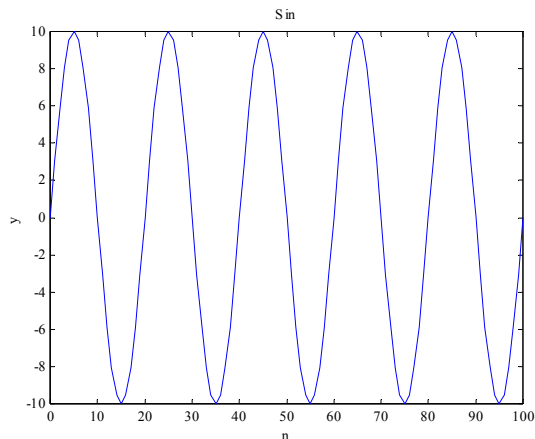


Variáveis, expressões, vectores e matrizes

- **Variáveis**
idade=30; /* cria uma matriz de 1x1 com valor=30 */
- **Números válidos**
3 3+i pi 3.5e6 0.03 Inf NaN
- **Operadores**
* - + / ^ ' ()
- **Expressões**
v=(1+sqrt(3))/2; a=abs(3+4i);
- **Vectores e matrizes**
x=[1 2 3 4]; y=4+8*[-2:4]; z=-10.:5:10
A=[1 2 3; 3 4 5; 4 5 6]
B=ones(3,5); C=zeros(2,3);
Z=transpose(A);
C=A+Z;

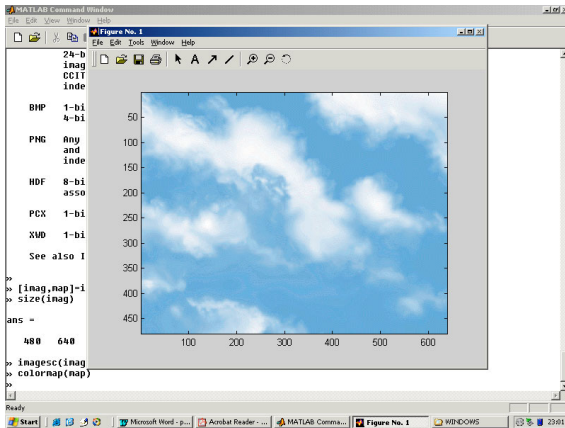
Gráficos - Plot

```
n=0:100; w0=pi/10;  
y=10*sin(w0*n);  
plot(n,y);  
title('Sin');  
xlabel('n');  
ylabel('y')
```



Gráficos - Image

```
» [imag,map]=imread('c:\windows\clouds.bmp','BMP');
» size(imag)
ans =
    480    640
» imagesc(imag)
» colormap(map)
```



Controlo de fluxo

```
if I == J
    A(I,J) = 2;
elseif abs(I-J) == 1
    A(I,J) = -1;
else
    A(I,J) = 0;
end
```

```
switch lower(METHOD)
    case {'linear','bilinear'}
        disp('Method is linear')
    case 'cubic'
        disp('Method is cubic')
    case 'nearest'
        disp('Method is nearest')
    otherwise
        disp('Unknown method.')
end
```

Controlo de fluxo

```
for I = 1:N,
    for J = 1:N,
        A(I,J) = 1/(I+J-1);
    end
end

while N < 100,
    E = E + F;
    F = A*F/N;
    N = N + 1;
end
```

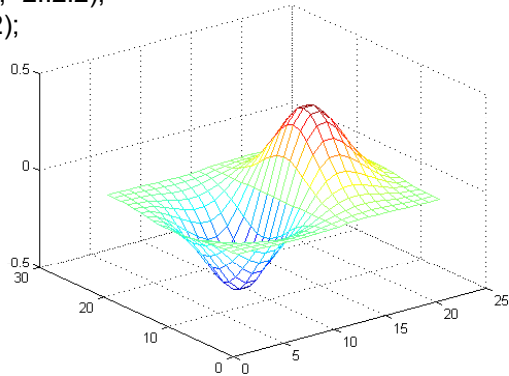
Funções

Funções são ficheiros com extensão .m

```
function [mean,stdev] = stat(x)
    %STAT Interesting statistics.
    n = length(x);
    mean = sum(x) / n;
    stdev = sqrt(sum((x - mean).^2)/n);
```

Visualização de funções de duas variáveis

```
[X,Y] = meshgrid(-2:.2:2, -2:.2:2);  
Z = X .* exp(-X.^2 - Y.^2);  
mesh(Z);
```



Meshgrid - exemplo

```
>> [X,Y] = meshgrid(-2:1:2, -2:1:2);
```

```
>> X
```

```
X =
```

```
-2 -1 0 1 2  
-2 -1 0 1 2  
-2 -1 0 1 2  
-2 -1 0 1 2  
-2 -1 0 1 2
```

```
>> Y
```

```
Y =
```

```
-2 -2 -2 -2 -2  
-1 -1 -1 -1 -1  
0 0 0 0 0  
1 1 1 1 1  
2 2 2 2 2
```

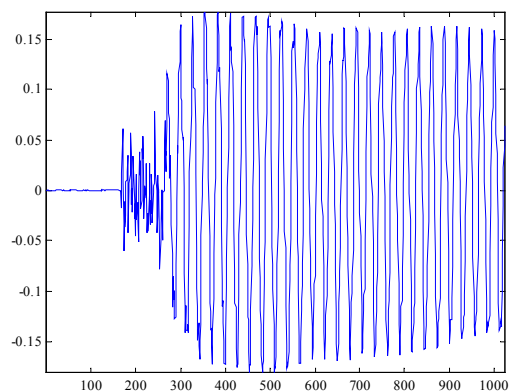
Som

Ex: tocar um tom com frequência de 1000 Hz durante meio segundo, utilizando frequência de amostragem de 8192 Hz.

```
fs=8192;  
f=1000;  
n=1:(0.5*fs);  
x=cos(2*pi*f*n/fs);  
sound(x,fs);
```

Som - manipulação de .wav

```
[y,fs,nbits]=wavread('c:\windows\media\ding.wav');  
soundsc(y,fs)  
plot(y(1:1024));  
axis tight;
```



Filtros - *freqz*

$$H(e^{j\omega}) = \frac{B(e^{j\omega})}{A(e^{j\omega})} = \frac{b(1) + b(2)e^{-j\omega} + \dots + b(m+1)e^{-j\omega m}}{a(1) + a(2)e^{-j\omega} + \dots + a(n+1)e^{-j\omega n}}$$

[H,F] = freqz(B,A,n,fs);

Ex:

$$y(n) = x(n) + 0.95x(n-8) - 0.99y(n-8) \Leftrightarrow y(n) + 0.99y(n-8) = x(n) + 0.95x(n-8)$$

B=[1 0 0 0 0 0 0 0 0.95];

A=[1 0 0 0 0 0 0 0 0.99];

Filtros - *freqz*

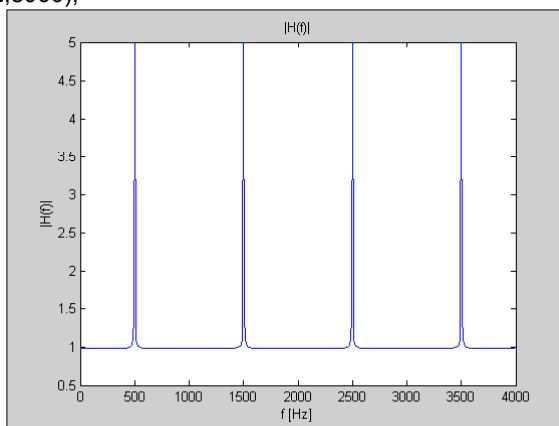
[H,F]=freqz(B,A,512,8000);

plot(F,abs(H));

title('|H(f)|');

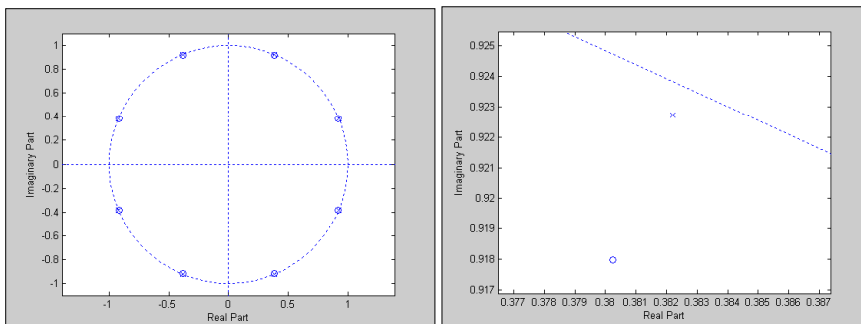
xlabel('f [Hz]');

ylabel('|H(f)|');



Filtros - *zplane*

`zplane(B,A)`



Para saber mais...

- http://www.mathworks.com/products/tech_computing/demos.shtml
- Comando matlab: demo
- <http://www.deetc.isel.ipl.pt/analisedesaini/downloads&links/matlab.htm>