DFT Octave Codes (0A)

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This document was produced by using OpenOffice and Octave.

Based on
M.J. Roberts, Fundamentals of Signals and Systems

B.D Storey, Computing Fourier Series and Power Spectrum with MATLAB
B Ninness, Spectral Analysis using the FFT
U of Rhode Island, ELE 436, FFT Tutorial

Normalized ω_s and ω_0

```
N = 2000;
x = [0:100]/100;
f = ones(1,101)*1/2;
for i = 1:2:N
  a = 2/pi/i;
  f = f + a*sin(2*pi*i*x);
end
plot(x, f);
```

Normalized ω_s and ω_0

```
N = 8;
t = [0:N-1]'/N;
f = sin(2*pi*t);
p = abs(fft(f))/(N/2);
p = p(1:N/2).^2
```

Normalized ω_s and ω_0

```
N = 10000;
T = 3.4;
t = [0:N-1]/N;
t = t*T;
f = sin(2*pi*10*t);
p = abs(fft(f))/(N/2);
p = p(1:N/2).^2;
freq = [0:N/2-1]/T;
seilogy(freq,p);
axis([0 20 0 1]);
```

Normalized ω_s and ω_0

```
Fs = 44100;
y = wavrecord(5*Fs, Fs);
wavply(y, Fs);
```

Normalized ω_s and ω_0

```
fs= 10;
t= (0:1:length(x)-1)/fs;
plot(t,x);

X= fft(x);
plot(abs(X));
```

Normalized ω_s and ω_0

```
N= length(x);
ws= 2*pi/N;
wnorm= -pi:ws:pi;
wnorm= wnorm(1:length(x));
w= wnorm*fs;
plot(w,abs(fftshift(X)));
axis([-30,30,0,160]);
```

Normalized ω_s and ω_0

```
[freq,amp]= ginput;
amp*2/N;
fil= [zeros(1,160), ones(1,15), zeros(1,50),
ones(1,15), zeros(1,160)];
plot(w,abs(fftshift(X)),'b',w,160*fil,'-.r');

Xf= fil.*fftshift(X);
xf= ifft(fftshift(Xf));
plot(t, real(xf));
```

Normalized ω_s and ω_0

```
N= length(x);
ws= 2*pi/N;
wnorm= -pi:ws:pi;
wnorm= wnorm(1:length(x));
w= wnorm*fs;
X= fft(x);
plot(w,abs(fftshift(X));
axis([-30,30,0,500]);
```

Normalized ω_s and ω_0

```
n= [0:29];
x= cos(2*pi*n/10);

N1= 64;
N2= 128;
N3= 256;
X1= abs(fft(x,N1));
X2= abs(fft(x,N2));
X3= abs(fft(x,N3));


F1= [0: N1-1]/N1;
F2= [0: N2-1]/N2;
F3= [0: N3-1]/N3;
```

Normalized ω_s and ω_0

```
subplot(3,1,1);
plot(F1,X1,'-x'), title('N=64'),  axis([0 1 0 20]);
subplot(3,1,2);
plot(F2,X2,'-x'), title('N=128'), axis([0 1 0 20]);
subplot(3,1,3);
plot(F3,X3,'-x'), title('N=256'), axis([0 1 0 20]);
```

Normalized ω_s and ω_0

```
n= [0:29];
x1= cos(2*pi*n/10); % 3 periods
x2= [x1 x1]; % 6 periods
x3= [x1 x1 x1] % 9 periods

N= 2048;

X1= abs(fft(x1,N));
X2= abs(fft(x2,N));
X3= abs(fft(x3,N));

F= [0:N-1]/N;
```

Normalized ω_s and ω_0

```
subplot(3,1,1);
plot(F,X1), title('3 periods'), axis([0 1 0 50]);
subplot(3,1,2);
plot(F,X2), title('6 periods'), axis([0 1 0 50]);
subplot(3,1,3);
plot(F,X3), title('9 periods'), axis([0 1 0 50]);
```

Normalized ω_s and ω_0

```
n= [0: 140];
x1= cos(2*pi*n/10);

N= 2048;

X= abs(fft(x1,N));
X= fftshift(X);

F= [-N/2:N/2-1]/N;

plot(F, X);
xlabel('frequency / f_s');
```

Normalized ω_s and ω_0

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References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
[3] M.J. Roberts, Fundamentals of Signals and Systems
[4] S.J. Orfanidis, Introduction to Signal Processing
[5] K. Shin, et al., Fundamentals of Signal Processing for Sound and Vibration Engineerings

[6] A “graphical interpretation” of the DFT and FFT, by Steve Mann