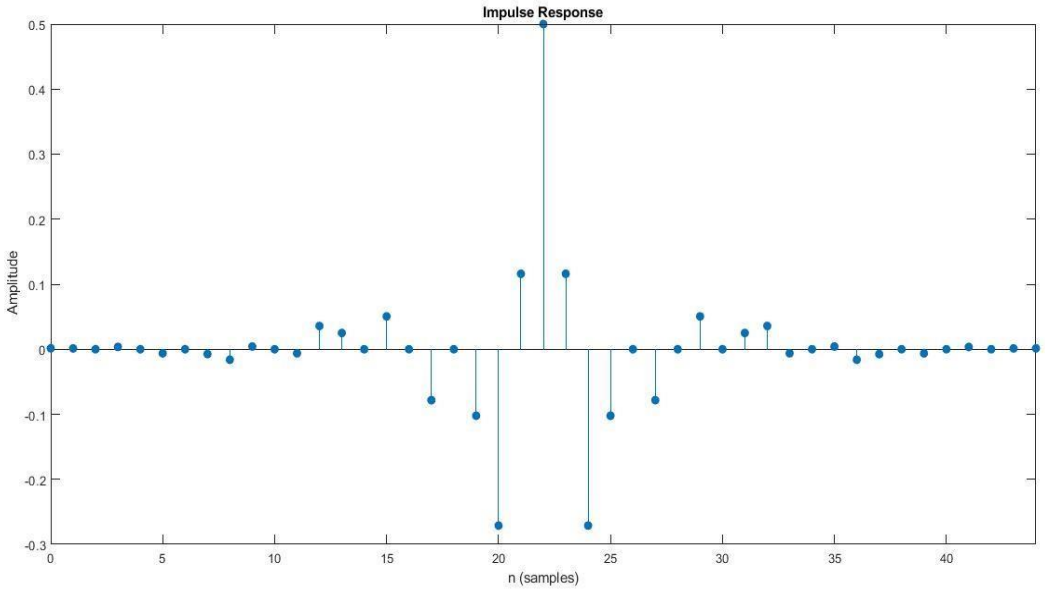
G.K.M.I.D. Rajarathna

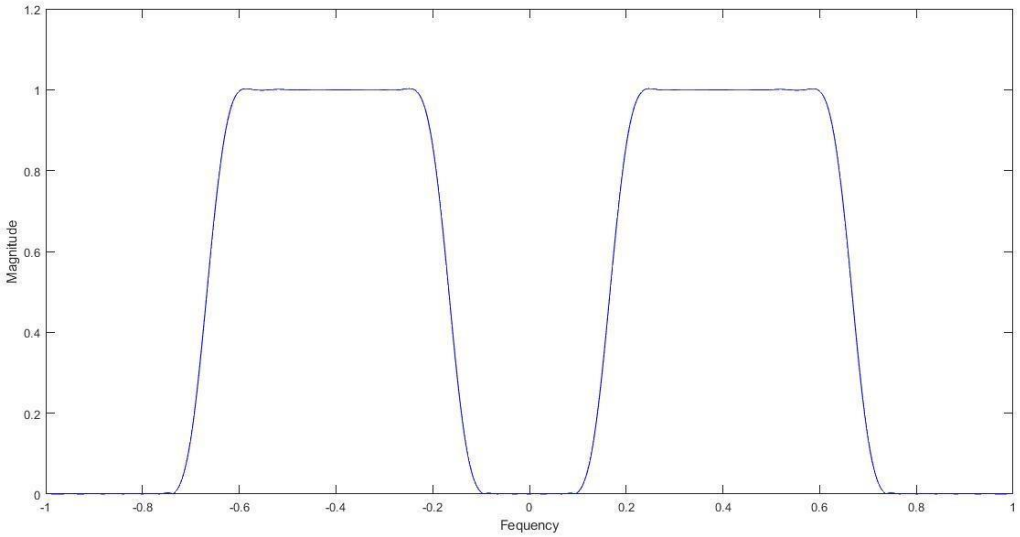
FIR and IIR Filter Designing

FIR Filter Design

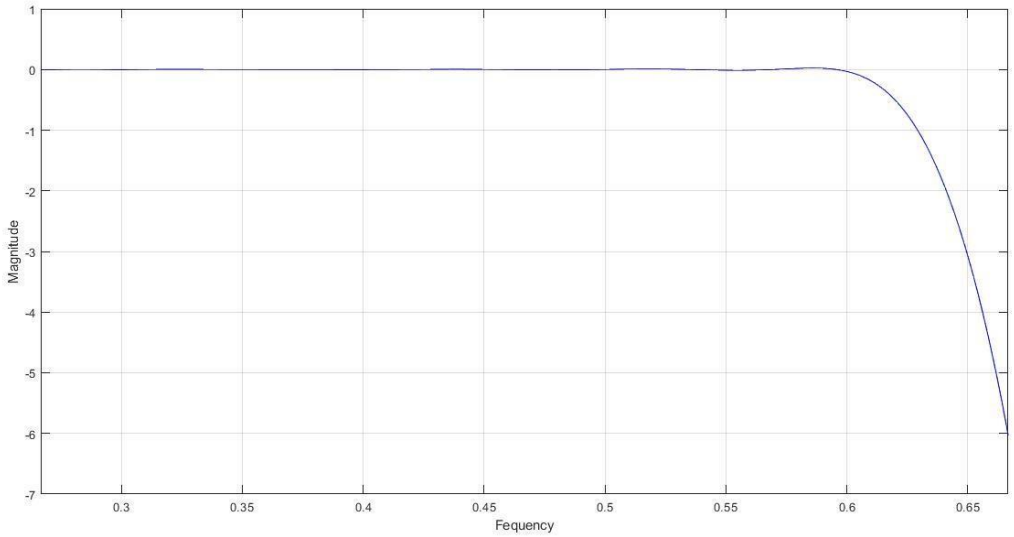
a. Impulse response



b. Magnitude response of the FIR filter ($-\pi \leq \omega \leq \pi$)



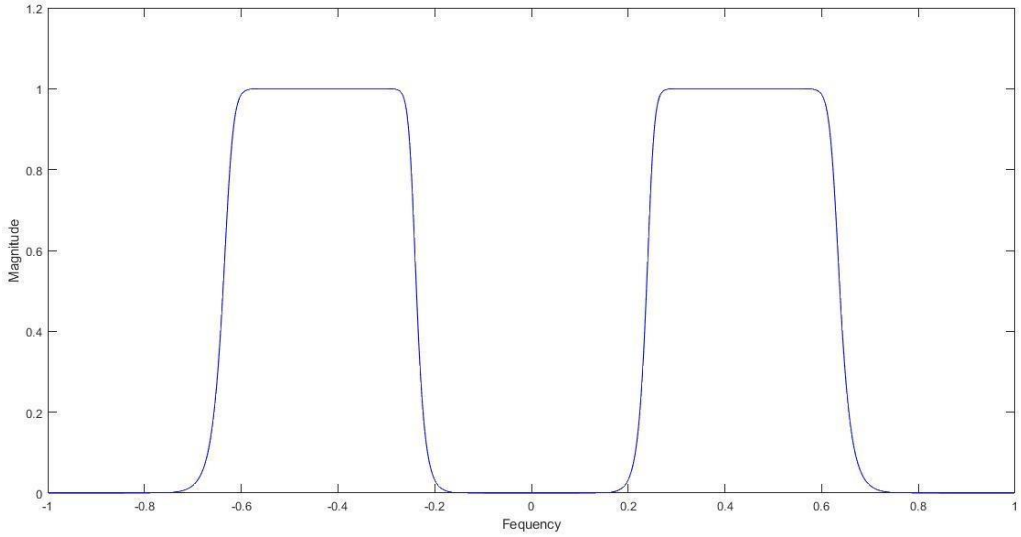
c. Magnitude response $\omega p1 \leq \omega \leq \omega p2$



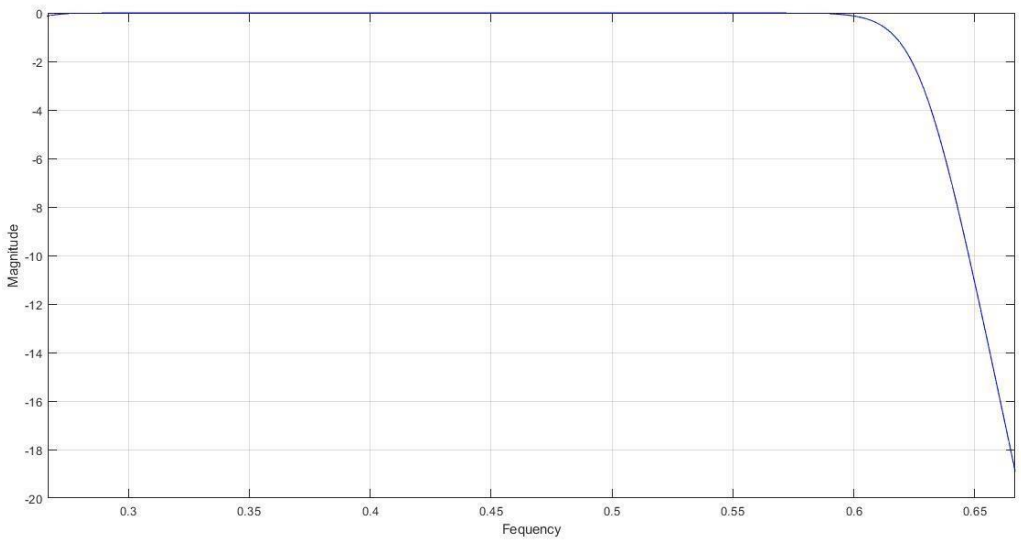
IIR Filter Design

D = 0 , Butterworth filter used
N = order = 10

b. Magnitude response of the digital filter ($-\pi \leq \omega < \pi$)



c. Magnitude response for $\omega p1 \leq \omega \leq \omega p2$



3. FIR filter

- Order = 44.
- Number of additions = 44
- Multipliers = order + 1 = 45
- Group delay = 22

IIR filter

- Used bilinear transform
- Order = 10
- Number of additions = 10 * 2 = 28
- Multipliers = 21
- Group delay = 5

Appendix

1. Fir filter.

Editor - D:\semester 3\signal\filter kuppi\fir.m

fir.m

```
fsamp = 3000/(2*pi);
fcuts = [100/(2*pi) 400/(2*pi) 900/(2*pi) 1100/(2*pi)];
mags = [0 1 0];
devs = [10^(-50/20) 10^(0.15/20) 10^(-50/20)];
[n,Wn,beta,ftype] = kaiserord(fcuts,mags,devs,fsamp);
n = n + rem(n,2);
hn = firl(n,Wn,ftype,kaiser(n+1,beta),'noscale');
[H,f] = freqz(hn,1);

figure('name','Impulse Response Of FIR');
impz(hn,1);

figure('name','FIR Filter Magnitude Response B');
plot(f/pi,abs(H),'b')
hold on
plot(-f/pi,abs(H),'b')
xlabel('Fequency');
ylabel('Magnitude');

figure('name','FIR Filter Magnitude Response C');
plot(f/pi,20*log10(abs(H)),'b')
xlim([(4/15) (10/15)])
xlabel('Fequency');
ylabel('Magnitude');
grid on;
```

2. Iir filter.

Editor - D:\semester 3\signal\filter kuppi\iir.m

iir.m

```
%Butterworth
T = (2*pi)/3000;
fcuts = [(2/T)*tan(pi/15) (2/T)*tan((4*pi)/15) (2/T)*tan((9*pi)/15) (2/T)*tan((11*pi)/15) ];
mags = [0 1 0];
devs = [10^(-50/20) 10^(0.15/20) 10^(-50/20)];
Wp = [abs((2/T)*tan((4*pi)/30)) abs((2/T)*tan((9*pi)/30))];
Ws = [abs((2/T)*tan(pi/30)) abs((2/T)*tan((11*pi)/30))];
Rp = 0.15;
Rs = 50;
[n,W] = buttord(Wp,Ws,Rp,Rs,'s');
%disp(n)order
[b,a] = butter(n,W,'s');
freqs(b,a,4096)
%title('Butterworth Bandpass Filter')
[zd,zp]=bilinear(b,a,1/T);
freqz([zd,zp])
[H,f] = freqz(zd,zp);

figure('name','Butterworth Bandpass Filter Magnitude Response B');
plot(f/pi,abs(H),'b')
hold on
plot(-f/pi,abs(H),'b')
xlabel('Fequency');
ylabel('Magnitude');

figure('name','Butterworth Bandpass Filter Magnitude Response C');
plot(f/pi,20*log10(abs(H)),'b')
xlim([(4/15) (10/15)])
xlabel('Fequency');
ylabel('Magnitude');
grid on;
```