```

is equivalent to calling either of these forms:

```
mxIsDouble(pm);
```

```
strcmp(mxGetClassName(pm), "double");
```

In Fortran:

```
mxIsClass(pm, 'double')
```

is equivalent to calling either one of the following:

```
mxIsDouble(pm)
```

```
mxGetClassName(pm) .eq. 'double'
```

It is most efficient to use the `mxIsDouble` form.

C Examples

See `mxisclass.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxClassID`, `mxGetClassID`, `mxIsEmpty`, `mxGetClassName`

mxIsComplex (C and Fortran)

Purpose

Determine whether data is complex

C Syntax

```
#include "matrix.h"
bool mxIsComplex(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsComplex(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

Logical `1` (`true`) if `pm` is a numeric array containing complex data, and logical `0` (`false`) otherwise. If `pm` points to a cell array or a structure array, `mxIsComplex` returns `false`.

Description

Use `mxIsComplex` to determine whether or not an imaginary part is allocated for an `mxArray`. The imaginary pointer `pi` is `NULL` in C (`0` in Fortran) if an `mxArray` is purely real and does not have any imaginary data. If an `mxArray` is complex, `pi` points to an array of numbers.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

Additional examples:

- `convec.c`, `phonebook.c`, `timestwo.c`, and `xtimesy.c` in the `refbook` subdirectory of the `examples` directory
- `explore.c`, `yprime.c`, `mexlock.c`, and `mexsettrapflag.c` in the `mex` subdirectory of the `examples` directory
- `mxcalcsinglesubscript.c`, `mxgeteps.c`, and `mxgetinf.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxIsNumeric`

Purpose

Determine whether mxArray represents data as double-precision, floating-point numbers

C Syntax

```
#include "matrix.h"
bool mxIsDouble(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsDouble(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray stores its data as double-precision, floating-point numbers, and logical 0 (false) otherwise.

Description

Call mxIsDouble to determine whether or not the specified mxArray represents its real and imaginary data as double-precision, floating-point numbers.

Older versions of MATLAB software store all mxArray data as double-precision, floating-point numbers. However, starting with MATLAB Version 5 software, MATLAB can store real and imaginary data in a variety of numerical formats.

In C, calling mxIsDouble is equivalent to calling:

```
mxGetClassID(pm) == mxDOUBLE_CLASS
```

In Fortran, calling mxIsDouble is equivalent to calling:

```
mxGetClassName(pm) .eq. 'double'
```

C Examples

See findnz.c, fulltosparse.c, timestwo.c, and xtimesy.c in the refbook subdirectory of the examples directory.

Additional examples:

- `mexget.c`, `mexlock.c`, `mexsettrapflag.c`, and `yprime.c` in the `mex` subdirectory of the `examples` directory
- `mxcalcsinglesubscript.c`, `mxgeteps.c`, `mxgetinf.c`, and `mxisfinite.c` in the `mx` subdirectory of the `examples` directory

See Also

`mxIsClass`, `mxGetClassID`

Purpose

Determine whether mxArray is empty

C Syntax

```
#include "matrix.h"
bool mxIsEmpty(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsEmpty(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray is empty, and logical 0 (false) otherwise.

Description

Use mxIsEmpty to determine whether an mxArray contains no data. An mxArray is empty if the size of any of its dimensions is 0.

C Examples

See mxisfinite.c in the mx subdirectory of the examples directory.

See Also

mxIsClass

mxIsFinite (C and Fortran)

Purpose

Determine whether input is finite

C Syntax

```
#include "matrix.h"
bool mxIsFinite(double value);
```

Fortran Syntax

```
integer*4 mxIsFinite(value)
real*8 value
```

Arguments

`value`
The double-precision, floating-point number that you are testing

Returns

Logical `1` (`true`) if `value` is finite, and logical `0` (`false`) otherwise.

Description

Call `mxIsFinite` to determine whether or not `value` is finite. A number is finite if it is greater than `-Inf` and less than `Inf`.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxIsInf`, `mxIsNan`

Purpose

Determine whether `mxArray` was copied from MATLAB global workspace

C Syntax

```
#include "matrix.h"
bool mxIsFromGlobalWS(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsFromGlobalWS(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

Logical `1` (`true`) if the array was copied out of the global workspace, and logical `0` (`false`) otherwise.

Description

`mxIsFromGlobalWS` is useful for stand alone MAT programs. `mexIsGlobal` tells you whether the pointer you pass actually points into the global workspace.

C Examples

See `matdgns.c` and `matcreat.c` in the `eng_mat` subdirectory of the `examples` directory.

See Also

`mexIsGlobal`

mxIsInf (C and Fortran)

Purpose

Determine whether input is infinite

C Syntax

```
#include "matrix.h"
bool mxIsInf(double value);
```

Fortran Syntax

```
integer*4 mxIsInf(value)
real*8 value
```

Arguments

`value`
The double-precision, floating-point number that you are testing

Returns

Logical `1` (`true`) if value is infinite, and logical `0` (`false`) otherwise.

Description

Call `mxIsInf` to determine whether or not `value` is equal to infinity or minus infinity. MATLAB software stores the value of infinity in a permanent variable named `Inf`, which represents IEEE arithmetic positive infinity. The value of the variable `Inf` is built into the system; you cannot modify it.

Operations that return infinity include

- Division by 0. For example, `5/0` returns infinity.
- Operations resulting in overflow. For example, `exp(10000)` returns infinity because the result is too large to be represented on your machine.

If `value` equals `NaN` (Not-a-Number), `mxIsInf` returns `false`. In other words, `NaN` is not equal to infinity.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxIsFinite`, `mxIsNaN`

Purpose

Determine whether mxArray represents data as signed 16-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsInt16(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsInt16(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the array stores its data as signed 16-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsInt16 to determine whether or not the specified array represents its real and imaginary data as 16-bit signed integers.

In C, calling mxIsInt16 is equivalent to calling:

```
mxGetClassID(pm) == mxINT16_CLASS
```

In Fortran, calling mxIsInt16 is equivalent to calling:

```
mxGetClassName(pm) == 'int16'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt32, mxIsInt64, mxIsUint8, mxIsUint16, mxIsUint32, mxIsUint64

mxIsInt32 (C and Fortran)

Purpose

Determine whether mxArray represents data as signed 32-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsInt32(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsInt32(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the array stores its data as signed 32-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsInt32 to determine whether or not the specified array represents its real and imaginary data as 32-bit signed integers.

In C, calling mxIsInt32 is equivalent to calling:

```
mxGetClassID(pm) == mxINT32_CLASS
```

In Fortran, calling mxIsInt32 is equivalent to calling:

```
mxGetClassName(pm) == 'int32'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt64, mxIsUint8, mxIsUint16, mxIsUint32, mxIsUint64

Purpose

Determine whether mxArray represents data as signed 64-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsInt64(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsInt64(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the array stores its data as signed 64-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsInt64 to determine whether or not the specified array represents its real and imaginary data as 64-bit signed integers.

In C, calling mxIsInt64 is equivalent to calling:

```
mxGetClassID(pm) == mxINT64_CLASS
```

In Fortran, calling mxIsInt64 is equivalent to calling:

```
mxGetClassName(pm) == 'int64'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt32, mxIsUint8, mxIsUint16, mxIsUint32, mxIsUint64

mxIsInt8 (C and Fortran)

Purpose

Determine whether mxArray represents data as signed 8-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsInt8(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsInt8(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the array stores its data as signed 8-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsInt8 to determine whether or not the specified array represents its real and imaginary data as 8-bit signed integers.

In C, calling mxIsInt8 is equivalent to calling:

```
mxGetClassID(pm) == mxINT8_CLASS
```

In Fortran, calling mxIsInt8 is equivalent to calling:

```
mxGetClassName(pm) .eq. 'int8'
```

See Also

mxIsClass, mxGetClassID, mxIsInt16, mxIsInt32, mxIsInt64, mxIsUint8, mxIsUint16, mxIsUint32, mxIsUint64

Purpose

Determine whether `mxArray` is of type `mxLogical`

C Syntax

```
#include "matrix.h"
bool mxIsLogical(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsLogical(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

Logical `1` (`true`) if `pm` points to a logical `mxArray`, and logical `0` (`false`) otherwise.

Description

Use `mxIsLogical` to determine whether MATLAB software treats the data in the `mxArray` as Boolean (logical). If an `mxArray` is logical, MATLAB treats all zeros as meaning `false` and all nonzero values as meaning `true`. For additional information on the use of logical variables in MATLAB software, type `help logical` at the MATLAB prompt.

C Examples

See `mxislogical.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxIsClass`

mxIsLogicalScalar (C)

Purpose

Determine whether scalar `mxArray` is of type `mxLogical`

C Syntax

```
#include "matrix.h"
bool mxIsLogicalScalar(const mxArray *array_ptr);
```

Arguments

`array_ptr`
Pointer to an `mxArray`

Returns

Logical `1` (`true`) if the `mxArray` is of class `mxLogical` and has `1`-by-`1` dimensions, and logical `0` (`false`) otherwise.

Description

Use `mxIsLogicalScalar` to determine whether MATLAB software treats the scalar data in the `mxArray` as logical or numerical. For additional information on the use of logical variables in MATLAB software, type `help logical` at the MATLAB prompt.

`mxIsLogicalScalar(pa)` is equivalent to:

```
mxIsLogical(pa) && mxGetNumberOfElements(pa) == 1
```

See Also

`mxIsLogical`, `mxIsLogicalScalarTrue`, `mxGetLogicals`, `mxGetScalar`

Purpose

Determine whether scalar `mxArray` of type `mxLogical` is `true`

C Syntax

```
#include "matrix.h"
bool mxIsLogicalScalarTrue(const mxArray *array_ptr);
```

Arguments

`array_ptr`
Pointer to an `mxArray`

Returns

Logical `1` (`true`) if the value of the `mxArray`'s logical, scalar element is `true`, and logical `0` (`false`) otherwise.

Description

Use `mxIsLogicalScalarTrue` to determine whether the value of a scalar `mxArray` is true or false. For additional information on the use of logical variables in MATLAB software, type `help logical` at the MATLAB prompt.

`mxIsLogicalScalarTrue(pa)` is equivalent to:

```
mxIsLogical(pa) && mxGetNumberOfElements(pa) == 1 &&
mxGetLogicals(pa)[0] == true
```

See Also

`mxIsLogical`, `mxIsLogicalScalar`, `mxGetLogicals`, `mxGetScalar`

mxIsNaN (C and Fortran)

Purpose

Determine whether input is NaN (Not-a-Number)

C Syntax

```
#include "matrix.h"
bool mxIsNaN(double value);
```

Fortran Syntax

```
integer*4 mxIsNaN(value)
real*8 value
```

Arguments

`value`
The double-precision, floating-point number that you are testing

Returns

Logical `1` (`true`) if `value` is `NaN` (Not-a-Number), and logical `0` (`false`) otherwise.

Description

Call `mxIsNaN` to determine whether or not `value` is `NaN`. `NaN` is the IEEE arithmetic representation for Not-a-Number. A `NaN` is obtained as a result of mathematically undefined operations such as

- `0.0/0.0`
- `Inf-Inf`

The system understands a family of bit patterns as representing `NaN`. In other words, `NaN` is not a single value; rather, it is a family of numbers that MATLAB software (and other IEEE-compliant applications) uses to represent an error condition or missing data.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

For additional examples, see `findnz.c` and `fulltosparse.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mxIsFinite`, `mxIsInf`

Purpose

Determine whether `mxArray` is numeric

C Syntax

```
#include "matrix.h"
bool mxIsNumeric(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsNumeric(pm)
mwPointer pm
```

Arguments

`pm`
Pointer to an `mxArray`

Returns

Logical `1` (`true`) if the array can contain numeric data. The following class IDs represent storage types for arrays that can contain numeric data:

- `mxDOUBLE_CLASS`
- `mxSINGLE_CLASS`
- `mxINT8_CLASS`
- `mxUINT8_CLASS`
- `mxINT16_CLASS`
- `mxUINT16_CLASS`
- `mxINT32_CLASS`
- `mxUINT32_CLASS`
- `mxINT64_CLASS`
- `mxUINT64_CLASS`

Logical `0` (`false`) if the array cannot contain numeric data.

Description

Call `mxIsNumeric` to determine whether the specified array contains numeric data. If the specified array has a storage type that represents

numeric data, `mxIsNumeric` returns logical `1` (`true`). Otherwise, `mxIsNumeric` returns logical `0` (`false`).

Call `mxGetClassID` to determine the exact storage type.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

Fortran Examples

See `matdemo1.F` in the `eng_mat` subdirectory of the `examples` directory.

See Also

`mxGetClassID`

Purpose

Determine whether `mxArray` represents data as single-precision, floating-point numbers

C Syntax

```
#include "matrix.h"
bool mxIsSingle(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsSingle(pm)
mwPointer pm
```

Arguments

`pm`

Pointer to an `mxArray`

Returns

Logical `1` (`true`) if the array stores its data as single-precision, floating-point numbers, and logical `0` (`false`) otherwise.

Description

Use `mxIsSingle` to determine whether or not the specified array represents its real and imaginary data as single-precision, floating-point numbers.

In C, calling `mxIsSingle` is equivalent to calling:

```
mxGetClassID(pm) == mxSINGLE_CLASS
```

In Fortran, calling `mxIsSingle` is equivalent to calling:

```
mxGetClassName(pm) .eq. 'single'
```

See Also

`mxIsClass`, `mxGetClassID`

mxIsSparse (C and Fortran)

Purpose

Determine whether input is sparse mxArray

C Syntax

```
#include "matrix.h"
bool mxIsSparse(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsSparse(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if pm points to a sparse mxArray, and logical 0 (false) otherwise. A false return value means that pm points to a full mxArray or that pm does not point to a legal mxArray.

Description

Use mxIsSparse to determine whether pm points to a sparse mxArray. Many routines (for example, mxGetIr and mxGetJc) require a sparse mxArray as input.

C Examples

See phonebook.c in the refbook subdirectory of the examples directory.

For additional examples, see mxgetnzmax.c, mxsetdimensions.c, and mxsetnzmax.c in the mx subdirectory of the examples directory.

See Also

mxGetIr, mxGetJc, mxCreateSparse

Purpose

Determine whether input is structure mxArray

C Syntax

```
#include "matrix.h"
bool mxIsStruct(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsStruct(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if pm points to a structure mxArray, and logical 0 (false) otherwise.

Description

Use mxIsStruct to determine whether pm points to a structure mxArray. Many routines (for example, mxGetFieldName and mxSetField) require a structure mxArray as an argument.

C Examples

See phonebook.c in the refbook subdirectory of the examples directory.

See Also

mxCreateStructArray, mxCreateStructMatrix, mxGetNumberOfFields, mxGetField, mxSetField

mxIsUint16 (C and Fortran)

Purpose

Determine whether mxArray represents data as unsigned 16-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsUint16(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsUint16(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray stores its data as unsigned 16-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsUint16 to determine whether or not the specified mxArray represents its real and imaginary data as 16-bit unsigned integers.

In C, calling mxIsUint16 is equivalent to calling:

```
mxGetClassID(pm) == mxUINT16_CLASS
```

In Fortran, calling mxIsUint16 is equivalent to calling:

```
mxGetClassName(pm) .eq. 'uint16'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt32, mxIsInt64, mxIsUint8, mxIsUint32, mxIsUint64

Purpose

Determine whether mxArray represents data as unsigned 32-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsUint32(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsUint32(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray stores its data as unsigned 32-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsUint32 to determine whether or not the specified mxArray represents its real and imaginary data as 32-bit unsigned integers.

In C, calling mxIsUint32 is equivalent to calling:

```
mxGetClassID(pm) == mxUINT32_CLASS
```

In Fortran, calling mxIsUint32 is equivalent to calling:

```
mxGetClassName(pm) .eq. 'uint32'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt32, mxIsInt64, mxIsUint8, mxIsUint16, mxIsUint64

mxIsUint64 (C and Fortran)

Purpose

Determine whether mxArray represents data as unsigned 64-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsUint64(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsUint64(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray stores its data as unsigned 64-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsUint64 to determine whether or not the specified mxArray represents its real and imaginary data as 64-bit unsigned integers.

In C, calling mxIsUint64 is equivalent to calling:

```
mxGetClassID(pm) == mxUINT64_CLASS
```

In Fortran, calling mxIsUint64 is equivalent to calling:

```
mxGetClassName(pm) .eq. 'uint64'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt32, mxIsInt64, mxIsUint8, mxIsUint16, mxIsUint32

Purpose

Determine whether mxArray represents data as unsigned 8-bit integers

C Syntax

```
#include "matrix.h"
bool mxIsUint8(const mxArray *pm);
```

Fortran Syntax

```
integer*4 mxIsUint8(pm)
mwPointer pm
```

Arguments

pm

Pointer to an mxArray

Returns

Logical 1 (true) if the mxArray stores its data as unsigned 8-bit integers, and logical 0 (false) otherwise.

Description

Use mxIsUint8 to determine whether or not the specified mxArray represents its real and imaginary data as 8-bit unsigned integers.

In C, calling mxIsUint8 is equivalent to calling:

```
mxGetClassID(pm) == mxUINT8_CLASS
```

In Fortran, calling mxIsUint8 is equivalent to calling:

```
mxGetClassName(pm) .eq. 'uint8'
```

See Also

mxIsClass, mxGetClassID, mxIsInt8, mxIsInt16, mxIsInt32, mxIsInt64, mxIsUint16, mxIsUint32, mxIsUint64

mxLogical (C)

Purpose

Type for logical `mxArray`

Description

All logical `mxArray`s store their data elements as `mxLogical` rather than as `bool`.

The header file containing this type is:

```
#include "matrix.h"
```

Examples

See `mxislogical.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateLogicalArray`

Purpose

Allocate dynamic memory using MATLAB memory manager

C Syntax

```
#include "matrix.h"
#include <stdlib.h>
void *mxMalloc(mwSize n);
```

Fortran Syntax

```
mwPointer mxMalloc(n)
mwSize n
```

Arguments

`n`

Number of bytes to allocate

Returns

A pointer to the start of the allocated dynamic memory, if successful. If unsuccessful in a stand alone (non-MEX-file) application, `mxMalloc` returns `NULL` in C (`0` in Fortran). If unsuccessful in a MEX-file, the MEX-file terminates and control returns to the MATLAB prompt.

`mxMalloc` is unsuccessful when there is insufficient free heap space.

Description

MATLAB applications should always call `mxMalloc` rather than the ANSI C `malloc` function to allocate memory. In stand alone applications, such as the MATLAB engine, `mxMalloc` calls the `malloc` function. In MEX-files, `mxMalloc` automatically:

- Allocates enough contiguous heap space to hold `n` bytes.
- Registers the returned heap space with the MATLAB memory manager.

How you manage the memory created by this function depends on the purpose of the data assigned to it. If you assign it to an output argument in `plhs[]` using the `mxSetPr` function, MATLAB is responsible for freeing the memory.

If you use the data internally, the MATLAB memory manager maintains a list of all memory allocated by the function and automatically frees (deallocates) the memory when control returns to the MATLAB prompt.

In general, we recommend that MEX-file functions destroy their own temporary arrays and free their own dynamically allocated memory. It is more efficient to perform this cleanup in the source MEX-file than to rely on the automatic mechanism. Therefore, when you finish using the memory allocated by this function, call `mxFree` to deallocate the memory.

If you do not assign this data to an output argument, and you want it to persist after the MEX-file completes, call `mexMakeMemoryPersistent` after calling this function. If you write a MEX-file with persistent memory, be sure to register a `mexAtExit` function to free allocated memory in the event your MEX-file is cleared.

C Examples

See `mxmalloc.c` in the `mx` subdirectory of the `examples` directory. For an additional example, see `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mexAtExit`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mxCalloc`, `mxDestroyArray`, `mxFree`, `mxRealloc`

Purpose

Reallocate memory

C Syntax

```
#include "matrix.h"
#include <stdlib.h>
void *mxRealloc(void *ptr, mwSize size);
```

Fortran Syntax

```
mwPointer mxRealloc(ptr, size)
mwPointer ptr
mwSize size
```

Arguments

ptr
: Pointer to a block of memory allocated by `mxCalloc`, `mxMalloc`, or `mxRealloc`

`size`
: New size of allocated memory, in bytes

Returns

A pointer to the reallocated block of memory, or `NULL` in C (`0` in Fortran) if `size` is `0`. In a stand alone (non-MEX-file) application, if not enough memory is available to expand the block to the given size, `mxRealloc` returns `NULL` in C (`0` in Fortran). In a MEX-file, if not enough memory is available to expand the block to the given size, the MEX-file terminates and control returns to the MATLAB prompt.

Description

`mxRealloc` changes the size of a memory block that has been allocated with `mxCalloc`, `mxMalloc`, or `mxRealloc`.

If `size` is `0` and `ptr` is not `NULL` in C (`0` in Fortran), `mxRealloc` frees the memory pointed to by `ptr` and returns `NULL` in C (`0` in Fortran).

If `size` is greater than `0` and `ptr` is `NULL` in C (`0` in Fortran), `mxRealloc` behaves like `mxMalloc`, allocating a new block of memory of `size` bytes and returning a pointer to the new block.

Otherwise, `mxRealloc` changes the size of the memory block pointed to by `ptr` to `size` bytes. The contents of the reallocated memory are unchanged up to the smaller of the new and old sizes. The reallocated memory may be in a different location from the original memory, so

the returned pointer can be different from `ptr`. If the memory location changes, `mxRealloc` frees the original memory block pointed to by `ptr`.

In a stand alone (non-MEX-file) application, if not enough memory is available to expand the block to the given size, `mxRealloc` returns `NULL` in C (`0` in Fortran) and leaves the original memory block unchanged. You must use `mxFree` to free the original memory block.

How you manage the memory created by this function depends on the purpose of the data assigned to it. If you assign it to an output argument in `plhs[]` using the `mxSetPr` function, MATLAB is responsible for freeing the memory.

If you use the data internally, the MATLAB memory manager maintains a list of all memory allocated by the function and automatically frees (deallocates) the memory when control returns to the MATLAB prompt. In general, we recommend that MEX-file functions destroy their own temporary arrays and free their own dynamically allocated memory. It is more efficient to perform this cleanup in the source MEX-file than to rely on the automatic mechanism. Therefore, when you finish using the memory allocated by this function, call `mxFree` to deallocate the memory.

If you do not assign this data to an output argument, and you want it to persist after the MEX-file completes, call `mexMakeMemoryPersistent` after calling this function. If you write a MEX-file with persistent memory, be sure to register a `mexAtExit` function to free allocated memory in the event your MEX-file is cleared.

C Examples

See `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mexAtExit`, `mexMakeArrayPersistent`, `mexMakeMemoryPersistent`, `mxCalloc`, `mxDestroyArray`, `mxFree`, `mxMalloc`

Purpose

Remove field from structure array

C Syntax

```
#include "matrix.h"
void mxRemoveField(mxArray *pm, int fieldnumber);
```

Fortran Syntax

```
subroutine mxRemoveField(pm, fieldnumber)
mwPointer pm
integer*4 fieldnumber
```

Arguments

`pm`

Pointer to a structure `mxArray`

`fieldnumber`

Number of the field you want to remove. In C, to remove the first field, set `fieldnumber` to `0`; to remove the second field, set `fieldnumber` to `1`; and so on. In Fortran, to remove the first field, set `fieldnumber` to `1`; to remove the second field, set `fieldnumber` to `2`; and so on.

Description

Call `mxRemoveField` to remove a field from a structure array. If the field does not exist, nothing happens. This function does not destroy the field values. Use `mxDestroyArray` to destroy the actual field values.

Consider a MATLAB structure initialized to:

```
patient.name = 'John Doe';
patient.billing = 127.00;
patient.test = [79 75 73; 180 178 177.5; 220 210 205];
```

In C, the field number `0` represents the field `name`; field number `1` represents field `billing`; field number `2` represents field `test`. In Fortran, the field number `1` represents the field `name`; field number `2` represents field `billing`; field number `3` represents field `test`.

See Also

`mxAddField`, `mxDestroyArray`, `mxGetFieldByNumber`

mxSetCell (C and Fortran)

Purpose

Set value of one cell of `mxArray`

C Syntax

```
#include "matrix.h"
void mxSetCell(mxArray *pm, mwIndex index, mxArray *value);
```

Fortran Syntax

```
mxSetCell(pm, index, value)
mwPointer pm, value
mwIndex index
```

Arguments

`pm`
: Pointer to a cell `mxArray`

`index`
: Index from the beginning of the `mxArray`. Specify the number of elements between the first cell of the `mxArray` and the cell you want to set. The easiest way to calculate `index` in a multidimensional cell array is to call `mxCalcSingleSubscript`.

`value`
: The new value of the cell. You can put any kind of `mxArray` into a cell. In fact, you can even put another cell `mxArray` into a cell.

Description

Call `mxSetCell` to put the designated `value` into a particular cell of a cell `mxArray`.

Note Inputs to a MEX-file are constant read-only `mxArrays` and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxDestroyArray` on the pointer returned by `mxGetCell` before you call `mxSetCell`.

C Examples

See `phonebook.c` in the `refbook` subdirectory of the `examples` directory. For an additional example, see `mxcreatecellmatrix.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateCellArray`, `mxCreateCellMatrix`, `mxGetCell`, `mxIsCell`, `mxDestroyArray`

mxSetClassName (C)

Purpose

Convert structure array to MATLAB object array

C Syntax

```
#include "matrix.h"
int mxSetClassName(mxArray *array_ptr, const char *classname);
```

Arguments

`array_ptr`
Pointer to an `mxArray` of class `mxSTRUCT_CLASS`

`classname`
The object class to which to convert `array_ptr`

Returns

`0` if successful, and nonzero otherwise. One cause of failure is that `array_ptr` is not a structure `mxArray`. Call `mxIsStruct` to determine whether `array_ptr` is a structure.

Description

`mxSetClassName` converts a structure array to an object array, to be saved subsequently to a MAT-file. The object is not registered or validated by MATLAB software until it is loaded via the `LOAD` command. If the specified `classname` is an undefined class within MATLAB, `LOAD` converts the object back to a simple structure array.

See Also

`mxIsClass`, `mxGetClassID`

Purpose

Set pointer to data

C Syntax

```
#include "matrix.h"
void mxSetData(mxArray *pm, void *pr);
```

Fortran Syntax

```
mxSetData(pm, pr)
mwPointer pm, pr
```

Arguments

`pm`

Pointer to an `mxArray`

`pr`

Pointer to an array. Each element in the array contains the real component of a value. The array must be in dynamic memory; call `mxCalloc` to allocate this memory.

Description

`mxSetData` is similar to `mxSetPr`, except that in C, its second argument is a `void *`. Use this on numeric arrays with contents other than `double`.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxFree` on the pointer returned by `mxGetData` before you call `mxSetData`.

See Also

`mxCalloc`, `mxFree`, `mxGetData`, `mxSetPr`

mxSetDimensions (C and Fortran)

Purpose

Modify number of dimensions and size of each dimension

C Syntax

```
#include "matrix.h"
int mxSetDimensions(mxArray *pm, const mwSize *dims,
  mwSize ndim);
```

Fortran Syntax

```
integer*4 mxSetDimensions(pm, dims, ndim)
mwPointer pm
mwSize dims, ndim
```

Arguments

`pm`

Pointer to an `mxArray`

`dims`

The dimensions array. Each element in the dimensions array contains the size of the array in that dimension. For example, in C, setting `dims[0]` to `5` and `dims[1]` to `7` establishes a `5`-by-`7` `mxArray`. In Fortran, setting `dims(1)` to `5` and `dims(2)` to `7` establishes a `5`-by-`7` `mxArray`. In most cases, there should be `ndim` elements in the `dims` array.

`ndim`

The desired number of dimensions

Returns

`0` on success, and `1` on failure. `mxSetDimensions` allocates heap space to hold the input size array. So it is possible (though extremely unlikely) that increasing the number of dimensions can cause the system to run out of heap space.

Description

Call `mxSetDimensions` to reshape an existing `mxArray`. `mxSetDimensions` is similar to `mxSetM` and `mxSetN`; however, `mxSetDimensions` provides greater control for reshaping `mxArrays` that have more than two dimensions.

`mxSetDimensions` does not allocate or deallocate any space for the `pr` or `pi` arrays. Consequently, if your call to `mxSetDimensions` increases the number of elements in the `mxArray`, you must enlarge the `pr` (and `pi`, if it exists) arrays accordingly.

If your call to `mxSetDimensions` reduces the number of elements in the `mxArray`, you can optionally reduce the size of the `pr` and `pi` arrays using `mxRealloc`.

Any trailing singleton dimensions specified in the `dims` argument are automatically removed from the resulting array. For example, if `ndim` equals `5` and `dims` equals `[4 1 7 1 1]`, the resulting array is given the dimensions `4`-by-`1`-by-`7`.

C Examples

See `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetNumberOfDimensions`, `mxSetM`, `mxSetN`, `mxRealloc`

mxSetField (C and Fortran)

Purpose

Set structure array field, given field name and index

C Syntax

```
#include "matrix.h"
void mxSetField(mxArray *pm, mwIndex index,
  const char *fieldname, mxArray *value);
```

Fortran Syntax

```
mxSetField(pm, index, fieldname, value)
mwPointer pm, value
mwIndex index
character*(*) fieldname
```

Arguments

`pm`

Pointer to a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` points to a structure `mxArray`.

`index`

Index of the desired element.

In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

See `mxCalcSingleSubscript` for details on calculating an index.

`fieldname`

The name of the existing field whose value you are assigning. Call `mxGetFieldNameByNumber` or `mxGetFieldNumber` to determine existing field names.

value

Pointer to the `mxArray` you are assigning.

Description

Use `mxSetField` to assign a `value` to the specified element of the specified field. In pseudo-C terminology, `mxSetField` performs the assignment:

```
pm[index].fieldname = value;
```

Note Inputs to a MEX-file are constant read-only `mxArrays` and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

In C, calling:

```
mxSetField(pa, index, "fieldname", new_value_pa);
```

is equivalent to calling:

```
field_num = mxGetFieldNumber(pa, "fieldname");
mxSetFieldByNumber(pa, index, field_num, new_value_pa);
```

In Fortran, calling:

```
mxSetField(pm, index, 'fieldname', newvalue)
```

is equivalent to calling:

```
fieldnum = mxGetFieldNumber(pm, 'fieldname')
mxSetFieldByNumber(pm, index, fieldnum, newvalue)
```

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxDestroyArray` on the pointer returned by `mxGetField` before you call `mxSetField`.

To free memory for structures created using `mxSetField`, call `mxDestroyArray` only on the structure array, not the array used by `mxSetField`. If you also call `mxDestroyArray` on the `mxArray value` points to, the same memory is freed twice and this can corrupt memory.

C Examples

See `mxcreatestructarray.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCreateStructArray`, `mxCreateStructMatrix`, `mxGetField`, `mxGetFieldByNumber`, `mxGetFieldNameByNumber`, `mxGetFieldNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetFieldByNumber`, `mxDestroyArray`

Purpose

Set structure array field, given field number and index

C Syntax

```
#include "matrix.h"
void mxSetFieldByNumber(mxArray *pm, mwIndex index,
  int fieldnumber, mxArray *value);
```

Fortran Syntax

```
mxSetFieldByNumber(pm, index, fieldnumber, value)
mwPointer pm, value
mwIndex index
integer*4 fieldnumber
```

Arguments

`pm`

Pointer to a structure `mxArray`. Call `mxIsStruct` to determine whether `pm` points to a structure `mxArray`.

`index`

Index of the desired element.

In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

See `mxCalcSingleSubscript` for details on calculating an index.

`fieldnumber`

Position of the existing field whose value you want to set.

In C, the first field within each element has a `fieldnumber` of `0`, the second field has a `fieldnumber` of `1`, and so on. The last field has a `fieldnumber` of `N-1`, where `N` is the number of fields.

In Fortran, the first field within each element has a `fieldnumber` of `1`, the second field has a `fieldnumber` of `2`, and so on. The last field has a `fieldnumber` of `N`.

`value`
Pointer to the `mxArray` you are assigning.

Description

Use `mxSetFieldByNumber` to assign a `value` to the specified element of the specified field. `mxSetFieldByNumber` is almost identical to `mxSetField`; however, the former takes a field number as its third argument and the latter takes a field name as its third argument.

Note Inputs to a MEX-file are constant read-only `mxArray`s and should not be modified. Using `mxSetCell*` or `mxSetField*` to modify the cells or fields of a MATLAB argument causes unpredictable results.

In C, calling:

```
mxSetField(pa, index, "field_name", new_value_pa);
```

is equivalent to calling:

```
field_num = mxGetFieldNumber(pa, "field_name");
mxSetFieldByNumber(pa, index, field_num, new_value_pa);
```

In Fortran, calling:

```
mxSetField(pm, index, 'fieldname', newvalue)
```

is equivalent to calling:

```
fieldnum = mxGetFieldNumber(pm, 'fieldname')
mxSetFieldByNumber(pm, index, fieldnum, newvalue)
```

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxDestroyArray` on the pointer returned by `mxGetFieldByNumber` before you call `mxSetFieldByNumber`.

To free memory for structures created using `mxSetFieldByNumber`, call `mxDestroyArray` only on the structure array, not the array used by `mxSetFieldByNumber`. If you also call `mxDestroyArray` on the `mxArray` `value` points to, the same memory is freed twice and this can corrupt memory.

C Examples

See `mxcreatestructarray.c` in the `mx` subdirectory of the `examples` directory. For an additional example, see `phonebook.c` in the `refbook` subdirectory of the `examples` directory.

See Also

`mxCreateStructArray`, `mxCreateStructMatrix`, `mxGetField`, `mxGetFieldByNumber`, `mxGetFieldNameByNumber`, `mxGetFieldNumber`, `mxGetNumberOfFields`, `mxIsStruct`, `mxSetField`, `mxDestroyArray`

mxSetImagData (C and Fortran)

Purpose

Set imaginary data pointer for `mxArray`

C Syntax

```
#include "matrix.h"
void mxSetImagData(mxArray *pm, void *pi);
```

Fortran Syntax

```
mxSetImagData(pm, pi)
mwPointer pm, pi
```

Arguments

`pm`

Pointer to an `mxArray`

`pi`

Pointer to the first element of an array. Each element in the array contains the imaginary component of a value. The array must be in dynamic memory; call `mxCalloc` to allocate this dynamic memory. If `pi` points to static memory, memory errors will result when the array is destroyed.

Description

`mxSetImagData` is similar to `mxSetPi`, except that in C, its `pi` argument is a `void *`. Use this on numeric arrays with contents other than `double`.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxFree` on the pointer returned by `mxGetImagData` before you call `mxSetImagData`.

C Examples

See `mxisfinite.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxCalloc`, `mxFree`, `mxGetImagData`, `mxSetPi`

Purpose

Set ir array of sparse mxArray

C Syntax

```
#include "matrix.h"
void mxSetIr(mxArray *pm, mwIndex *ir);
```

Fortran Syntax

```
mxSetIr(pm, ir)
mwPointer pm, ir
```

Arguments

pm

Pointer to a sparse mxArray

ir

Pointer to the ir array. The ir array must be sorted in column-major order.

Description

Use mxSetIr to specify the ir array of a sparse mxArray. The ir array is an array of integers; the length of the ir array should equal the value of nzmax.

Each element in the ir array indicates a row (offset by 1) at which a nonzero element can be found. (The jc array is an index that indirectly specifies a column where nonzero elements can be found. See mxSetJc for more details on jc.)

For example, suppose you create a 7-by-3 sparse mxArray named Sparrow containing six nonzero elements by typing:

```
Sparrow = zeros(7,3);
Sparrow(2,1) = 1;
Sparrow(5,1) = 1;
Sparrow(3,2) = 1;
Sparrow(2,3) = 2;
Sparrow(5,3) = 1;
Sparrow(6,3) = 1;
Sparrow = sparse(Sparrow);
```

The pr array holds the real data for the sparse matrix, which in Sparrow is the five 1s and the one 2. If there is any nonzero imaginary data, it is in a pi array.

Subscript	ir	pr	jc	Comments
(2,1)	1	1	0	Column 1; ir is 1 because row is 2.
(5,1)	4	1	2	Column 1; ir is 4 because row is 5.
(3,2)	2	1	3	Column 2; ir is 2 because row is 3.
(2,3)	1	2	6	Column 3; ir is 1 because row is 2.
(5,3)	4	1		Column 3; ir is 4 because row is 5.
(6,3)	5	1		Column 3; ir is 5 because row is 6.

Notice how each element of the ir array is always 1 less than the row of the corresponding nonzero element. For instance, the first nonzero element is in row 2; therefore, the first element in ir is 1 (that is, 2 – 1). The second nonzero element is in row 5; therefore, the second element in ir is 4 (5 – 1).

The ir array must be in column-major order. That means that the ir array must define the row positions in column 1 (if any) first, then the row positions in column 2 (if any) second, and so on through column N. Within each column, row position 1 must appear prior to row position 2, and so on.

mxSetIr does not sort the ir array for you; you must specify an ir array that is already sorted.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call mxFree on the pointer returned by mxGetIr before you call mxSetIr.

C Examples

See mxsetnzmax.c in the mx subdirectory of the examples directory. For an additional example, see explore.c in the mex subdirectory of the examples directory.

See Also mxCreateSparse, mxGetIr, mxGetJc, mxSetJc, mxFree

mxSetJc (C and Fortran)

Purpose

Set jc array of sparse mxArray

C Syntax

```
#include "matrix.h"
void mxSetJc(mxArray *pm, mwIndex *jc);
```

Fortran Syntax

```
mxSetJc(pm, jc)
mwPointer pm, jc
```

Arguments

pm
: Pointer to a sparse mxArray

jc
: Pointer to the jc array

Description

Use mxSetJc to specify a new jc array for a sparse mxArray. The jc array is an integer array having n+1 elements, where n is the number of columns in the sparse mxArray.

If the jth column of the sparse mxArray has any nonzero elements:

- jc[j] is the index in ir, pr, and pi (if it exists) of the first nonzero element in the jth column.
- jc[j+1]-1 is the index of the last nonzero element in the jth column.
- For the jth column of the sparse matrix, jc[j] is the total number of nonzero elements in all preceding columns.

The number of nonzero elements in the jth column of the sparse mxArray is:

```
jc[j+1] - jc[j];
```

For the jth column of the sparse mxArray, jc[j] is the total number of nonzero elements in all preceding columns. The last element of the jc array, jc[number of columns], is equal to nnz, which is the number of nonzero elements in the entire sparse mxArray.

For example, consider a 7-by-3 sparse `mxArray` named `Sparrow` containing six nonzero elements, created by typing:

```
Sparrow = zeros(7,3);
Sparrow(2,1) = 1;
Sparrow(5,1) = 1;
Sparrow(3,2) = 1;
Sparrow(2,3) = 2;
Sparrow(5,3) = 1;
Sparrow(6,3) = 1;
Sparrow = sparse(Sparrow);
```

The contents of the `ir`, `jc`, and `pr` arrays are listed in this table.

Subscript	ir	pr	jc	Comment
(2,1)	1	1	0	Column 1 contains two nonzero elements, with rows designated by `ir[0]` and `ir[1]`
(5,1)	4	1	2	Column 2 contains one nonzero element, with row designated by `ir[2]`
(3,2)	2	1	3	Column 3 contains three nonzero elements, with rows designated by `ir[3]`,`ir[4]`, and `ir[5]`
(2,3)	1	2	6	There are six nonzero elements in all.
(5,3)	4	1		
(6,3)	5	1		

As an example of a much sparser `mxArray`, consider a 1000-by-8 sparse `mxArray` named `Spacious` containing only three nonzero elements. The `ir`, `pr`, and `jc` arrays contain the values listed in this table.

Subscript	ir	pr	jc	Comment
(73,2)	72	1	0	Column 1 contains no nonzero elements.
(50,3)	49	1	0	Column 2 contains one nonzero element, with row designated by ir[0].
(64,5)	63	1	1	Column 3 contains one nonzero element, with row designated by ir[1].
			2	Column 4 contains no nonzero elements.
			2	Column 5 contains one nonzero element, with row designated by ir[2].
			3	Column 6 contains no nonzero elements.
			3	Column 7 contains no nonzero elements.
			3	Column 8 contains no nonzero elements.
			3	There are three nonzero elements in all.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxFree` on the pointer returned by `mxGetJc` before you call `mxSetJc`.

C Examples

See `mxsetdimensions.c` in the `mx` subdirectory of the `examples` directory. For an additional example, see `explore.c` in the `mex` subdirectory of the `examples` directory.

See Also

`mxCreateSparse`, `mxGetIr`, `mxGetJc`, `mxSetIr`, `mxFree`

Purpose

Set number of rows in mxArray

C Syntax

```
#include "matrix.h"
void mxSetM(mxArray *pm, mwSize m);
```

Fortran Syntax

```
mxSetM(pm, m)
mwPointer pm
mwSize m
```

Arguments

pm
: Pointer to an mxArray

m
: The desired number of rows

Description

Call mxSetM to set the number of rows in the specified mxArray. The term *rows* means the first dimension of an mxArray, regardless of the number of dimensions. Call mxSetN to set the number of columns.

You typically use mxSetM to change the shape of an existing mxArray. Note that mxSetM does not allocate or deallocate any space for the pr, pi, ir, or jc arrays. Consequently, if your calls to mxSetM and mxSetN increase the number of elements in the mxArray, you must enlarge the pr, pi, ir, and/or jc arrays. Call mxRealloc to enlarge them.

If your calls to mxSetM and mxSetN end up reducing the number of elements in the mxArray, you may want to reduce the sizes of the pr, pi, ir, and/or jc arrays in order to use heap space more efficiently. However, reducing the size is not mandatory.

C Examples

See mxsetdimensions.c in the mx subdirectory of the examples directory. For an additional example, see sincall.c in the refbook subdirectory of the examples directory.

See Also

mxGetM, mxGetN, mxSetN

mxSetN (C and Fortran)

Purpose

Set number of columns in mxArray

C Syntax

```
#include "matrix.h"
void mxSetN(mxArray *pm, mwSize n);
```

Fortran Syntax

```
mxSetN(pm, n)
mwPointer pm
mwSize n
```

Arguments

pm
: Pointer to an mxArray

n
: The desired number of columns

Description

Call mxSetN to set the number of columns in the specified mxArray. The term *columns* always means the second dimension of a matrix. Calling mxSetN forces an mxArray to have two dimensions. For example, if pm points to an mxArray having three dimensions, calling mxSetN reduces the mxArray to two dimensions.

You typically use mxSetN to change the shape of an existing mxArray. Note that mxSetN does not allocate or deallocate any space for the pr, pi, ir, or jc arrays. Consequently, if your calls to mxSetN and mxSetM increase the number of elements in the mxArray, you must enlarge the pr, pi, ir, and/or jc arrays.

If your calls to mxSetM and mxSetN end up reducing the number of elements in the mxArray, you may want to reduce the sizes of the pr, pi, ir, and/or jc arrays in order to use heap space more efficiently. However, reducing the size is not mandatory.

C Examples

See mxsetdimensions.c in the mx subdirectory of the examples directory. For an additional example, see sincall.c in the refbook subdirectory of the examples directory.

See Also

mxGetM, mxGetN, mxSetM

Purpose

Set storage space for nonzero elements

C Syntax

```
#include "matrix.h"
void mxSetNzmax(mxArray *pm, mwSize nzmax);
```

Fortran Syntax

```
mxSetNzmax(pm, nzmax)
mwPointer pm
mwSize nzmax
```

Arguments

`pm`

Pointer to a sparse `mxArray`.

`nzmax`

The number of elements that `mxCreateSparse` should allocate to hold the arrays pointed to by `ir`, `pr`, and `pi` (if it exists). Set `nzmax` greater than or equal to the number of nonzero elements in the `mxArray`, but set it to be less than or equal to the number of rows times the number of columns. If you specify an `nzmax` value of `0`, `mxSetNzmax` sets the value of `nzmax` to `1`.

Description

Use `mxSetNzmax` to assign a new value to the `nzmax` field of the specified sparse `mxArray`. The `nzmax` field holds the maximum possible number of nonzero elements in the sparse `mxArray`.

The number of elements in the `ir`, `pr`, and `pi` (if it exists) arrays must be equal to `nzmax`. Therefore, after calling `mxSetNzmax`, you must change the size of the `ir`, `pr`, and `pi` arrays. To change the size of one of these arrays:

1. Call `mxRealloc` with a pointer to the array, setting the size to the new value of `nzmax`.
2. Call the appropriate `mxSet` routine (`mxSetIr`, `mxSetPr`, or `mxSetPi`) to establish the new memory area as the current one.

Two ways of determining how big you should make `nzmax` are

- Set `nzmax` equal to or slightly greater than the number of nonzero elements in a sparse `mxArray`. This approach conserves precious heap space.
- Make `nzmax` equal to the total number of elements in an `mxArray`. This approach eliminates (or, at least reduces) expensive reallocations.

C Examples

See `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetNzmax`, `mxRealloc`

Purpose

Set new imaginary data for mxArray

C Syntax

```
#include "matrix.h"
void mxSetPi(mxArray *pm, double *pi);
```

Fortran Syntax

```
mxSetPi(pm, pi)
mwPointer pm, pi
```

Arguments

pm

Pointer to a full (nonsparse) mxArray

pi

Pointer to the first element of an array. Each element in the array contains the imaginary component of a value. The array must be in dynamic memory; call mxCalloc to allocate this dynamic memory. If pi points to static memory, memory leaks and other memory errors may result.

Description

Use mxSetPi to set the imaginary data of the specified mxArray.

Most mxCreate* functions optionally allocate heap space to hold imaginary data. If you tell an mxCreate* function to allocate heap space—for example, by setting the ComplexFlag to mxCOMPLEX in C (1 in Fortran) or by setting pi to a non-NULL value in C (a nonzero value in Fortran)—you do not ordinarily use mxSetPi to initialize the created mxArray's imaginary elements. Rather, you call mxSetPi to replace the initial imaginary values with new ones.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call mxFree on the pointer returned by mxGetPi before you call mxSetPi.

C Examples

See mxisfinite.c and mxsetnzmax.c in the mx subdirectory of the examples directory.

See Also

mxGetPi, mxGetPr, mxSetImagData, mxSetPr, mxFree

mxSetPr (C and Fortran)

Purpose

Set new real data for `mxArray`

C Syntax

```
#include "matrix.h"
void mxSetPr(mxArray *pm, double *pr);
```

Fortran Syntax

```
mxSetPr(pm, pr)
mwPointer pm, pr
```

Arguments

`pm`

Pointer to a full (nonsparse) `mxArray`

`pr`

Pointer to the first element of an array. Each element in the array contains the real component of a value. The array must be in dynamic memory; call `mxCalloc` to allocate this dynamic memory. If `pr` points to static memory, memory leaks and other memory errors can result.

Description

Use `mxSetPr` to set the real data of the specified `mxArray`.

All `mxCreate*` calls allocate heap space to hold real data. Therefore, you do not ordinarily use `mxSetPr` to initialize the real elements of a freshly created `mxArray`. Rather, you call `mxSetPr` to replace the initial real values with new ones.

This function does not free any memory allocated for existing data that it displaces. To free existing memory, call `mxFree` on the pointer returned by `mxGetPr` before you call `mxSetPr`.

C Examples

See `mxsetnzmax.c` in the `mx` subdirectory of the `examples` directory.

See Also

`mxGetPi`, `mxGetPr`, `mxSetData`, `mxSetPi`, `mxFree`

Purpose

Set value of public property of MATLAB object

C Syntax

```
#include "matrix.h"
void mxSetProperty(mxArray *pa, mwIndex index,
  const char *propname, const mxArray *value);
```

Fortran Syntax

```
mwPointer mxSetProperty(pa, index, propname, value)
mwPointer pa, value
mwIndex index
character*(*) propname
```

Arguments

`pa`
: Pointer to an `mxArray` which is an object.

`index`
: Index of the desired element of the object array.

  In C, the first element of an `mxArray` has an `index` of `0`, the second element has an `index` of `1`, and the last element has an `index` of `N-1`, where `N` is the total number of elements in the `mxArray`.

  In Fortran, the first element of an `mxArray` has an `index` of `1`, the second element has an `index` of `2`, and the last element has an `index` of `N`, where `N` is the total number of elements in the `mxArray`.

`propname`
: Name of the property whose value you are assigning.

value
: Pointer to the `mxArray` you are assigning.

Description

Use `mxSetProperty` to assign a `value` to the specified property. In pseudo-C terminology, `mxSetProperty` performs the assignment:

```
pa[index].propname = value;
```

`mxSetProperty` makes a copy of the value before assigning it as the new property value. This may be a concern if the property uses a large amount of memory.

See Also

`mxGetProperty`

Index

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