

Matlab Commands Summary

Math 353 Section 12, Fall 2008, University of Delaware

Help Topics

- >> help general - General purpose commands.
- >> help ops - Operators and special characters.
- >> help lang - Programming language construction.
- >> help elmat - Elementary matrices and matrix operations.
- >> help elfun - Elementary Mathematical functions.
- >> help specfun - Specialized mathematical functions.

Numbers and Formats

| Type | Example |
|--------------|-----------------------------------|
| Integer | -290, 234532, ... |
| Real | 1.234, -0.9822, 3.41e+01, pi, ... |
| Complex | $3.42 + 4.5i$ ($i = \sqrt{-1}$) |
| Infinity | Inf (result of dividing by 0) |
| Not a Number | NaN (result of 0/0 or Inf/Inf) |

| Command | Output (example for 123.1234567890123456890) |
|-------------------|--|
| >> format short | 123.123 (4 decimal places) |
| >> format short e | 1.2312e+02 |
| >> format long | 123.123456789012345 (15 decimal places) |
| >> format long e | 1.231234567890124e+002 |
| >> format bank | 123.12 (2 decimal places) |

Elementary Functions

| Trigonometric/Hyperbolic | |
|--------------------------|------------------------------------|
| sin(x) | - Sine. |
| sinh(x) | - Hyperbolic sine. |
| asin(x) | - Inverse sine. |
| asind(x) | - Inverse sine, result in degrees. |
| asinh(x) | - Inverse hyperbolic sine. |
| cos(x) | - Cosine. |
| tan(x) | - Tangent. |
| tanh(x) | - Hyperbolic tangent. |
| sec(x) | - Secant. |
| csc(x) | - Cosecant. |
| csch(x) | - Hyperbolic cosecant. |
| cot(x) | - Cotangent. |
| coth(x) | - Hyperbolic cotangent. |

| Exponential. | |
|--------------|---|
| exp(x) | - Exponential. (e^x) |
| expm1(x) | - Compute $e^x - 1$ accurately. |
| log(x) | - Natural logarithm. |
| log1p(x) | - Compute $\ln(1+x)$ accurately. |
| log10(x) | - Common (base 10) logarithm. |
| log2(x) | - Base 2 logarithm and dissect floating point number. |
| pow2(x) | - Base 2 power and scale floating point number. |
| realpow(x) | - Power that will error out on complex result. |
| reallog(x) | - Natural logarithm of real number. |
| realsqrt(x) | - Square root of number greater than or equal to zero. |
| sqrt(x) | - Square root. |
| nthroot(x) | - Real n-th root of real numbers. |
| Complex. | |
| abs | - Absolute value. |
| angle | - Phase angle. |
| complex | - Construct complex data from real and imaginary parts. |
| conj | - Complex conjugate. |
| imag | - Complex imaginary part. |
| real | - Complex real part. |
| unwrap | - Unwrap phase angle. |
| isreal | - True for real array. |
| cplxpair | - Sort numbers into complex conjugate pairs. |

Rounding and remainder.

| | |
|-------|--|
| fix | - Round towards zero. |
| floor | - Round towards minus infinity. |
| ceil | - Round towards plus infinity. |
| round | - Round towards nearest integer. |
| mod | - Modulus (signed remainder after division). |
| rem | - Remainder after division. |
| sign | - Signum. |

Relational operators

| | |
|----|-------------------------|
| == | - Equal |
| ~= | - Not equal |
| < | - Less than |
| > | - Greater than |
| <= | - Less than or equal |
| >= | - Greater than or equal |

Elementary matrices.

| | |
|---|--|
| zeros(n,m) | - Zero matrix with n rows and m columns. |
| ones(n,m) | - Matrix with n rows and m columns whose elements are one. |
| eye(n,n) | - Identity matrix. |
| rand(n,m) | - Uniformly distributed random numbers. |
| randn(n,m) | - Normally distributed random numbers. |
| linspace(x ₁ ,x ₂ ,N) | - Linearly spaced vector. |
| logspace(x ₁ ,x ₂ ,N) | - Logarithmically spaced vector. |
| freqspace | - Frequency spacing for frequency response. |
| meshgrid | - X and Y arrays for 3-D plots. |
| accumarray | - Construct an array with accumulation. |
| : | - Regularly spaced vector and index into matrix. |

Matrix Manipulation and Analysis

| | |
|-----------|---|
| cond(A) | - Condition number of matrix A. |
| diag(A) | - Diagonal matrices and diagonals of matrix. |
| norm(A) | - Norm |
| rank(A) | - Number of linearly independent rows or columns. |
| det(A) | - Determinant of matrix A. |
| inv(A) | - Inverse matrix of matrix A. |
| trace(A) | - Sum of diagonal elements. |
| null(A) | - Null space. |
| tril(A) | - Extract lower triangular part. |
| triu(A) | - Extract upper triangular part. |
| fliplr(A) | - Flip matrix in left/right direction. |
| flipud(A) | - Flip matrix in up/down direction. |
| rot90(A) | - Rotate matrix 90 degrees. |
| find(A) | - Find indices of nonzero elements. |

Plotting and Graphics

| | |
|-------------------------|--|
| plot(x,y) | - Plotting x versus y (Example 1). |
| title('Name') | - Graph title (Example 1). |
| xlabel('Name') | - Horizontal axis label (Example 1). |
| ylabel('Name') | - Vertical axis label (Example 1). |
| subplot(n,m,p) | - Create axes in tiled positions (Example 2). |
| ezplot('f(x)',[a,b]) | - Plotting the graph of $y = f(x)$ over $[a,b]$ intervals. |
| grid | - Grid lines. |
| zoom | - Zooming options. |
| figure | - Create figure (graph) window. |
| polar(θ, ρ) | - Polar coordinate plot (Example 3). |

Examples for plotting and graphing:

1. $x = -\pi:1:\pi;$
 $y = \sin(x);$
 $\text{plot}(x,y)$

```

title('Plot of y=sin(x)')
xlabel('X variables')
ylabel('Y variables')

2. x=linspace(0,2,200);
   y=x-10*cos(10*x);
   z=2*x+sin(5*x);
   subplot(1,2,1); plot(x,y)
   subplot(1,2,2); plot(x,z)

3. t = 0:01:2*pi;
   polar(t,cos(2*t).*sin(2*t),'-r')

```

Functions

```
function [out1, out2,...] = funcname(in1,in2,...)
```

where out1 etc. are output (result) arguments and in1 etc. are input (parameter) arguments.

Example. File: quadeq.m

```
% Solves the equation  $ax^2 + bx + c = 0$ 
```

```
% Input:  $a, b, c$  coefficients of the equation.
```

```
% Output: x1 and x2 solutions of the equation.
```

```
function[x1,x2]=quadeq(a,b,c)
```

```
d=sqrt(b^2-4*a*c);
```

```
x1=(-b+d)/(2*a);
```

```
x2=(-b-d)/(2*a);
```

From MatLab we call

```
>> [root1,root2]=quadeq(1,1,-2)
```

```
root1 = 1
```

```
root2 = -2
```

Conditionals

```
if logical test 1
```

Commands to be executed if test 1 is true

```
elseif logical test 2
```

Commands to be executed if test 2 is true but test 1 is false

```
...
```

```
else
```

Commands to be executed if all above tests are false

```
end
```

Loops

```
for variable 1
```

```
    for variable 2
```

Statements

```
    end
```

```
end
```

Example. Find

$$S = \sum_{i=1}^{100} \sum_{j=1}^{20} \frac{1}{i+j}.$$

```

>> S=0;
>> for i=1:100;
for j=1:20;
S=S+1/(i+j);
end
end
>> S
S=
50.15540068814227

```

while a logical test

Commands to be executed when the condition is true

end

Example. What is the greatest value of n that can be used in the sum

$$S = \sum_{i=1}^n i^3 = 1 + 2^3 + \dots + n^3$$

and get value of less than 1000.

```

>> S=0; n=1;
>> while S+(n+1)^3 <1000
n=n+1; S=S+n^3;
end
>> [n S]
ans =
7 783

```