

# MATLAB Quick Reference

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## General Purpose Commands

### Managing Commands and Functions

<b>addpath</b>	Add directories to MATLAB's search path
<b>doc</b>	Display HTML documentation in Help browser
<b>docopt</b>	Display location of help file directory for UNIX platforms
<b>genpath</b>	Generate a path string
<b>help</b>	Display M-file help for MATLAB functions in the Command Window
<b>helpbrowser</b>	Display Help browser for access to all MathWorks online help
<b>helpdesk</b>	Display the Help browser
<b>helpwin</b>	Display M-file help and provide access to M-file help for all functions
<b>lasterr</b>	Last error message
<b>lastwarn</b>	Last warning message
<b>license</b>	license
<b>lookfor</b>	Search for specified keyword in all help entries
<b>partialpath</b>	Partial pathname
<b>path</b>	Control MATLAB's directory search path
<b>pathool</b>	Open the GUI for viewing and modifying MATLAB's path
<b>profile</b>	Start the M-file profiler, a utility for debugging and optimizing code
<b>profreport</b>	Generate a profile report
<b>refresh</b>	Refresh function and file system caches
<b>rmpath</b>	Remove directories from MATLAB's search path
<b>support</b>	Open MathWorks Technical Support Web Page
<b>type</b>	List file
<b>ver</b>	Display version information for MATLAB, Simulink, and toolboxes
<b>version</b>	Get MATLAB version number
<b>web</b>	Point Help browser or Web browser at file or Web site
<b>what</b>	List MATLAB-specific files in current directory
<b>whatsnew</b>	Display README files for MATLAB and toolboxes
<b>which</b>	Locate functions and files

### Managing Variables and the Workspace

<b>clear</b>	Remove items from the workspace
<b>disp</b>	Display text or array
<b>length</b>	Length of vector
<b>load</b>	Retrieve variables from disk
<b>memory</b>	Help for memory limitations
<b>mlock</b>	Prevent M-file clearing
<b>munlock</b>	Allow M-file clearing
<b>openvar</b>	Open workspace variable in Array Editor, for graphical editing
<b>pack</b>	Consolidate workspace memory
<b>save</b>	Save workspace variables on disk
<b>saveas</b>	Save figure or model using specified format
<b>size</b>	Array dimensions
<b>who, whos</b>	List the variables in the workspace
<b>workspace</b>	Display the Workspace Browser, a GUI for managing the workspace

### Controlling the Command Window

<b>clc</b>	Clear Command Window
<b>echo</b>	Echo M-files during execution
<b>format</b>	Control the display format for output
<b>home</b>	Move cursor to upper left corner of Command Window
<b>more</b>	Control paged output for the Command Window

### Working with Operating Environment

<b>beep</b>	Produce a beep sound
<b>cd</b>	Change working directory
<b>checkin</b>	Check file into source control system
<b>checkout</b>	Check file out of source control system
<b>cmopts</b>	Get name of source control system, and PVCS project filename
<b>copyfile</b>	Copy file
<b>customverctrl</b>	Allow custom source control system
<b>delete</b>	Delete files or graphics objects
<b>diary</b>	Save session to a disk file
<b>dir</b>	Display a directory listing
<b>dos</b>	Execute a DOS command and return the result
<b>edit</b>	Edit an M-file
<b>fileparts</b>	Get filename parts
<b>filebrowser</b>	Display Current Directory browser, for viewing files

<b>fullfile</b>	Build full filename from parts
<b>info</b>	Display contact information or toolbox Readme files
<b>inmem</b>	Functions in memory
<b>ls</b>	List directory on UNIX
<b>matlabroot</b>	Get root directory of MATLAB installation
<b>mkdir</b>	Make new directory
<b>open</b>	Open files based on extension
<b>pwd</b>	Display current directory
<b>tempdir</b>	Return the name of the system's temporary directory
<b>tempname</b>	Unique name for temporary file
<b>undocheckout</b>	Undo previous checkout from source control system
<b>unix</b>	Execute a UNIX command and return the result
<b>!</b>	Execute operating system command

### Starting and Quitting MATLAB

<b>finish</b>	MATLAB termination M-file
<b>exit</b>	Terminate MATLAB
<b>matlab</b>	Start MATLAB (UNIX systems only)
<b>matlabrc</b>	MATLAB startup M-file
<b>quit</b>	Terminate MATLAB
<b>startup</b>	MATLAB startup M-file

### Operators and Special Characters

<b>+</b>	Plus
<b>-</b>	Minus
<b>*</b>	Matrix multiplication
<b>.*</b>	Array multiplication
<b>^</b>	Matrix power
<b>.^</b>	Array power
<b>kron</b>	Kronecker tensor product
<b>\</b>	Backslash or left division
<b>/</b>	Slash or right division
<b>./ and .\</b>	Array division, right and left
<b>:</b>	Colon
<b>()</b>	Parentheses
<b>[]</b>	Brackets
<b>{}</b>	Curly braces
<b>.</b>	Decimal point
<b>...</b>	Continuation

,	Comma
;	Semicolon
%	Comment
!	Exclamation point
'	Transpose and quote
.'	Nonconjugated transpose
=	Assignment
==	Equality
<>	Relational operators
&	Logical and
	Logical or
~	Logical not
xor	Logical exclusive or

## Logical Functions

<b>all</b>	Test to determine if all elements are nonzero
<b>any</b>	Test for any nonzeros
<b>exist</b>	Check if a variable or file exists
<b>find</b>	Find indices and values of nonzero elements
<b>is*</b>	Detect state
<b>isa</b>	Detect an object of a given class
<b>iskeyword</b>	Test if string is a MATLAB keyword
<b>isvarname</b>	Test if string is a valid variable name
<b>logical</b>	Convert numeric values to logical
<b>mislocked</b>	True if M-file cannot be cleared

## Elementary Math Functions

<b>abs</b>	Absolute value and complex magnitude
<b>acos, acosh</b>	Inverse cosine and inverse hyperbolic cosine
<b>acot, acoth</b>	Inverse cotangent and inverse hyperbolic cotangent
<b>acsc, acsch</b>	Inverse cosecant and inverse hyperbolic cosecant
<b>angle</b>	Phase angle
<b>asec, asech</b>	Inverse secant and inverse hyperbolic secant
<b>asin, asinh</b>	Inverse sine and inverse hyperbolic sine
<b>atan, atanh</b>	Inverse tangent and inverse hyperbolic tangent
<b>atan2</b>	Four-quadrant inverse tangent
<b>ceil</b>	Round toward infinity
<b>complex</b>	Construct complex data from real and imaginary components
<b>conj</b>	Complex conjugate

<b>cos, cosh</b>	Cosine and hyperbolic cosine
<b>cot, coth</b>	Cotangent and hyperbolic cotangent
<b>csc, csch</b>	Cosecant and hyperbolic cosecant
<b>exp</b>	Exponential
<b>fix</b>	Round towards zero
<b>floor</b>	Round towards minus infinity
<b>gcd</b>	Greatest common divisor
<b>imag</b>	Imaginary part of a complex number
<b>lcm</b>	Least common multiple
<b>log</b>	Natural logarithm
<b>log2</b>	Base 2 logarithm and dissect floating-point numbers into exponent and mantissa
<b>log10</b>	Common (base 10) logarithm
<b>mod</b>	Modulus (signed remainder after division)
<b>nchoosek</b>	Binomial coefficient or all combinations
<b>real</b>	Real part of complex number
<b>rem</b>	Remainder after division
<b>round</b>	Round to nearest integer
<b>sec, sech</b>	Secant and hyperbolic secant
<b>sign</b>	Signum function
<b>sin, sinh</b>	Sine and hyperbolic sine
<b>sqrt</b>	Square root
<b>tan, tanh</b>	Tangent and hyperbolic tangent

## Language Constructs and Debugging

### MATLAB as a Programming Language

<b>builtin</b>	Execute builtin function from overloaded method
<b>eval</b>	Interpret strings containing MATLAB expressions
<b>evalc</b>	Evaluate MATLAB expression with capture
<b>evalin</b>	Evaluate expression in workspace
<b>feval</b>	Function evaluation
<b>function</b>	Function M-files
<b>global</b>	Define global variables
<b>nargchk</b>	Check number of input arguments
<b>persistent</b>	Define persistent variable
<b>script</b>	Script M-files

### Control Flow

<b>break</b>	Terminate execution of for loop or while loop
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<b>case</b>	Case switch
<b>catch</b>	Begin catch block
<b>continue</b>	Pass control to the next iteration of for or while loop
<b>else</b>	Conditionally execute statements
<b>elseif</b>	Conditionally execute statements
<b>end</b>	Terminate for, while, switch, try, and if statements or indicate last index
<b>error</b>	Display error messages
<b>for</b>	Repeat statements a specific number of times
<b>if</b>	Conditionally execute statements
<b>otherwise</b>	Default part of switch statement
<b>return</b>	Return to the invoking function
<b>switch</b>	Switch among several cases based on expression
<b>try</b>	Begin try block
<b>warning</b>	Display warning message
<b>while</b>	Repeat statements an indefinite number of times

### Interactive Input

<b>input</b>	Request user input
<b>keyboard</b>	Invoke the keyboard in an M-file
<b>menu</b>	Generate a menu of choices for user input
<b>pause</b>	Halt execution temporarily

### Object-Oriented Programming

<b>class</b>	Create object or return class of object
<b>double</b>	Convert to double precision
<b>inferiorto</b>	Inferior class relationship
<b>inline</b>	Construct an inline object
<b>int8, int16, int32</b>	Convert to signed integer
<b>isa</b>	Detect an object of a given class
<b>loadobj</b>	Extends the load function for user objects
<b>saveobj</b>	Save filter for objects
<b>single</b>	Convert to single precision
<b>superiorto</b>	Superior class relationship
<b>uint8, uint16, uint32</b>	Convert to unsigned integer

### Debugging

<b>dbclear</b>	Clear breakpoints
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<b>dbcont</b>	Resume execution
<b>dbdown</b>	Change local workspace context
<b>dbmex</b>	Enable MEX-file debugging
<b>dbquit</b>	Quit debug mode
<b>dbstack</b>	Display function call stack
<b>dbstatus</b>	List all breakpoints
<b>dbstep</b>	Execute one or more lines from a breakpoint
<b>dbstop</b>	Set breakpoints in an M-file function
<b>dbtype</b>	List M-file with line numbers
<b>dbup</b>	Change local workspace context

## Function Handles

<b>function_handle</b>	MATLAB data type that is a handle to a function
<b>functions</b>	Return information about a function handle
<b>func2str</b>	Constructs a function name string from a function handle
<b>str2func</b>	Constructs a function handle from a function name string

## Character String Functions

### General

<b>abs</b>	Absolute value and complex magnitude
<b>eval</b>	Interpret strings containing MATLAB expressions
<b>real</b>	Real part of complex number
<b>strings</b>	MATLAB string handling

## String to Function Handle Conversion

<b>func2str</b>	Constructs a function name string from a function handle
<b>str2func</b>	Constructs a function handle from a function name string

## String Manipulation

<b>deblank</b>	Strip trailing blanks from the end of a string
<b>findstr</b>	Find one string within another
<b>lower</b>	Convert string to lower case
<b>strcat</b>	String concatenation
<b>strcmp</b>	Compare strings
<b>strcmpi</b>	Compare strings, ignoring case
<b>strjust</b>	Justify a character array
<b>strmatch</b>	Find possible matches for a string

<b>strncmp</b>	Compare the first n characters of strings
<b>strncmpi</b>	Compare the first n characters of strings, ignoring case
<b>strrep</b>	String search and replace
<b>strtok</b>	First token in string
<b>strvcat</b>	Vertical concatenation of strings
<b>symvar</b>	Determine symbolic variables in an expression
<b>texlabel</b>	Produce the TeX format from a character string
<b>upper</b>	Convert string to upper case

## String to Number Conversion

<b>char</b>	Create character array (string)
<b>int2str</b>	Integer to string conversion
<b>mat2str</b>	Convert a matrix into a string
<b>num2str</b>	Number to string conversion
<b>sprintf</b>	Write formatted data to a string
<b>sscanf</b>	Read string under format control
<b>str2double</b>	Convert string to double-precision value
<b>str2mat</b>	String to matrix conversion
<b>str2num</b>	String to number conversion

## Radix Conversion

<b>bin2dec</b>	Binary to decimal number conversion
<b>dec2bin</b>	Decimal to binary number conversion
<b>dec2hex</b>	Decimal to hexadecimal number conversion
<b>hex2dec</b>	Hexadecimal to decimal number conversion
<b>hex2num</b>	Hexadecimal to double number conversion

## Matrix Manipulation

### Elementary Matrices and Arrays

<b>blkdiag</b>	Construct a block diagonal matrix from input arguments
<b>eye</b>	Identity matrix
<b>linspace</b>	Generate linearly spaced vectors
<b>logspace</b>	Generate logarithmically spaced vectors
<b>numel</b>	Number of elements in a matrix or cell array
<b>ones</b>	Create an array of all ones
<b>rand</b>	Uniformly distributed random numbers and arrays
<b>randn</b>	Normally distributed random numbers and arrays
<b>zeros</b>	Create an array of all zeros

**:** (colon) Regularly spaced vector

## Special Variables and Constants

<b>ans</b>	The most recent answer
<b>computer</b>	Identify the computer on which MATLAB is running
<b>eps</b>	Floating-point relative accuracy
<b>i</b>	Imaginary unit
<b>Inf</b>	Infinity
<b>inputname</b>	Input argument name
<b>j</b>	Imaginary unit
<b>NaN</b>	Not-a-Number
<b>nargin, nargout</b>	Number of function arguments
<b>nargoutchk</b>	Validate number of output arguments
<b>pi</b>	Ratio of a circle's circumference to its diameter,
<b>realmax</b>	Largest positive floating-point number
<b>realmin</b>	Smallest positive floating-point number
<b>varargin, varargout</b>	Pass or return variable numbers of arguments

## Time and Dates

<b>calendar</b>	Calendar
<b>clock</b>	Current time as a date vector
<b>cputime</b>	Elapsed CPU time
<b>date</b>	Current date string
<b>datenum</b>	Serial date number
<b>datestr</b>	Date string format
<b>datevec</b>	Date components
<b>eomday</b>	End of month
<b>etime</b>	Elapsed time
<b>now</b>	Current date and time
<b>tic, toc</b>	Stopwatch timer
<b>weekday</b>	Day of the week

## Matrix Manipulation

<b>cat</b>	Concatenate arrays
<b>diag</b>	Diagonal matrices and diagonals of a matrix
<b>fliplr</b>	Flip matrices left-right
<b>flipud</b>	Flip matrices up-down

<b>repmat</b>	Replicate and tile an array
<b>reshape</b>	Reshape array
<b>rot90</b>	Rotate matrix 90 degrees
<b>tril</b>	Lower triangular part of a matrix
<b>triu</b>	Upper triangular part of a matrix
<b>: (colon)</b>	Index into array, rearrange array

## Vector Functions

<b>cross</b>	Vector cross product
<b>dot</b>	Vector dot product
<b>intersect</b>	Set intersection of two vectors
<b>ismember</b>	Detect members of a set
<b>setdiff</b>	Return the set difference of two vector
<b>setxor</b>	Set exclusive or of two vectors
<b>union</b>	Set union of two vectors
<b>unique</b>	Unique elements of a vector

## Specialized Matrices

<b>compan</b>	Companion matrix
<b>gallery</b>	Test matrices
<b>hadamard</b>	Hadamard matrix
<b>hankel</b>	Hankel matrix
<b>hilb</b>	Hilbert matrix
<b>invhilb</b>	Inverse of the Hilbert matrix
<b>magic</b>	Magic square
<b>pascal</b>	Pascal matrix
<b>toeplitz</b>	Toeplitz matrix
<b>wilkinson</b>	Wilkinson's eigenvalue test matrix

## Bitwise Functions

<b>bitand</b>	Bit-wise AND
<b>bitcmp</b>	Complement bits
<b>bitor</b>	Bit-wise OR
<b>bitmax</b>	Maximum floating-point integer
<b>bitset</b>	Set bit
<b>bitshift</b>	Bit-wise shift
<b>bitget</b>	Get bit
<b>bitxor</b>	Bit-wise XOR

## Structure Functions

<b>fieldnames</b>	Field names of a structure
<b>getfield</b>	Get field of structure array
<b>rmfield</b>	Remove structure fields
<b>setfield</b>	Set field of structure array
<b>struct</b>	Create structure array
<b>struct2cell</b>	Structure to cell array conversion

## MATLAB Object Functions

<b>class</b>	Create object or return class of object
<b>isa</b>	Detect an object of a given class
<b>methods</b>	Display method names
<b>methodsview</b>	Displays information on all methods implemented by a class
<b>subsasgn</b>	Overloaded method for A(I)=B, A{I}=B, and A.field=B
<b>subsindex</b>	Overloaded method for X(A)
<b>subsref</b>	Overloaded method for A(I), A{I} and A.field

## Cell Array Functions

<b>cell</b>	Create cell array
<b>cellfun</b>	Apply a function to each element in a cell array
<b>cellstr</b>	Create cell array of strings from character array
<b>cell2struct</b>	Cell array to structure array conversion
<b>celldisp</b>	Display cell array contents
<b>cellplot</b>	Graphically display the structure of cell arrays
<b>num2cell</b>	Convert a numeric array into a cell array

## Multidimensional Array Functions

<b>cat</b>	Concatenate arrays
<b>flipdim</b>	Flip array along a specified dimension
<b>ind2sub</b>	Subscripts from linear index
<b>ipermute</b>	Inverse permute the dimensions of a multidimensional array
<b>ndgrid</b>	Generate arrays for multidimensional functions and interpolation
<b>ndims</b>	Number of array dimensions
<b>permute</b>	Rearrange the dimensions of a multidimensional array
<b>reshape</b>	Reshape array
<b>shiftdim</b>	Shift dimensions
<b>squeeze</b>	Remove singleton dimensions

<b>sub2ind</b>	Single index from subscripts
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## Sound Processing Functions

### General Sound Functions

<b>lin2mu</b>	Convert linear audio signal to mu-law
<b>mu2lin</b>	Convert mu-law audio signal to linear
<b>sound</b>	Convert vector into sound
<b>soundsc</b>	Scale data and play as sound

### SPARCstation-Specific Sound Functions

<b>auread</b>	Read NeXT/SUN (.au) sound file
<b>auwrite</b>	Write NeXT/SUN (.au) sound file

### .WAV Sound Functions

<b>wavplay</b>	Play recorded sound on a PC-based audio output device
<b>wavread</b>	Read Microsoft WAVE (.wav) sound file
<b>wavrecord</b>	Record sound using a PC-based audio input device
<b>wavwrite</b>	Write Microsoft WAVE (.wav) sound file

## File I/O Functions

### File Opening and Closing

<b>fclose</b>	Close one or more open files
<b>fopen</b>	Open a file or obtain information about open files

### Unformatted I/O

<b>fread</b>	Read binary data from file
<b>fwrite</b>	Write binary data to a file

### Formatted I/O

<b>fgetl</b>	Return the next line of a file as a string without line terminator(s)
<b>fgets</b>	Return the next line of a file as a string with line terminator(s)
<b>fprintf</b>	Write formatted data to file
<b>fscanf</b>	Read formatted data from file

### File Positioning

<b>feof</b>	Test for end-of-file
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<b>error</b>	Query MATLAB about errors in file input or output
<b>frewind</b>	Rewind an open file
<b>fseek</b>	Set file position indicator
<b>ftell</b>	Get file position indicator

## String Conversion

<b>sprintf</b>	Write formatted data to a string
<b>sscanf</b>	Read string under format control

## Specialized File I/O

<b>dlmread</b>	Read an ASCII delimited file into a matrix
<b>dlmwrite</b>	Write a matrix to an ASCII delimited file
<b>hdf</b>	HDF interface
<b>imfinfo</b>	Return information about a graphics file
<b>imread</b>	Read image from graphics file
<b>imwrite</b>	Write an image to a graphics file
<b>strread</b>	Read formatted data from a string
<b>textread</b>	Read formatted data from text file
<b>wk1read</b>	Read a Lotus123 WK1 spreadsheet file into a matrix
<b>wk1write</b>	Write a matrix to a Lotus123 WK1 spreadsheet file

## Specialized Math Functions

<b>airy</b>	Airy functions
<b>besselh</b>	Bessel functions of the third kind (Hankel functions)
<b>besseli, bessell</b>	Modified Bessel functions
<b>besselj, bessely</b>	Bessel functions
<b>beta, betainc, betaln</b>	Beta functions
<b>ellipj</b>	Jacobi elliptic functions
<b>ellipke</b>	Complete elliptic integrals of the first and second kind
<b>erf, erfc, erfcx, erfinv</b>	Error functions
<b>expint</b>	Exponential integral
<b>factorial</b>	Factorial function
<b>gamma, gammaln, gammaln</b>	Gamma functions
<b>legendre</b>	Associated Legendre functions
<b>pow2</b>	Base 2 power and scale floating-point numbers

<b>rat, rats</b>	Rational fraction approximation
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## Coordinate System Conversion

<b>cart2pol</b>	Transform Cartesian coordinates to polar or cylindrical
<b>cart2sph</b>	Transform Cartesian coordinates to spherical
<b>pol2cart</b>	Transform polar or cylindrical coordinates to Cartesian
<b>sph2cart</b>	Transform spherical coordinates to Cartesian

## Matrix Functions

### Matrix Analysis

<b>cond</b>	Condition number with respect to inversion
<b>condeig</b>	Condition number with respect to eigenvalues
<b>det</b>	Matrix determinant
<b>norm</b>	Vector and matrix norms
<b>null</b>	Null space of a matrix
<b>orth</b>	Range space of a matrix
<b>rank</b>	Rank of a matrix
<b>rcond</b>	Matrix reciprocal condition number estimate
<b>rref, rrefmovie</b>	Reduced row echelon form
<b>subspace</b>	Angle between two subspaces
<b>trace</b>	Sum of diagonal elements

### Linear Equations

<b>chol</b>	Cholesky factorization
<b>inv</b>	Matrix inverse
<b>lscov</b>	Least squares solution in the presence of known covariance
<b>lu</b>	LU matrix factorization
<b>lsqnonneg</b>	Nonnegative least squares
<b>minres</b>	Minimum Residual Method
<b>pinv</b>	Moore-Penrose pseudoinverse of a matrix
<b>qr</b>	Orthogonal-triangular decomposition
<b>symmlq</b>	Symmetric LQ method

### Eigenvalues and Singular Values

<b>balance</b>	Improve accuracy of computed eigenvalues
<b>cdf2rdf</b>	Convert complex diagonal form to real block diagonal form
<b>eig</b>	Eigenvalues and eigenvectors
<b>gsvd</b>	Generalized singular value decomposition

<b>hess</b>	Hessenberg form of a matrix
<b>poly</b>	Polynomial with specified roots
<b>qz</b>	QZ factorization for generalized eigenvalues
<b>rsf2csf</b>	Convert real Schur form to complex Schur form
<b>schur</b>	Schur decomposition
<b>svd</b>	Singular value decomposition

## Matrix Functions

<b>expm</b>	Matrix exponential
<b>funm</b>	Evaluate general matrix function
<b>logm</b>	Matrix logarithm
<b>sqrtn</b>	Matrix square root

## Low Level Functions

<b>qrdelete</b>	Delete column from QR factorization
<b>qrinsert</b>	Insert column in QR factorization

## Data Analysis and Fourier Transform

### Basic Operations

<b>cumprod</b>	Cumulative product
<b>cumsum</b>	Cumulative sum
<b>cumtrapz</b>	Cumulative trapezoidal numerical integration
<b>factor</b>	Prime factors
<b>inpolygon</b>	Detect points inside a polygonal region
<b>max</b>	Maximum elements of an array
<b>mean</b>	Average or mean value of arrays
<b>median</b>	Median value of arrays
<b>min</b>	Minimum elements of an array
<b>perms</b>	All possible permutations
<b>polyarea</b>	Area of polygon
<b>primes</b>	Generate list of prime numbers
<b>prod</b>	Product of array elements
<b>rectint</b>	Rectangle intersection Area
<b>sort</b>	Sort elements in ascending order
<b>sortrows</b>	Sort rows in ascending order
<b>std</b>	Standard deviation
<b>sum</b>	Sum of array elements
<b>trapz</b>	Trapezoidal numerical integration

**var** Variance

## Finite Differences

**del2** Discrete Laplacian

**diff** Differences and approximate derivatives

**gradient** Numerical gradient

## Correlation

**corrcoef** Correlation coefficients

**cov** Covariance matrix

## Filtering and Convolution

**conv** Convolution and polynomial multiplication

**conv2** Two-dimensional convolution

**deconv** Deconvolution and polynomial division

**filter** Filter data with an infinite impulse response (IIR) or finite impulse response (FIR) filter

**filter2** Two-dimensional digital filtering

## Fourier Transforms

**abs** Absolute value and complex magnitude

**angle** Phase angle

**cplxpair** Sort complex numbers into complex conjugate pairs

**fft** One-dimensional fast Fourier transform

**fft2** Two-dimensional fast Fourier transform

**fftshift** Shift DC component of fast Fourier transform to center of spectrum

**ifft** Inverse one-dimensional fast Fourier transform

**ifft2** Inverse two-dimensional fast Fourier transform

**ifftn** Inverse multidimensional fast Fourier transform

**ifftshift** Inverse FFT shift

**nextpow2** Next power of two

**unwrap** Correct phase angles

## Polynomial and Interpolation Functions

### Polynomials

**conv** Convolution and polynomial multiplication

**deconv** Deconvolution and polynomial division

**poly** Polynomial with specified roots

**polyder** Polynomial derivative

**polyeig** Polynomial eigenvalue problem

**polyfit** Polynomial curve fitting

**polyint** Analytic polynomial integration

**polyval** Polynomial evaluation

**polyvalm** Matrix polynomial evaluation

**residue** Convert between partial fraction expansion and polynomial coefficients

**roots** Polynomial roots

## Data Interpolation

**convhull** Convex hull

**convhulln** Multidimensional convex hull

**delaunay** Delaunay triangulation

**delaunay3** Three-dimensional Delaunay tessellation

**delaunayn** Multidimensional Delaunay tessellation

**dsearch** Search for nearest point

**dsearchn** Multidimensional closest point search

**griddata** Data gridding

**griddata3** Data gridding and hypersurface fitting for three-dimensional data

**griddatan** Data gridding and hypersurface fitting (dimension  $\geq 2$ )

**interp1** One-dimensional data interpolation (table lookup)

**interp2** Two-dimensional data interpolation (table lookup)

**interp3** Three-dimensional data interpolation (table lookup)

**interpft** One-dimensional interpolation using the FFT method

**interpn** Multidimensional data interpolation (table lookup)

**meshgrid** Generate X and Y matrices for three-dimensional plots

**ndgrid** Generate arrays for multidimensional functions and interpolation

**pchip** Piecewise Cubic Hermite Interpolating Polynomial (PCHIP)

**ppval** Piecewise polynomial evaluation

**spline** Cubic spline data interpolation

**tsearch** Search for enclosing Delaunay triangle

**tsearchn** Multidimensional closest simplex search

**voronoi** Voronoi diagram

**voronoin** Multidimensional Voronoi diagrams

## Function Functions - Nonlinear Numerical Methods

**bvp4c** Solve two-point boundary value problems (BVPs) for ordinary differential equations (ODEs)

**bvpget** Extract parameters from BVP options structure

**bvpinit** Form the initial guess for bvp4c

**bvpset** Create/alter BVP options structure

**bvpval** Evaluate the solution computed by bvp4c

**dblquad** Numerical evaluation of double integrals

**fminbnd** Minimize a function of one variable

**fminsearch** Minimize a function of several variables

**fzero** Find zero of a function of one variable

**ode45, ode23, ode113, ode15s, ode23s, ode23t, ode23tb** Solve initial value problems for ODEs

**odeget** Extract parameters from ODE options structure

**odeset** Create/alter ODE options structure

**optimget** Get optimization options structure parameter values

**optimset** Create or edit optimization options parameter structure

**pdepe** Solve initial-boundary value problems

**pdeval** Evaluate the solution computed by pdepe

**quad** Numerical evaluation of integrals, adaptive Simpson quadrature

**quadl** Numerical evaluation of integrals, adaptive Lobatto quadrature

**vectorize** Vectorize expression

## Sparse Matrix Functions

### Elementary Sparse Matrices

**spdiags** Extract and create sparse band and diagonal matrices

**speye** Sparse identity matrix

**sprand** Sparse uniformly distributed random matrix

**sprandn** Sparse normally distributed random matrix

**sprandsym** Sparse symmetric random matrix

### Full to Sparse Conversion

**find** Find indices and values of nonzero elements

**full** Convert sparse matrix to full matrix

**sparse** Create sparse matrix

**spconvert** Import matrix from sparse matrix external format

## Working with Nonzero Entries

**nnz** Number of nonzero matrix elements  
**nonzeros** Nonzero matrix elements  
**nzmax** Amount of storage allocated for nonzero matrix elements  
**spalloc** Allocate space for sparse matrix  
**spfun** Apply function to nonzero sparse matrix elements  
**spones** Replace nonzero sparse matrix elements with ones

## Visualizing Sparse Matrices

**spy** Visualize sparsity pattern

## Reordering Algorithms

**colamd** Column approximate minimum degree permutation  
**colmmd** Sparse column minimum degree permutation  
**colperm** Sparse column permutation based on nonzero count  
**dmperm** Dulmage-Mendelsohn decomposition  
**randperm** Random permutation  
**symamd** Symmetric approximate minimum degree permutation  
**symmmd** Sparse symmetric minimum degree ordering  
**symrcm** Sparse reverse Cuthill-McKee ordering

## Norm, Condition Number, and Rank

**condest** 1-norm matrix condition number estimate  
**normest** 2-norm estimate

## Sparse Systems of Linear Equations

**bicg** BiConjugate Gradients method  
**bicgstab** BiConjugate Gradients Stabilized method  
**cgs** Conjugate Gradients Squared method  
**cholinc** Sparse Incomplete Cholesky and Cholesky-Infinity factorizations  
**cholupdate** Rank 1 update to Cholesky factorization  
**gmres** Generalized Minimum Residual method (with restarts)  
**lsqr** LSQR implementation of Conjugate Gradients on the normal equations

**luinc** Incomplete LU matrix factorizations  
**pcg** Preconditioned Conjugate Gradients method  
**qmr** Quasi-Minimal Residual method  
**qr** Orthogonal-triangular decomposition  
**qrdelete** Delete column from QR factorization  
**qrinsert** Insert column in QR factorization  
**qrupdate** Rank 1 update to QR factorization

## Sparse Eigenvalues and Singular Values

**eigs** Find eigenvalues and eigenvectors  
**svds** Find singular values

## Miscellaneous

**spparms** Set parameters for sparse matrix routines

## Plotting and Data Visualization

### Basic Plots and Graphs

**bar** Vertical bar chart  
**barh** Horizontal bar chart  
**hist** Plot histograms  
**histc** Histogram count  
**hold** Hold current graph  
**loglog** Plot using log-log scales  
**pie** Pie plot  
**plot** Plot vectors or matrices.  
**polar** Polar coordinate plot  
**semilogx** Semi-log scale plot  
**semilogy** Semi-log scale plot  
**subplot** Create axes in tiled positions

### Three-Dimensional Plotting

**bar3** Vertical 3-D bar chart  
**bar3h** Horizontal 3-D bar chart  
**comet3** 3-D comet plot  
**cylinder** Generate cylinder  
**fill3** Draw filled 3-D polygons in 3-space  
**plot3** Plot lines and points in 3-D space  
**quiver3** 3-D quiver (or velocity) plot

**slice** Volumetric slice plot  
**sphere** Generate sphere  
**stem3** Plot discrete surface data  
**waterfall** Waterfall plot

## Plot Annotation and Grids

**clabel** Add contour labels to a contour plot  
**datetick** Date formatted tick labels  
**grid** Grid lines for 2-D and 3-D plots  
**gtext** Place text on a 2-D graph using a mouse  
**legend** Graph legend for lines and patches  
**plotyy** Plot graphs with Y tick labels on the left and right  
**title** Titles for 2-D and 3-D plots  
**xlabel** X-axis labels for 2-D and 3-D plots  
**ylabel** Y-axis labels for 2-D and 3-D plots  
**zlabel** Z-axis labels for 3-D plots

## Surface, Mesh, and Contour Plots

**contour** Contour (level curves) plot  
**contourc** Contour computation  
**contourf** Filled contour plot  
**hidden** Mesh hidden line removal mode  
**meshc** Combination mesh/contourplot  
**mesh** 3-D mesh with reference plane  
**peaks** A sample function of two variables  
**surf** 3-D shaded surface graph  
**surface** Create surface low-level objects  
**surfc** Combination surf/contourplot  
**surfl** 3-D shaded surface with lighting  
**trimesh** Triangular mesh plot  
**trisurf** Triangular surface plot

## Volume Visualization

**coneplot** Plot velocity vectors as cones in 3-D vector field  
**contourslice** Draw contours in volume slice plane  
**curl** Compute the curl and angular velocity of a vector field  
**divergence** Compute the divergence of a vector field

<b>flow</b>	Generate scalar volume data
<b>interpstreamspeed</b>	Interpolate streamline vertices from vector-field magnitudes
<b>isocaps</b>	Compute isosurface end-cap geometry
<b>isocolors</b>	Compute the colors of isosurface vertices
<b>isonormals</b>	Compute normals of isosurface vertices
<b>isosurface</b>	Extract isosurface data from volume data
<b>reducepatch</b>	Reduce the number of patch faces
<b>reducevolume</b>	Reduce number of elements in volume data set
<b>shrinkfaces</b>	Reduce the size of patch faces
<b>slice</b>	Draw slice planes in volume
<b>smooth3</b>	Smooth 3-D data
<b>stream2</b>	Compute 2-D stream line data
<b>stream3</b>	Compute 3-D stream line data
<b>streamline</b>	Draw stream lines from 2- or 3-D vector data
<b>streamparticles</b>	Draws stream particles from vector volume data
<b>streamribbon</b>	Draws stream ribbons from vector volume data
<b>streamslice</b>	Draws well-spaced stream lines from vector volume data
<b>streamtube</b>	Draws stream tubes from vector volume data
<b>surf2patch</b>	Convert surface data to patch data
<b>subvolume</b>	Extract subset of volume data set
<b>volumebounds</b>	Return coordinate and color limits for volume (scalar and vector)

## Domain Generation

<b>griddata</b>	Data gridding and surface fitting
<b>meshgrid</b>	Generation of X and Y arrays for 3-D plots

## Specialized Plotting

<b>area</b>	Area plot
<b>box</b>	Axis box for 2-D and 3-D plots
<b>comet</b>	Comet plot
<b>compass</b>	Compass plot
<b>errorbar</b>	Plot graph with error bars
<b>ezcontour</b>	Easy to use contour plotter
<b>ezcontourf</b>	Easy to use filled contour plotter
<b>ezmesh</b>	Easy to use 3-D mesh plotter
<b>ezmeshc</b>	Easy to use combination mesh/contour plotter
<b>ezplot</b>	Easy to use function plotter

<b>ezplot3</b>	Easy to use 3-D parametric curve plotter
<b>ezpolar</b>	Easy to use polar coordinate plotter
<b>ezsurf</b>	Easy to use 3-D colored surface plotter
<b>ezsurfz</b>	Easy to use combination surface/contour plotter
<b>feather</b>	Feather plot
<b>fill</b>	Draw filled 2-D polygons
<b>fplot</b>	Plot a function
<b>pareto</b>	Pareto char
<b>pie3</b>	3-D pie plot
<b>plotmatrix</b>	Scatter plot matrix
<b>pcolor</b>	Pseudocolor (checkerboard) plot
<b>rose</b>	Plot rose or angle histogram
<b>quiver</b>	Quiver (or velocity) plot
<b>ribbon</b>	Ribbon plot
<b>stairs</b>	Stairstep graph
<b>scatter</b>	Scatter plot
<b>scatter3</b>	3-D scatter plot
<b>stem</b>	Plot discrete sequence data
<b>convhull</b>	Convex hull
<b>delaunay</b>	Delaunay triangulation
<b>dsearch</b>	Search Delaunay triangulation for nearest point
<b>inpolygon</b>	True for points inside a polygonal region
<b>polyarea</b>	Area of polygon
<b>tsearch</b>	Search for enclosing Delaunay triangle
<b>voronoi</b>	Voronoi diagram

## View Control

<b>camdolly</b>	Move camera position and target
<b>camlookat</b>	View specific objects
<b>camorbit</b>	Orbit about camera target
<b>campan</b>	Rotate camera target about camera position
<b>campos</b>	Set or get camera position
<b>camproj</b>	Set or get projection type
<b>camroll</b>	Rotate camera about viewing axis
<b>camtarget</b>	Set or get camera target
<b>camup</b>	Set or get camera up-vector
<b>camva</b>	Set or get camera view angle
<b>camzoom</b>	Zoom camera in or out
<b>daspect</b>	Set or get data aspect ratio

<b>pbaspect</b>	Set or get plot box aspect ratio
<b>view</b>	3-D graph viewpoint specification.
<b>viewmtx</b>	Generate view transformation matrices
<b>xlim</b>	Set or get the current x-axis limits
<b>ylim</b>	Set or get the current y-axis limits
<b>zlim</b>	Set or get the current z-axis limits

## Lighting

<b>camlight</b>	Create or position Light
<b>light</b>	Light object creation function
<b>lighting</b>	Lighting mode
<b>lightangle</b>	Position light in spherical coordinates
<b>material</b>	Material reflectance mode

## Transparency

<b>alpha</b>	Set or query transparency properties for objects in current axes
<b>alphamap</b>	Specify the figure alphamap
<b>alim</b>	Set or query the axes alpha limits

## Color Operations

<b>brighten</b>	Brighten or darken color map
<b>caxis</b>	Pseudocolor axis scaling
<b>colorbar</b>	Display color bar (color scale)
<b>colordef</b>	Set up color defaults
<b>colormap</b>	Set the color look-up table (list of colormaps)
<b>graymon</b>	Graphics figure defaults set for grayscale monitor
<b>hsv2rgb</b>	Hue-saturation-value to red-green-blue conversion
<b>rgb2hsv</b>	RGB to HSV conversion
<b>rgbplot</b>	Plot color map
<b>shading</b>	Color shading mode
<b>spinmap</b>	Spin the colormap
<b>surfnorm</b>	3-D surface normals
<b>whitebg</b>	Change axes background color for plots

## Colormaps

<b>autumn</b>	Shades of red and yellow color map
<b>bone</b>	Gray-scale with a tinge of blue color map



<b>contrast</b>	Gray color map to enhance image contrast
<b>cool</b>	Shades of cyan and magenta color map
<b>copper</b>	Linear copper-tone color map
<b>flag</b>	Alternating red, white, blue, and black color map
<b>gray</b>	Linear gray-scale color map
<b>hot</b>	Black-red-yellow-white color map
<b>hsv</b>	Hue-saturation-value (HSV) color map
<b>jet</b>	Variant of HSV
<b>lines</b>	Line color colormap
<b>prism</b>	Colormap of prism colors
<b>spring</b>	Shades of magenta and yellow color map
<b>summer</b>	Shades of green and yellow colormap
<b>winter</b>	Shades of blue and green color map

## Printing

<b>orient</b>	Hardcopy paper orientation
<b>pagesetupdlg</b>	Page position dialog box
<b>print</b>	Print graph or save graph to file
<b>printdlg</b>	Print dialog box
<b>printopt</b>	Configure local printer defaults
<b>saveas</b>	Save figure to graphic file

## Handle Graphics, General

<b>allchild</b>	Find all children of specified objects
<b>copyobj</b>	Make a copy of a graphics object and its children
<b>findall</b>	Find all graphics objects (including hidden handles)
<b>findobj</b>	Find objects with specified property values
<b>gcbo</b>	Return object whose callback is currently executing
<b>geo</b>	Return handle of current object
<b>get</b>	Get object properties
<b>rotate</b>	Rotate objects about specified origin and direction
<b>ishandle</b>	True for graphics objects
<b>set</b>	Set object properties

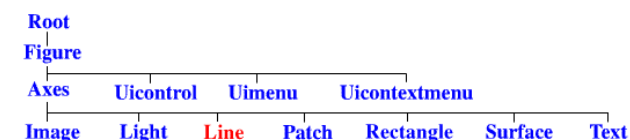
## Working with Application Data

<b>getappdata</b>	Get value of application data
<b>isappdata</b>	True if application data exists
<b>rmappdata</b>	Remove application data

**setappdata** Specify application data

## Handle Graphics, Object Creation

<b>axes</b>	Create Axes object
<b>figure</b>	Create Figure (graph) windows
<b>image</b>	Create Image (2-D matrix)
<b>light</b>	Create Light object (illuminates Patch and Surface)
<b>line</b>	Create Line object (3-D polylines)
<b>patch</b>	Create Patch object (polygons)
<b>rectangle</b>	Create Rectangle object (2-D rectangle)
<b>surface</b>	Create Surface (quadrilaterals)
<b>text</b>	Create Text object (character strings)
<b>uicontextmenu</b>	Create context menu (popup associated with object)



## Handle Graphics, Figure Windows

<b>capture</b>	Screen capture of the current figure
<b>clc</b>	Clear figure window
<b>clf</b>	Clear figure
<b>close</b>	Close specified window
<b>closereq</b>	Default close request function
<b>gcf</b>	Get current figure handle
<b>newplot</b>	Graphics M-file preamble for NextPlot property
<b>refresh</b>	Refresh figure
<b>saveas</b>	Save figure or model to desired output format

## Handle Graphics, Axes

<b>axis</b>	Plot axis scaling and appearance
<b>cla</b>	Clear Axes
<b>gca</b>	Get current Axes handle

## Object Manipulation

<b>reset</b>	Reset axis or figure
<b>rotate3d</b>	Interactively rotate the view of a 3-D plot
<b>selectmoveresize</b>	Interactively select, move, or resize objects

## Interactive User Input

<b>ginput</b>	Graphical input from a mouse or cursor
<b>zoom</b>	Zoom in and out on a 2-D plot

## Region of Interest

<b>dragrect</b>	Drag XOR rectangles with mouse
<b>drawnow</b>	Complete any pending drawing
<b>rbbox</b>	Rubberband box

## Graphical User Interfaces

### Dialog Boxes

<b>dialog</b>	Create a dialog box
<b>errordlg</b>	Create error dialog box
<b>helpdlg</b>	Display help dialog box
<b>inputdlg</b>	Create input dialog box
<b>listdlg</b>	Create list selection dialog box
<b>msgbox</b>	Create message dialog box
<b>pagedlg</b>	Display page layout dialog box
<b>printdlg</b>	Display print dialog box
<b>questdlg</b>	Create question dialog box
<b>uigetfile</b>	Display dialog box to retrieve name of file for reading
<b>uiputfile</b>	Display dialog box to retrieve name of file for writing
<b>uisetcolor</b>	Interactively set a ColorSpec using a dialog box
<b>uisetfont</b>	Interactively set a font using a dialog box
<b>warndlg</b>	Create warning dialog box

## User Interface Deployment

<b>guidata</b>	Store or retrieve application data
<b>guihandles</b>	Create a structure of handles
<b>movegui</b>	Move GUI figure onscreen
<b>openfig</b>	Open or raise GUI figure

## User Interface Development

<b>guide</b>	Open the GUI Layout Editor
<b>inspect</b>	Display Property Inspector

## MATLAB Interface to Java

<b>class</b>	Create object or return class of object
<b>import</b>	Add a package or class to the current Java import list
<b>isa</b>	Detect an object of a given class
<b>isjava</b>	Test whether an object is a Java object
<b>javaArray</b>	Constructs a Java array
<b>javaMethod</b>	Invokes a Java method
<b>javaObject</b>	Constructs a Java object
<b>methods</b>	Display method names
<b>methodsview</b>	Displays information on all methods implemented by a class

## External Programming Interface

### C MEX-Functions

<b>mexAtExit</b>	Register function to be called when MATLAB is cleared or terminates
<b>mexCallMATLAB</b>	Call MATLAB function or user-defined M-file or MEX-file
<b>mexErrMsgTxt</b>	Issue error message and return to MATLAB
<b>mexEvalString</b>	Execute MATLAB command in caller's workspace
<b>mexFunction</b>	Entry point to C MEX-file
<b>mexFunctionName</b>	Name of current MEX-file
<b>mexGet</b>	Get value of Handle Graphics property
<b>mexGetArray</b>	Get copy of variable from another workspace
<b>mexGetArrayPtr</b>	Get read-only pointer to variable from another workspace
<b>mexIsGlobal</b>	True if mxArray has global scope
<b>mexIsLocked</b>	True if MEX-file is locked
<b>mexLock</b>	Lock MEX-file so it cannot be cleared from memory
<b>mexMakeArrayPersistent</b>	Make mxArray persist after MEX-file completes
<b>mexMakeMemoryPersistent</b>	Make memory allocated by MATLAB's memory allocation routines persist after MEX-file completes
<b>mexPrintf</b>	ANSI C printf-style output routine
<b>mexPutArray</b>	Copy mxArray from your MEX-file into another workspace
<b>mexSet</b>	Set value of Handle Graphics property
<b>mexSetTrapFlag</b>	Control response of mexCallMATLAB to errors
<b>mexUnlock</b>	Unlock MEX-file so it can be cleared from memory

**mexWarnMsgTxt** Issue warning message

### C MX Functions

<b>mxAddField</b>	Add field to structure array
<b>mxArrayToString</b>	Convert arrays to strings
<b>mxAssert</b>	Check assertion value
<b>mxAssertS</b>	Check assertion value; doesn't print assertion's text
<b>mxCalcSingleSubscript</b>	Return offset from first element to desired element
<b>mxCalloc</b>	Allocate dynamic memory
<b>mxChar</b>	String mxArray's data type
<b>mxClassID</b>	Enumerated data type that identifies mxArray's class
<b>mxClearLogical</b>	Clear logical flag
<b>mxComplexity</b>	Specifies if mxArray has imaginary components
<b>mxCreateCellArray</b>	Create unpopulated N-dimensional cell mxArray
<b>mxCreateCellMatrix</b>	Create unpopulated two-dimensional cell mxArray
<b>mxCreateCharArray</b>	Create unpopulated N-dimensional string mxArray
<b>mxCreateCharMatrixFromStrings</b>	Create populated two-dimensional string mxArray
<b>mxCreateDoubleMatrix</b>	Create unpopulated two-dimensional, double-precision, floating-point mxArray
<b>mxCreateNumericArray</b>	Create unpopulated N-dimensional numeric mxArray
<b>mxCreateNumericMatrix</b>	Create numeric matrix and initialize data elements to 0
<b>mxCreateScalarDouble</b>	Create scalar, double-precision array initialized to specified value
<b>mxCreateSparse</b>	Create two-dimensional unpopulated sparse mxArray
<b>mxCreateString</b>	Create 1-by-n string mxArray initialized to specified string
<b>mxCreateStructArray</b>	Create unpopulated N-dimensional structure mxArray
<b>mxCreateStructMatrix</b>	Create unpopulated two-dimensional structure mxArray
<b>mxDestroyArray</b>	Free dynamic memory allocated by an mxCreate routine
<b>mxDuplicateArray</b>	Make deep copy of array
<b>mxFree</b>	Free dynamic memory allocated by mxCalloc

<b>mxGetCell</b>	Get cell's contents
<b>mxGetClassID</b>	Get mxArray's class
<b>mxGetClassName</b>	Get mxArray's class
<b>mxGetData</b>	Get pointer to data
<b>mxGetDimensions</b>	Get pointer to dimensions array
<b>mxGetElementSize</b>	Get number of bytes required to store each data element
<b>mxGetEps</b>	Get value of eps
<b>mxGetField</b>	Get field value, given field name and index in structure array
<b>mxGetFieldByNumber</b>	Get field value, given field number and index in structure array
<b>mxGetFieldNameByNumber</b>	Get field name, given field number in structure array
<b>mxGetFieldNumber</b>	Get field number, given field name in structure array
<b>mxGetImagData</b>	Get pointer to imaginary data of mxArray
<b>mxGetInf</b>	Get value of infinity
<b>mxGetIr</b>	Get ir array of sparse matrix
<b>mxGetJc</b>	Get jc array of sparse matrix
<b>mxGetM</b>	Get number of rows
<b>mxGetN</b>	Get number of columns or number of elements
<b>mxGetName</b>	Get name of specified mxArray
<b>mxGetNaN</b>	Get the value of NaN
<b>mxGetNumberOfDimensions</b>	Get number of dimensions
<b>mxGetNumberOfElements</b>	Get number of elements in array
<b>mxGetNumberOfFields</b>	Get number of fields in structure mxArray
<b>mxGetNzmax</b>	Get number of elements in ir, pr, and pi arrays
<b>mxGetPi</b>	Get mxArray's imaginary data elements
<b>mxGetPr</b>	Get mxArray's real data elements
<b>mxGetScalar</b>	Get real component of mxArray's first data element
<b>mxGetString</b>	Copy string mxArray's data into C-style string
<b>mxIsCell</b>	True if cell mxArray
<b>mxIsChar</b>	True if string mxArray
<b>mxIsClass</b>	True if mxArray is member of specified class
<b>mxIsComplex</b>	True if data is complex
<b>mxIsDouble</b>	True if mxArray represents its data as double-precision, floating-point numbers

<b>mxIsEmpty</b>	True if mxArray is empty
<b>mxIsFinite</b>	True if value is finite
<b>mxIsFromGlobalWS</b>	True if mxArray was copied from MATLAB's global workspace
<b>mxIsInf</b>	True if value is infinite
<b>mxIsInt8</b>	True if mxArray represents its data as signed 8-bit integers
<b>mxIsInt16</b>	True if mxArray represents its data as signed 16-bit integers
<b>mxIsInt32</b>	True if mxArray represents its data as signed 32-bit integers
<b>mxIsLogical</b>	True if mxArray is Boolean
<b>mxIsNaN</b>	True if value is NaN
<b>mxIsNumeric</b>	True if mxArray is numeric
<b>mxIsSingle</b>	True if mxArray represents its data as single-precision, floating-point numbers
<b>mxIsSparse</b>	True if sparse mxArray
<b>mxIsStruct</b>	True if structure mxArray
<b>mxIsUint8</b>	True if mxArray represents its data as unsigned 8-bit integers
<b>mxIsUint16</b>	True if mxArray represents its data as unsigned 16-bit integers
<b>mxIsUint32</b>	True if mxArray represents its data as unsigned 32-bit integers
<b>mxMalloc</b>	Allocate dynamic memory using MATLAB's memory manager
<b>mxRealloc</b>	Reallocate memory
<b>mxRemoveField</b>	Remove field from structure array
<b>mxSetAllocFcns</b>	Register memory allocation/deallocation functions in stand-alone engine or MAT application
<b>mxSetCell</b>	Set value of one cell
<b>mxSetClassName</b>	Convert MATLAB structure array to MATLAB object array
<b>mxSetData</b>	Set pointer to data
<b>mxSetDimensions</b>	Modify number/size of dimensions
<b>mxSetField</b>	Set field value of structure array, given field name/index
<b>mxSetFieldByNumber</b>	Set field value in structure array, given field number/index
<b>mxSetImagData</b>	Set imaginary data pointer for mxArray
<b>mxSetIr</b>	Set ir array of sparse mxArray
<b>mxSetJc</b>	Set jc array of sparse mxArray
<b>mxSetLogical</b>	Set logical flag
<b>mxSetM</b>	Set number of rows

<b>mxSetN</b>	Set number of columns
<b>mxSetName</b>	Set name of mxArray
<b>mxSetNzmax</b>	Set storage space for nonzero elements
<b>mxSetPi</b>	Set new imaginary data for mxArray
<b>mxSetPr</b>	Set new real data for mxArray

## C Engine Routines

<b>engClose</b>	Quit engine session
<b>engEvalString</b>	Evaluate expression in string
<b>engGetArray</b>	Copy variable from engine workspace
<b>engOpen</b>	Start engine session
<b>engOpenSingleUse</b>	Start engine session for single, nonshared use
<b>engOutputBuffer</b>	Specify buffer for MATLAB output
<b>engPutArray</b>	Put variables into engine workspace

## C MAT-File Routines

<b>matClose</b>	Close MAT -file
<b>matDeleteArray</b>	Delete named mxArray from MAT -file
<b>matGetArray</b>	Read mxArray from MAT -file
<b>matGetArrayHeader</b>	Load header array information only
<b>matGetDir</b>	Get directory of mxArrays in MAT -file
<b>matGetFp</b>	Get file pointer to MAT -file
<b>matGetNextArray</b>	Read next mxArray from MAT -file
<b>matGetNextArrayHeader</b>	Load array header information only
<b>matOpen</b>	Open MAT -file
<b>matPutArray</b>	Write mxArrays into MAT -files
<b>matPutArrayAsGlobal</b>	Put mxArrays into MAT -files

## Serial Port I/O

### Creating a Serial Port Object

<b>serial</b>	Create a serial port object
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### Writing and Reading Data

<b>fgetl</b>	Read one line of text from the device and discard the terminator
<b>fgets</b>	Read one line of text from the device and include the terminator
<b>fprintf</b>	Write text to the device

<b>fread</b>	Read binary data from the device
<b>fscanf</b>	Read data from the device, and format as text
<b>fwrite</b>	Write binary data to the device
<b>readasync</b>	Read data asynchronously from the device
<b>stopasync</b>	Stop asynchronous read and write operations

## Configuring and Returning Properties

<b>get</b>	Return serial port object properties
<b>set</b>	Configure or display serial port object properties

## State Change

<b>fclose</b>	Disconnect a serial port object from the device
<b>fopen</b>	Connect a serial port object to the device
<b>record</b>	Record data and event information to a file

## General Purpose

<b>clear</b>	Remove a serial port object from the MATLAB workspace
<b>delete</b>	Remove a serial port object from memory
<b>disp</b>	Display serial port object summary information
<b>instraction</b>	Display event information when an event occurs
<b>instrfind</b>	Return serial port objects from memory to the MATLAB workspace
<b>isvalid</b>	Determine if serial port objects are valid
<b>length</b>	Length of serial port object array
<b>load</b>	Load serial port objects and variables into the MATLAB workspace
<b>save</b>	Save serial port objects and variables to a MAT-file
<b>serialbreak</b>	Send a break to the device connected to the serial port
<b>size</b>	Size of serial port object array

## Handle Graphic Properties

### Root

**ButtonDownFcn; CallbackObject; Children; Clipping; CreateFcn; CurrentFigure; DeleteFcn; Diary; DiaryFile; Echo; ErrorMessage; FixedWidthFontName; Format; FormatSpacing; HandleVisibility; HitTest; Interruptible; Language; Parent; PointerLocation; PointerWindow; Profile; ProfileCount; ProfileFile; ProfileInterval; ScreenDepth; ScreenSize; Selected; SelectionHighlight; ShowHiddenHandles; Tag; Type; UIContextMenu; Units; UserData; Visible**

## Figure

AlphaMap; BackingStore; BusyAction; ButtonDownFcn; Children; Clipping; CloseRequestFcn; Color; Colormap; CreateFcn; CurrentAxes; CurrentCharacter; CurrentObject; CurrentPoint; DeleteFcn; Dithermap; DithermapMode; DoubleBuffer; FixedColors; HandleVisibility; HitTest; IntegerHandle; Interruptible; InvertHardcopy; KeyPressFcn; MenuBar; MinColormap; Name; NextPlot; NumberTitle; PaperOrientation; PaperPosition; PaperPositionMode; PaperSize; PaperType; PaperUnits; Parent; Pointer; PointerShapeCData; PointerShapeHotSpot; Position; Renderer; RendererMode; Resize; ResizeFcn; Selected; SelectionHighlight; SelectionType; ShareColors; Tag; Type; UIContextMenu; Units; UserData; Visible; WindowButtonDownFcn; WindowButtonMotionFcn; WindowButtonUpFcn; WindowStyle

## Axes

ALim; ALimMode; AmbientLightColor; Box; BusyAction; ButtonDownFcn; CLim; CLimMode; CameraPosition; CameraPositionMode; CameraTarget; CameraTargetMode; CameraUpVector; CameraUpVectorMode; CameraViewAngle; CameraViewAngleMode; Children; Clipping; Color; ColorOrder; CreateFcn; CurrentPoint; DataAspectRatio; DataAspectRatioMode; DeleteFcn; DrawMode; FontAngle; FontName; FontSize; FontUnits; FontWeight; GridLineStyle; HandleVisibility; HitTest; Interruptible; Layer; LineStyleOrder; LineWidth; NextPlot; Parent; PlotBoxAspectRatio; PlotBoxAspectRatioMode; Position; Projection; Selected; SelectionHighlight; Tag; TickDir; TickDirMode; TickLength; Title; Type; Units; UIContextMenu; UserData; View; Visible; XAxisLocation; XColor; Xdir; XGrid; XLabel; XLim; XLimMode; XScale; XTick; XTickLabel; XTickLabelMode; YTickMode; YAxisLocation; YColor; YDir; YGrid; YLabel; YLim; YLimMode; YScale; YTick; YTickLabel; YTickLabelMode; YTickMode; ZColor; ZDir; ZGrid; ZLabel; ZLim; ZLimMode; ZScale; ZTick; ZTickLabel; ZTickLabelMode; ZtickMode

## Line

BusyAction; ButtonDownFcn; Children; Clipping; Color; CreateFcn; DeleteFcn; EraseMode; HandleVisibility; HitTest; Interruptible; LineStyle; LineWidth; Marker; MarkerEdgeColor; MarkerFaceColor; MarkerSize; Parent; Selected; SelectionHighlight; Tag; Type; UIContextMenu; UserData; Visible; XData; YData; ZData

## Text

BusyAction; ButtonDownFcn; Children; Clipping; Color; CreateFcn; DeleteFcn; Editing; EraseMode; Extent; FontAngle; FontName; FontSize; FontUnits; FontWeight; HandleVisibility; HitTest; HorizontalAlignment; Interpreter; Interruptible; Parent; Position; Rotation; Selected; SelectionHighlight; String; Tag; Type; UIContextMenu; Units; UserData; VerticalAlignment; Visible

## Uicontrol

BackgroundColor; BusyAction; ButtonDownFcn; Callback; CData; Children; Clipping; CreateFcn; DeleteFcn; Enable; Extent; FontAngle; FontName; FontSize; FontUnits; FontWeight; ForegroundColor; HandleVisibility; HitTest; HorizontalAlignment; Interruptible; ListboxTop; Max; Min; Parent; Position; Selected; SelectionHighlight; SliderStep; String; Style; Tag; TooltipString; Type; UIContextMenu; Units; UserData; Value; Visible

## Uimenu

Accelerator; BusyAction; ButtonDownFcn; Callback; Checked; Children; Clipping; CreateFcn; DeleteFcn; Enable; ForegroundColor; HandleVisibility; HitTest; Interruptible; Label; Parent; Position; Selected; SelectionHighlight; Separator; Tag; Type; UIContextMenu; UserData; Visible