

**Digital Signal Processing**

**CSE-356**

Lab Report

Title :

Design & Simulation of Different types of Infinite Impulse Response (IIR) Filter.

Submitted by :

Nabilah Hossain Sarker

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Theory : Mainly Filters are used to improve magnitude and phase in certain range of frequency spectrum and attenuate frequencies in other range of the spectrum of the signal. It also used to reduce noise.

Objective : Filters can be applied in various ways. There are many kind of filters, objective of this experiment is to understand about IIR filters and the differences of these. Here we used the filters named by

* **butterworth filter**
* **Chebyshev filter**
* **Elliptic filter**

& explore the differences between these filter

%design a **10th order bandpass butterworth filter** with a passband from 100 to 200hr and plot both impulse response and freq response

Fs=1000; %sampling frequency

n=10; %order of filter

Wn=[100 200]/500;%normalize

[b,a]=butter(n,Wn);

figure(1)

[y,t]=impz(b,a,101);%sample size is 101

plot(t,y)

title('impulse response')

grid on

freqz(b,a,512,Fs)

title('frequency response')



%design a **10th order bandpass Chebyshev filter** with a passband from 100 to 200hr and plot both impulse response and freq response

Fs=1000;

n=10;

Rp=25;

Wn=[100 200]/(Fs/2);%normalize

[b,a]=cheby1(n,Rp,Wn);

[y,t]=impz(b,a,101);

figure(5)

plot(t,y)

title('impulse response')

grid on

freqz(b,a,512,Fs)

title('frequency response')



%design a **10th order band pass Elliptic filter** with a pass band from 100 to 200hr and plot both impulse response and freq response

Fs=1000;

n=10;

Rp=5;

Rs=20;

Wn=[100 200]/(Fs/2);%normalize

[b,a]=ellip(n,Rp,Rs,Wn);

figure(1)

freqz(b,a,512,Fs)

title('frequency response')

figure(2)

[y,t]=impz(b,a,500);

plot(t,y)

title('impulse response')

grid on



%comparison of **original & filtered signal**

t=0:0.01:1

Fs=1000;

y=sin(8\*pi\*t) %Original Signal

yn=y+0.5\*rand(1,length(t))%Signal with noise

subplot(2,2,1);

plot(t,y,'k')

title('Original Signal')

subplot(2,2,2);

plot(t,yn,'r')

title('Noisy signal')

[b,a]=butter(2,200/Fs);

z=filter(b,a,yn);

subplot(2,2,3);

plot(t,z,'b')

title('Filtered signal')

subplot(2,2,4)

plot(t,y,'m',t,z,'k');

title('Comparison of original and filtered signal')



Discussion : We have to be very careful about syntax to implement codes in MATLAB.