

Functions

| Hilfe und Abfrage | | | |
|--------------------------|---------------------|----------|-----------------------------|
| lookfor | search for | whatsnew | Display ReadMe files |
| help | Online help | what | List files in directory |
| demo | Run demo program | which | Locate a file |
| info | Info about MATLAB | why | Give philosophic advice |
| ver | MATLAB version info | path | List accessible directories |

| Command Window Control | | | |
|-------------------------------|-----------------------------|------|-----------------------------|
| clc | Clear command window | home | Send cursor home |
| format | Set screen output format | echo | Echo command in script file |
| more | Control paged screen output | ↑, ↓ | Recall previous commands |

| Arbeiten mit Dateien und Verzeichnissen | | | |
|--|--------------------------|--------|-----------------------------|
| pwd | Short current directory | delete | Delete files |
| cd | Change current directory | diary | Save text of MATLAB session |
| dir, ls | List directory contents | type | Show contents of file |
| mkdir | Create a new directory | ! | Access operating system |

| Variable und Workspace | | | |
|-------------------------------|-------------------------------|--------|--------------------------|
| clear | Clear variables and functions | length | Length of a vector |
| who, whos | List current variables | size | Size of a matrix |
| load | Load variables from file | pack | Consolidate memory space |
| save | Save variables in MAT-file | disp | Display text or matrix |

| Start und Exit | | | |
|-----------------------|----------------------------|------|-------------|
| matlabrc | Master startup file | quit | Quit MATLAB |
| startup | M-file executed at startup | exit | wie quit |

| Uhrzeit und Datum | | | |
|--------------------------|-------------------|-------|-----------------------|
| clock | Wall clock time | etime | Elapsed time function |
| cputime | Elapsed CPU time | tic | Start stopwatch timer |
| date | Date, month, year | toc | Read stopwatch timer |

Constante

| Konstante | | Variable | |
|-----------|-----------------------------------|----------|-----------------------------|
| Pi | $\pi (= 3,14159\dots)$ | ans | Default output variable |
| Inf | ∞ | flops | Count of floating point ops |
| NaN | Not-a-Number | computer | Computertyp |
| i, j | Imaginäre Einheit ($\sqrt{-1}$) | nargin | |
| eps | | nargout | |
| realmax | | | |
| realmin | | | |

Input/output and control functions

| Declarations/Definitions | | |
|--------------------------|--------|---------|
| Function | global | nargchk |

| Interactive Input Functions | | |
|-----------------------------|----------|------|
| input | keyboard | menu |
| ginput | pause | |

| Control Flow Functions | | |
|------------------------|--------|-------------|
| for | while | end |
| if | elseif | else |
| (switch) | (case) | (otherwise) |
| error | break | return |

| Debugging | | | | |
|-----------|--------|--------|---------|----------|
| dbclear | dbcont | dbstep | dbstack | dbstatus |
| dbup | dbdown | dbtype | dbstop | dbquit |

Open/close the file

| Öffnen, schließen und lokalisieren von Dateien | | | | | |
|--|--------|-------|-------|---------|--------|
| fopen | Fclose | fseek | ftell | frewind | ferror |

| Lesen und schreiben von Dateien | | | | | |
|---------------------------------|--------|---------|--------|-------|-------|
| fread | Fwrite | fprintf | fscanf | fgetl | fgets |

Operations and logical function

| Arithmetische Operatoren | | | | | |
|--------------------------|----------------|--|-------------------------|-----------------------|--|
| <i>Matrix-Operatoren</i> | | | <i>Array-Operatoren</i> | | |
| + | Addition | | + | Addition | |
| - | Subtraktion | | - | Subtraktion | |
| * | Multiplikation | | .* | Array Multiplikation | |
| ^ | Exponent | | .^ | Array Exponent | |
| / | Left division | | ./ | Array Left division | |
| \ | Right division | | (.\ | Array Right division) | |

| Relationale Operatoren | | Logische Operatoren | |
|------------------------|-------------------------|---------------------|------------------------|
| < | Kleiner als | & | Logisches AND |
| <= | Kleiner als oder gleich | | Logisches OR |
| > | Größer als | ~ | Logisches NOT |
| >= | Größer als oder gleich | xor | Logisches EXCLUSIVE OR |
| == | Gleich | | |
| ~= | Ungleich | | |

| Logische Funktionen | | | |
|---------------------|----------|-------|------------|
| all | any | exist | find |
| finite | isempty | isinf | isnan |
| isiec | issparse | isstr | (isfinite) |

Mathematical functions

| Trigonometrische Funktionen | | | |
|------------------------------------|------------|------|-------|
| sin | asin | sinh | asinh |
| cos | acos | cosh | acosh |
| tan | atan,atan2 | tanh | atanh |
| cot | acot | coth | acoth |
| sec | asec | sech | asech |
| csc | acsc | csch | acsch |

| Exponentialfunktionen | | | |
|------------------------------|-----|-------|----------------------|
| exp | log | log10 | sqrt (Quadratwurzel) |

| Komplexe Funktionen | | |
|----------------------------|-------|------|
| abs | angle | conj |
| real | imag | |

| Rundungsfunktionen | | | |
|---------------------------|-------|------|-------|
| fix | floor | ceil | round |
| rem | sign | | |

| Spezielle mathematische Funktionen | | | |
|---|----------|------|--------|
| bessel | besselk | beta | betain |
| ellipj | ellipke | erf | erfinv |
| gamma | gammainc | log2 | rat |

Functions for the matrix

| Elementarmatrizen | | | |
|--------------------------|----------|----------|----------|
| eye | ones | zeros | rand |
| randn | linspace | logspace | meshgrid |

| Spezielle Matrizen | | | |
|---------------------------|----------|-----------|---------|
| compan | hadamard | hankel | hilb |
| invhilb | magic | pascal | rosser |
| toeplitz | vander | wilkinson | gallery |

| Funktionen zur Matrixmanipulation | | | |
|--|--------|--------|---------|
| diag | fliplr | flipud | reshape |
| rot90 | tril | triu | : |

| Matrix- (mathematische) Funktionen | | | |
|---|------|-------|------|
| expm | logm | sqrtm | funm |

| Matrixanalyse | | | |
|----------------------|---------|------|-------|
| cond | det | norm | null |
| orth | Rank | rref | trace |
| eig | balance | poly | hess |

| Faktorisierung und Inversion von Matrizen | | | |
|--|-----|-----|------|
| chol | Lu | qr | qz |
| schur | Svd | inv | pinv |

Funktionen für geringfügig besetzte Matrizen:

z.B.: spdiag, spexe, sprandn, full, sparse, spconvert, spalloc, spfun, condest, normest, sprank, gplot und spy.

Funktionen Zeichenfolgen

| Allgemeine Zeichenfolge-Funktionen | | | | | |
|---|--------|-------|--------|----------|-----------|
| abs | (char) | eval | setstr | (strcat) | (strvcat) |
| string | strcmp | lower | upper | isstr | (Ischar) |

| Zeichenfolge \leftrightarrow Zahlenumwandlung | | | | | |
|---|---------|---------|---------|-----------|--|
| int2str | num2str | sprintf | dec2hex | (mat2str) | |
| str2num | sscanf | hex2dec | hex2num | (dec2bin) | |

Graphical functions

| 2-D-Graphik | | | | |
|--------------------|----------|----------|----------|--------|
| plot | loglog | semilogx | semilogy | fplot |
| bar | errorbar | compass | feather | stairs |
| polar | fill | hist | rose | quiver |

| 3-D-Graphik | | | | |
|--------------------|-------|-------|----------|--------|
| plot3 | fill3 | mesh | meshc | meshz |
| surf | surfc | surfl | cylinder | sphere |

| Konturplots | | | | |
|--------------------|----------|----------|--------|--------|
| contour | contour3 | contourc | clabel | pcolor |

| Graphikbeschriftung | | | | |
|----------------------------|--------|--------|------------|--------|
| xlabel | ylabel | zlabel | title | legend |
| text | gtext | grid | (plotedit) | |

| Darstellung von Achsen und Graphen | | | | |
|---|----------|--------|---------|------|
| axis | colormap | hidden | shading | view |

| Erstellung und Steuerung von Fenstern | | | | |
|--|-------|--------|-----|---------|
| clf | close | figure | gcf | subplot |

| Erzeugung und Steuerung von Achsen | | | | |
|------------------------------------|------|-------|-----|-----|
| axes | axis | caxis | cla | gca |

| Handhabung graphischer Objete und Operationen | | | | |
|---|---------|-----------|---------|------|
| axes | line | patch | surface | text |
| figure | image | uicontrol | uimenu | |
| delete | drawnow | get | reset | set |

| Animation und Film | | | | |
|--------------------|----------|-------|---------|--|
| comet | getframe | movie | moviein | |

| Hardcopy, Verschiedenes | | | | |
|-------------------------|--------|------------|--------|------|
| print | orient | (ptintopt) | ginput | hold |

| Farbsteuerung und Ausleuchtung | | | | |
|--------------------------------|----------|---------|----------|---------|
| caxis | colormap | flag | hsv2rgb | rgb2hsv |
| bone | copper | gray | hsv | pink |
| cool | hot | shading | brighten | diffuse |
| surfl | specular | rgbplot | | |

Anwendungsfunktionen

- Datenanalyse und Fourier-Transformationen

Zur Online-Hilfe eingeben: help datafun

| Grundlegende Statistikbefehle | | | | |
|----------------------------------|---------|----------|----------|----------|
| mean | median | std | min | max |
| prod | cumprod | sum | cumsum | sort |
| Korrelation und finite Differenz | | | | |
| corrcoef | cov | del2 | diff | gradient |
| Fourier-Transformationen | | | | |
| fft | fft2 | fftshift | ifft | ifft2 |
| abs | angle | cplxpair | nextpow2 | unwrap |
| Filterung und Konvolution | | | | |
| conv | conv2 | (dconv) | filter | filter2 |

- Polynome und Dateninterpolation

Zur Online-Hilfe eingeben: help polyfun

| Polynome | | | | |
|----------------------------------|----------|----------|----------|----------|
| poly | polyder | polyfit | polyval | polyvalm |
| conv | (deconv) | residue | roots | |
| Dateninterpolation | | | | |
| interp1 | interp2 | interpft | griddata | |
| Fourier-Transformationen | | | | |
| fft | fft2 | fftshift | ifft | ifft2 |
| abs | angle | cplxpair | nextpow2 | unwrap |
| Filterung und Konvolution | | | | |
| conv | conv2 | dconv | filter | filter2 |

- Nichtlineare numerische Methoden

Zur Online-Hilfe eingeben: help funfun

| Funktionen | | | | | |
|-------------------|-------|----------|----------|----------|-----------|
| fmin | fmins | fzero | trapz | quad | quad8 |
| ode23 | ode45 | (ode113) | (ode23t) | (ode23s) | (odefile) |

Grafikbefehle

- *2D Plots*

fplot:

```
fplot('x.*sin(x)', [0 10*pi])
```

semilogx:

```
t=linspace(0,2*pi , 200) ;  
x = exp(-t) ; y = t;  
semilogx(x,y) , grid
```

semilogy:

```
t=linspace(0,2*pi , 200) ;  
semilogy(t,exp(t))  
grid
```

loglog:

```
t=linspace(0,2*pi,200);  
x = exp(t);  
y = 100+exp(2*t);  
loglog(x,y) , grid
```

polar:

```
t=linspace(0,2*pi,200);  
r=sqrt(abs(2*sin(5*t)));  
polar(t,r)
```

fill:

```
t=linspace(0,2*pi,200);  
r=sqrt(abs(2*sin(5*t)));  
x=r.*cos(t);  
y=r.*sin(t);  
fill(x,y,'k'),  
axis('square')
```

bar:

```
t=linspace(0,2*pi,200);  
r=sqrt(abs(2*sin(5*t)));  
y=r.*sin(t);  
bar(t,y)  
axis([0 pi 0 inf]);
```

errorbar:

```
x=0: .1 : 2;  
aprx2=x-x.^3/6;  
er=aprx2-sin(x);  
errorbar(x,aprx2,er)
```

hist:

```
cont=char('Asia','Europe','Africa','...N. America','S. America');  
pop = [3332;696;694;437;307];  
barh(pop)  
for i=1 : 5,  
    gtext(cont(i,:));  
end  
xlabel('Population in millions')  
Title('World Population(1992)',... 'fontsize',18)
```

plotyy:

```
x=1: .1:10;  
y1 = exp(-x).*sin(x);  
y2 = exp(x);  
Ax = plotyy(x,y1,x,y2);  
hy1 = get(Ax(1), 'ylabel');  
hy2 = get(Ax(2), 'ylabel');  
set(hy1,'string', 'e^-x sin(x)');  
set(hy2,'string', 'e^x');
```

area:

```
x=linspace(-3*pi,3*pi,100);  
y=-sin(x)./x;  
area(x,y)  
xlabel('x'), ylabel('sin(x) ./x')  
hold on  
x1=x(46:55); y1=y(46:55);  
area(x1,y1,'facecolor','y')
```

pie:

```
cont=char('Asia','Europe','Africa','...N. America','S. America');  
pop = [3332;696;694;437;307];  
pie(pop)  
for i=1:5,  
    gtext(cont(i,:));  
end  
Title('World Population',... 'fontsize',18)
```

hist:

```
y=randn(50,1);  
hist(y)
```

stem:

```
t=linspace(0,2*pi,200);  
f=exp(-.2*t).*sin(t);  
stem(t,f)
```

stairs:

```
t=linspace(0,2*pi,200);  
r=sqrt(abs(2*sin(5*t)));  
y=r.*sin(t);  
stairs(t,y)  
axis([0 pi 0 inf]);
```

compass:

```
th=-pi : pi/5:pi;  
zx=cos(th);  
zy=sin(th);  
z=zx+i*zy;  
compass(z)
```

comet:

```
q=linspace(0,10*pi,200);  
y=q.*sin(q);  
comet(q,y)
```

contour:

```
r=-5:.2:5;  
[X,Y]=meshgrid(r,r);  
Z=-.5*X.^2 + X.*Y +Y.^2;  
cs=contour(X,Y,Z);  
clabel(cs)
```

quiver:

```
r=-2:.2:2;  
[X,Y]=meshgrid(r,r);  
Z=X.^2 -5*sin(X.*Y) + Y.^2;  
[dx,dy]=gradient (Z, .2, .2);  
quiver(X,Y,dx,dy,2);
```

pcolor:

```
r=-2:.2 :2;  
[X,Y]=meshgrid(r,r);  
Z=X.^2 -5*sin(X.*Y) + Y.^2;  
pcolor (Z), axis('off')  
shading interp
```

• **3-Dplots**

plot3:

```
t=linspace(0,1,100);  
x=t;y=t.^2;z=t.^3;  
plot3(x,y,z),grid
```

fill3:

```
X=[0 0 0 0; 1 1 -1 1; 1 -1 -1 -1];  
Y=[0 0 0 0; 4 4 4 4; 4 4 4 4];  
Z=[0 0 0 0; 1 1 -1 -1; -1 1 1 -1];  
fill3(X,Y,Z,rand(3,4))  
view(120,30)
```

contour3:

```
r = linspace(-3,3,50);  
[x,y]=meshgrid(r,r);  
z=-5./(1+x.^2+y.^2);  
contour3(z)
```

surf:

```
u = -5:.2:5;  
[X,Y] = meshgrid(u, u);  
Z = cos(X).*cos(Y).*...  
    exp(-sqrt(X.^2+Y.^2)/4);  
surf(X,Y,Z)
```

surfc:

```
u = -5:.2:5;  
[X,Y] = meshgrid(u, u);  
Z = cos(X).*cos(Y).*...  
    exp(-sqrt(X.^2+Y.^2)/4);  
surfc(Z)  
view(-37.5,20)  
axis('off')
```

surfl:

```
u = -5:.2:5;  
[X,Y] = meshgrid(u, u);  
Z = cos(X).*cos(Y).*...  
    exp(-sqrt(X.^2+Y.^2)/4);  
surfl(Z)  
shading interp  
colormap hot
```

mesh:

```
x = linspace(-3,3,50);  
y = x;  
[x,y] = meshgrid(x,y);  
z=-5./(1+x.^2+y.^2);  
mesh(z)
```

meshz:

```
x = linspace(-3,3,50);  
y = x;  
[x,y] = meshgrid(x,y);  
z=-5./(1+x.^2+y.^2);  
meshz(z)  
view(-37.5, 50)
```

waterfall:

```
x = linspace(-3,3,50);  
y = x;  
[x,y] = meshgrid(x,y);  
z=-5./(1+x.^2+y.^2);  
waterfall(z)  
hidden off
```

pie3:

```
% popdata: As,Eu,Af,NA,SA  
pop=[3332;696;694;437;307];  
pie3(pop)  
Title('World Population')
```

stem3:

```
t=linspace(0,6*pi,200);  
x=t; y=t.sin(t);  
z=exp(t/10)-1;  
stem3(x,y,z,'filled')  
xlabel('x'),  
ylabel('x sin(x)'),  
zlabel('e^t/10-1')
```

ribbon:

```
t=linspace(0,5*pi,100);  
y1 = sin(t);  
y2 = exp(-.15*t) .*sin(t);  
y3 = exp(-.8*t) .*sin(t);  
y = [y1; y2; y3];  
ribbon(t',y', .1)
```

sphere:

```
[x,y,z]=sphere(20);  
surf(x,y,z)
```

cylinder:

```
z=[0:.02:1]';  
r=sin(3*pi*z)+2;  
cylinder(r)
```

slice:

```
v = [-3:.2:3];  
[x,y,z]=meshgrid(v,v,v);  
f=(x.^2+y.^2-z.^2);  
xrows=[10,31]; yrows=28;zrows=16;  
slice(f,xrows,yrows,zrows);  
view([-30 30])
```