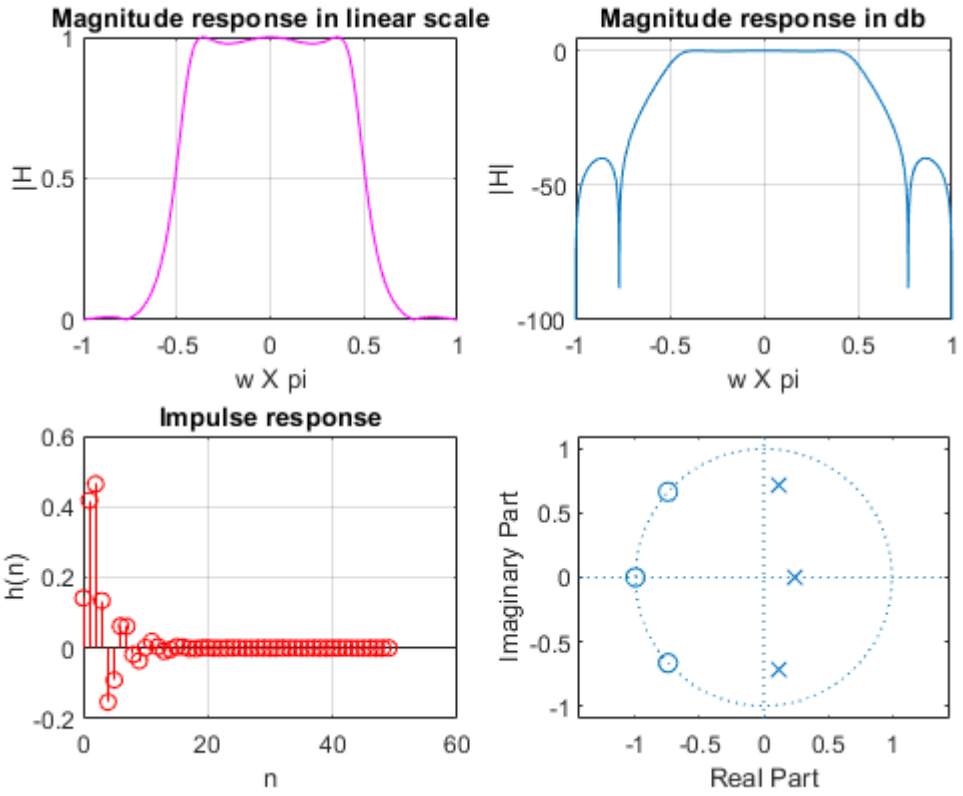
Contents

Part1

```
dp=0.01;ds=0.01;



Rp=-20*log(1-dp);



Rp = 0.2010;



Rs=-20*log10(ds);



Rs = 40;



wp=0.4;



N=3; % 3th order



figure (1)
```

```
[b,a]=ellip(N,Rp,Rs,wp);

w=linspace(-pi,pi,1000);

H=freqz(b,a,w);

%Magnitude response in linear scale

subplot(221)

plot(w/pi,abs(H),'m');grid;

xlabel('w X pi');ylabel('|H')

title('Magnitude response in linear scale')

%Magnitude response in db

subplot(222)

plot(w/pi,20*log10(abs(H)));grid;
```

```
xlabel('w X pi');ylabel('|H|')



ylim([-100,5])



title('Magnitude response in db')



%Impulse response



h=impz(b,a,50);



subplot(223)



stem([0:49],h,'r');grid;xlabel('n');ylabel('h(n)')



title('Impulse response')



%pole zero plot



subplot(224)



zplane(b,a)
```



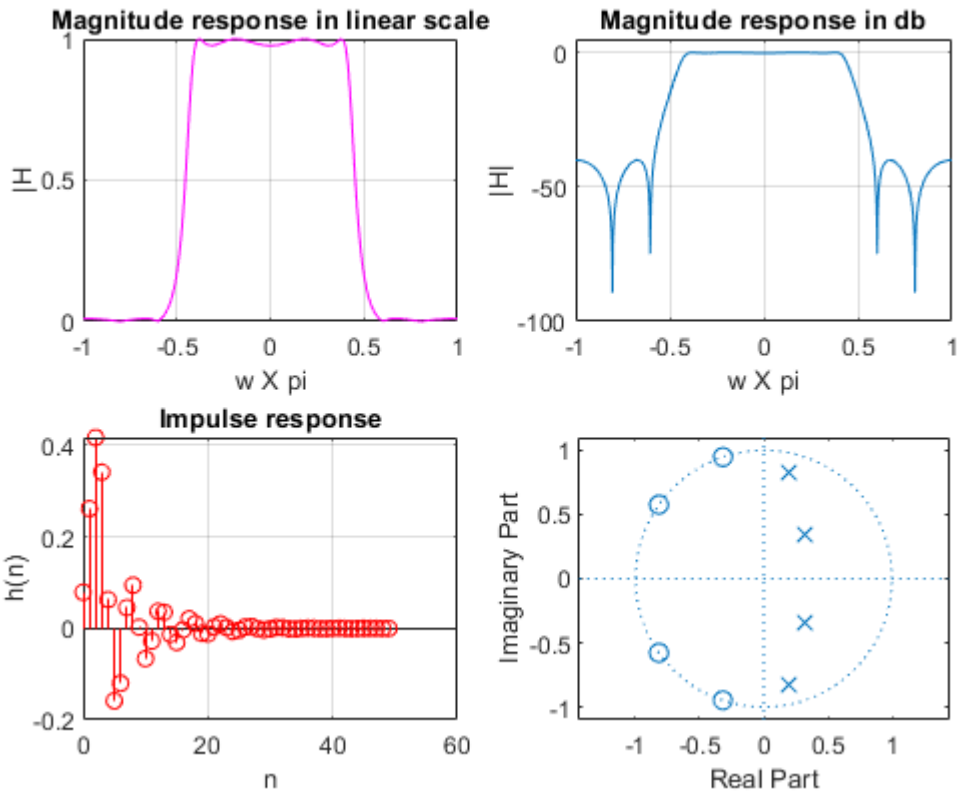
part 2

```
dp=0.01;ds=0.01;



Rp=-20*log(1-dp);



Rp = 0.2010;



Rs=-20*log10(ds);



Rs = 40;



wp=0.4;
```

```
N=4;% 4th order

figure (2)

[b,a]=ellip(N,Rp,Rs,wp);

w=linspace(-pi,pi,1000);

H=freqz(b,a,w);

%Magnitude response in linear scale

subplot(221)

plot(w/pi,abs(H),'m');grid;

xlabel('w X pi');ylabel('|H')

title('Magnitude response in linear scale')

%Magnitude response in db
```

```
subplot(222)

plot(w/pi,20*log10(abs(H)));grid;

xlabel('w X pi');ylabel('|H|')

ylim([-100,5])

title('Magnitude response in db')

%Impulse response

h=impz(b,a,50);

subplot(223)

stem([0:49],h,'r');grid;xlabel('n');ylabel('h(n)')

title('Impulse response')

%pole zero plot
```

```
subplot(224)


zplane(b,a)
```



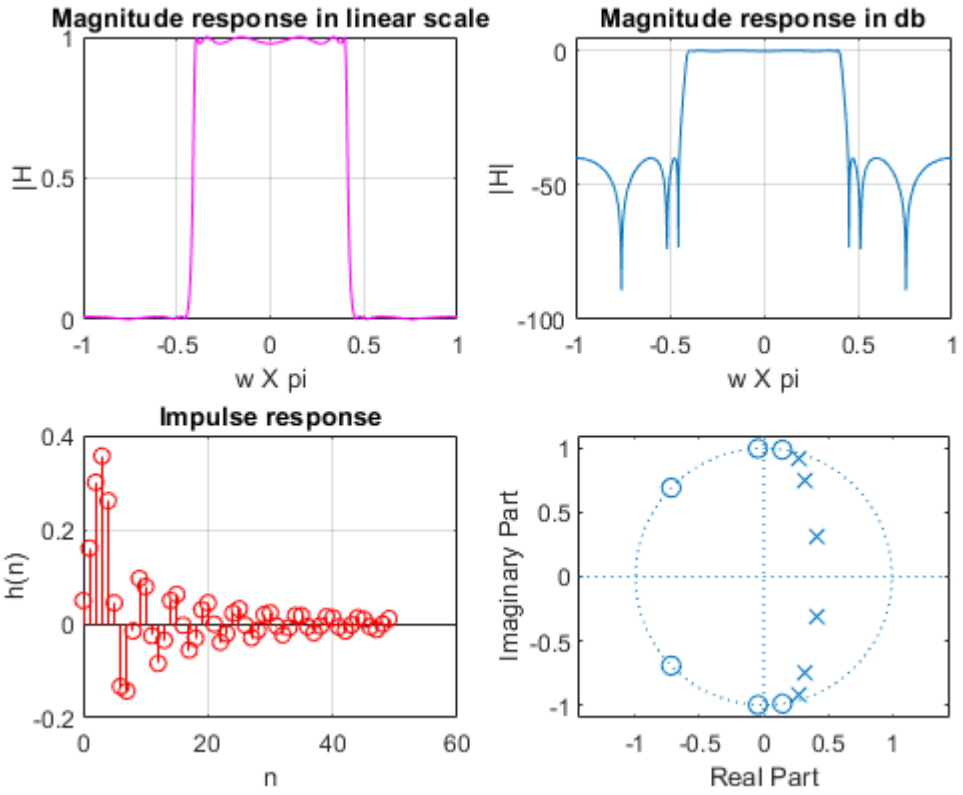
part 3

```
dp=0.01;ds=0.01;


Rp=-20*log(1-dp);


Rp = 0.2010;
```

```
Rs=-20*log10(ds);



Rs = 40;



wp=0.4;



% 6th order

N=6;



figure (3)



[b,a]=ellip(N,Rp,Rs,wp);



w=linspace(-pi,pi,1000);



H=freqz(b,a,w);



%Magnitude response in linear scale



subplot(221)



plot(w/pi,abs(H),'m');grid;
```

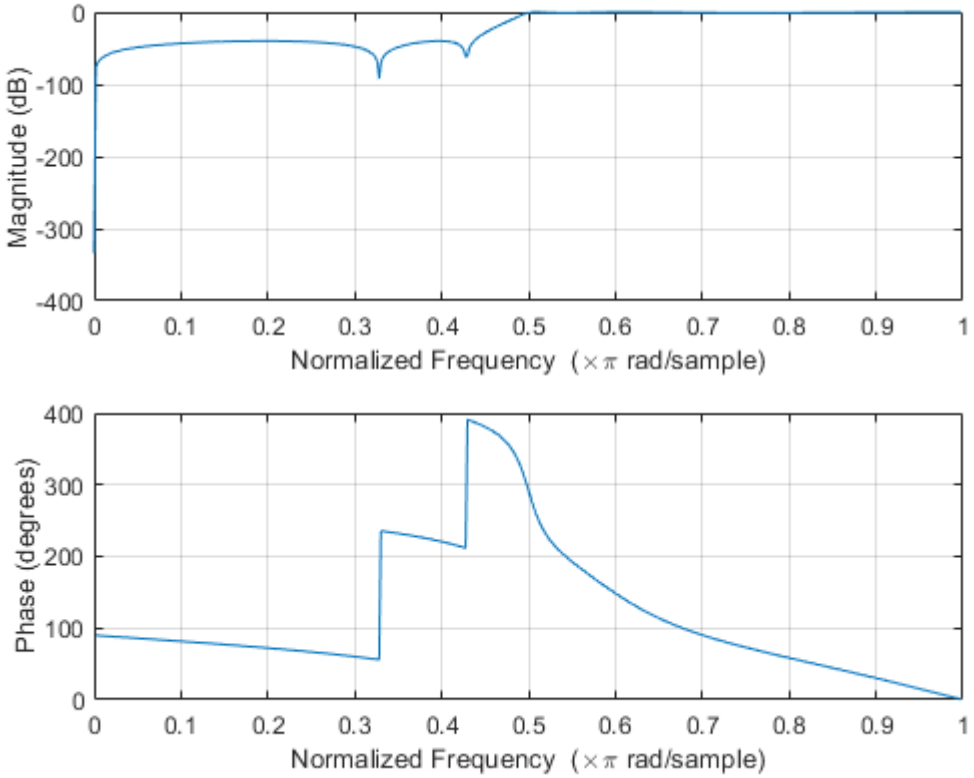
```
xlabel('w X pi');ylabel('|H')

title('Magnitude response in linear scale')

%Magnitude response in db

subplot(222)

plot(w/pi,20*log10(abs(H)));grid;

xlabel('w X pi');ylabel('|H|')

ylim([-100,5])

title('Magnitude response in db')

%Impulse response

h=impz(b,a,50);

subplot(223)
```

```
stem([0:49],h,'r');grid;xlabel('n');ylabel('h(n)')

title('Impulse response')

%pole zero plot

subplot(224)

zplane(b,a)
```



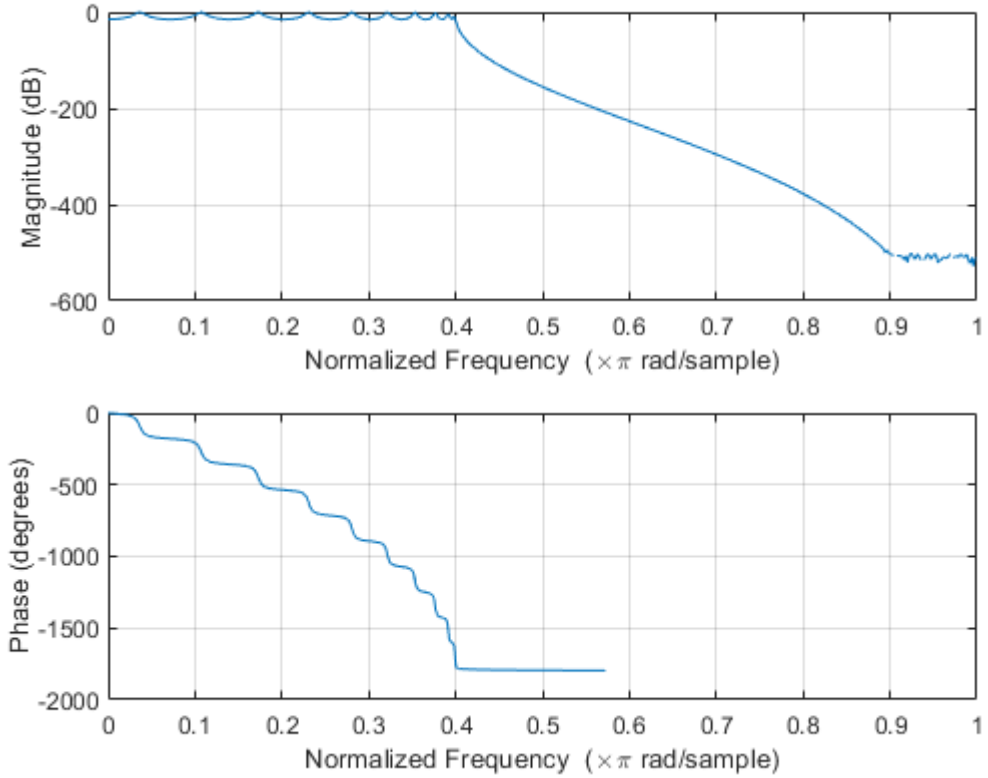
part 4

```
% define sampling frequency

fs = 400; % 400 Hz



% define fc, cutoff frequency

fc = 100; % 100 Hz



% define the filter characteristics

Wp = fc/(fs/2);

Rp = 1;% passband ripple

Rs = 40;% stopband attenuation

N = 5;



% obtain the filter coefficients

[B,A] = ellip(N,Rp,Rs,Wp,'high');



% plot the frequency response

figure;

freqz(B,A);grid on;
```



part 7

```
N=20;

Rp=15;

Wp=0.4;




[b,a] = cheby1(N,Rp,Wp,'low');

freqz(b,a); % Frequency Response



[z,p,k] =cheby1(N,Rp,Wp,'low'); % To know zeros (z) position ,poles position (p) and gain k
```

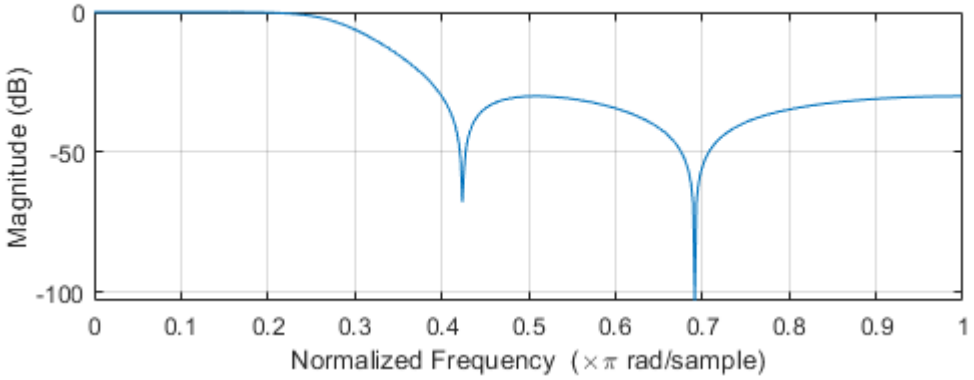


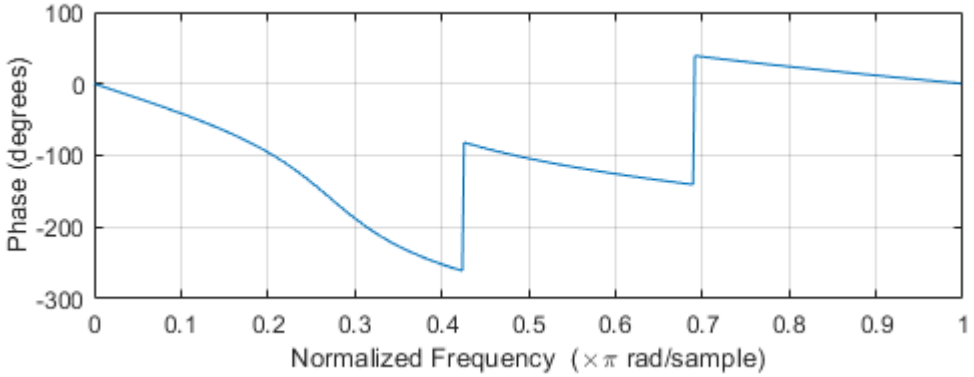
part 8

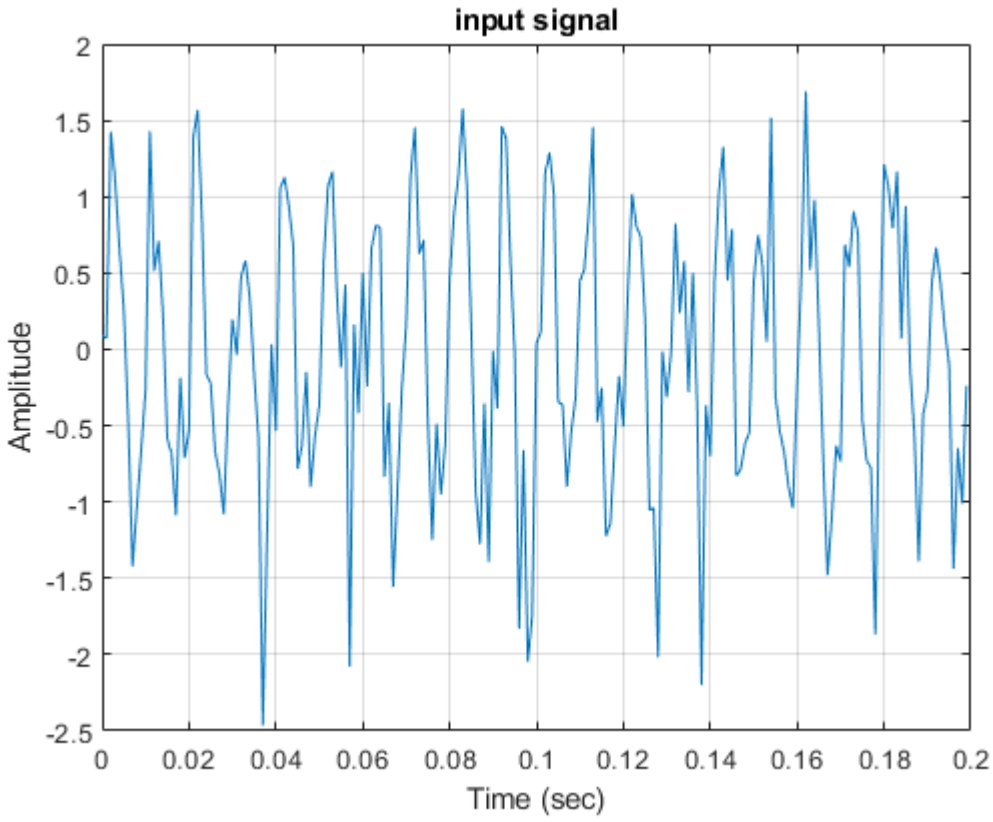
```
Order = 4;

SB_ate = 30; % in dB (stopband attenuation)

SB_fre = 200; % Hz (Stop-band edge frequency)

SamFre = 1000; % in Hz (sampling rate)

PB_val = (SB_fre/SamFre)*2; % rad/sec (peak pass-band value)

[n,d] = cheby2(Order,SB_ate,PB_val);

freqz(n,d)



dt = 1/SamFre; % seconds per sample

StopTime = 0.2;   % seconds

time = (0:dt:StopTime-dt)';   % Time step (seconds)
```

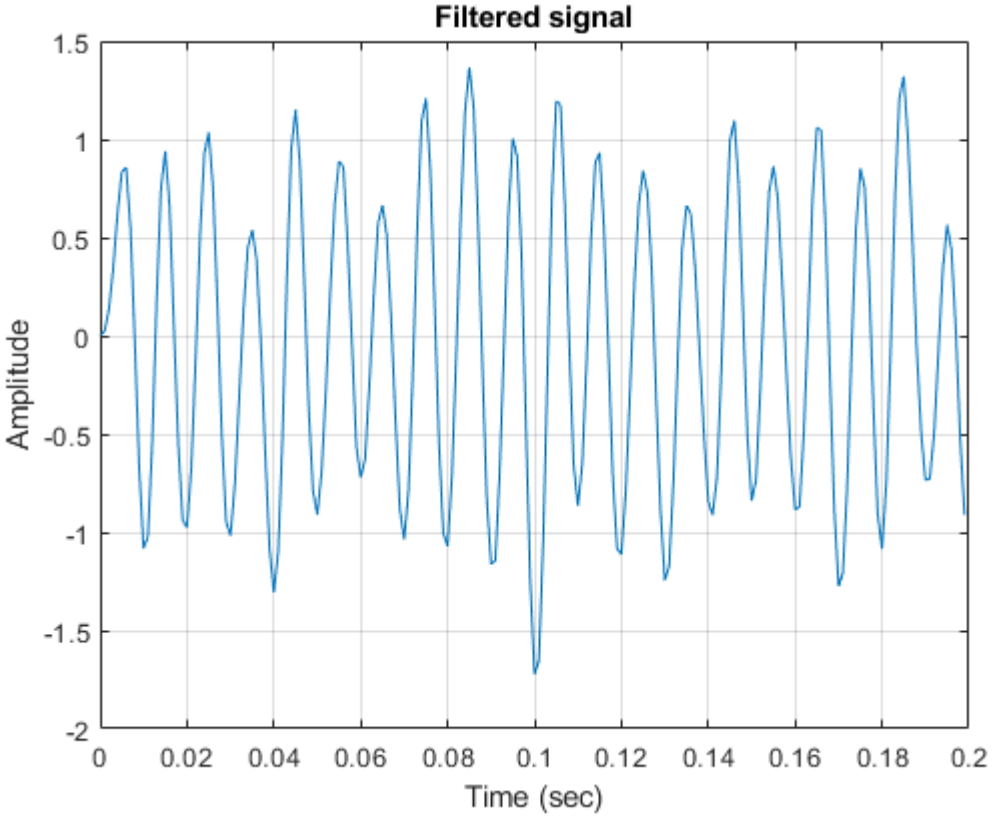
```
% Sine wave generation

Fre = 100;       % Hz Frequency of the signal

% generate the signal

Sig = sin(2*pi*Fre*time);

% adding noise

noi = 0.5*randn(size(time));



RS = Sig + noi;



figure

plot(time,RS)

grid on

xlabel('Time (sec)')

ylabel('Amplitude')

title('input signal')



ResOut = filter(n,d,RS);

%plot the signal

figure

plot(time,ResOut)

grid on

xlabel('Time (sec)')
```

```
ylabel('Amplitude')


title('Filtered signal')
```


Magnitude (dB)
0
-50
-100
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)


Phase (degrees)
100
0
-100
-200
-300
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)


input signal
Amplitude
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2
Time (sec)



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