% FIR LPF

clc;

clear all;

close all;

% Passband and Stopband edge frequencies

fp=2000;

fs=4000;

%Sampling frequency

Fs=20000;

% Normalising to half the sampling frequency

fn=Fs/2;

% cut off frequency (normalizes to fn)

fc=(fs+fp)/2/fn;

%normalized transition width

tw=abs(fs-fp)/Fs; % holds good for both LPF and HPF

N=ceil(4/tw);

% window N=8pi/2pi\*TW

% To ensure type-1 (N must be odd)

if(rem(N,2)==0)

N=N+1;

end

wn=hanning(N); % Hanning window coefficients

% calculate truncated ideal impulse response coefficients

hd=fir1(N-1,fc,boxcar(N));

% to obtain windowed coefficients of LPF

hn=fir1(N-1,fc,wn);

% Frequency response of the filter

[H,f]=freqz(hn,1,512,Fs); % return 512 points for the range Fs/2

mag=20\*log10(abs(H));

plot(f,mag);

grid on;

xlabel(' Frequency(Hz) ');

ylabel(' Magnitude response (dB) ');

title(' Frequency response of LPF ');

% impulse response of the filter

n=0:N-1;

figure;

plot(n,hn);

% FIR BPF

clc;

clear all;

close all;

% Passband and transition width

fp1=150;

fp2=250;

tw=50;

% saqmpling frequency

Fs=1000;

% normalised to half the sampling frequency

fn=Fs/2;

% cutoff frequency ( normalisede to fn)

fc1=(fp1-(tw/2))/fn;

fc2=(fp2+(tw/2))/fn;

% normalised transition width

tw=tw/Fs;

% stop band attenuation is 60dB choose blackman window

N=ceil(6/tw);

% to ensure type-1 (N must be odd)

if(rem(N,2)==0)

N=N+1

end

wn=blackman(N);

% calculate truncated ideal impulse response coefficient

hd=fir1(N-1,[fc1 fc2],boxcar(N));

% To obtain windowed coefficients

hn=fir1(N-1,[fc1,fc2],wn);

[H,f]=freqz(hn,1,512,Fs);

mag=20\*log10(abs(H));

plot(f,mag);

grid on;

xlabel(' Frequency(Hz) ');

ylabel(' Magnitude response (dB) ');

title(' Frequency response of BPF ');

% impulse response of the filter

n=0:N-1;

figure;

plot(n,hn);

% FIR BPF using Kaiser window

clc;

clear all;

close all;

Fs=8000; % Sampling frequency

fn=Fs/2; % Nyquist frequency

delp=10^(0.1/20)-1; % pass band ripple =0.1 dB

dels=10^(-60/20); % stop band ripple = 60 dB

del=min([delp,dels]);

tw=300; % Transition bandwidth

twn=tw/Fs; % normalized transition width

A=60; % stop band attenuation

N=ceil((A-7.95)/(14.36\*twn));

% To ensure type-1 (N must be odd)

if(rem(N,2)==0)

N=N+1

end

if A<=21

beta=0;

elseif A>21 & A<50

beta=0.5842\*(A-21)^0.4+0.07886\*(A-21);

else

beta=0.1102\*(A-8.7);

end

% delf = transition width = 50Hz

% fc1=fc1-delf/2=1k-300/2=850Hz, fc2=fc2+delf/2=2k+300/2=2150Hz

% Normalized cut off frequencies

fc1=850/fn;

fc2=2150/fn;

% band edge frequencies

fc=[fc1 fc2];

% obtain windowed filter coefficients

hn=fir1(N-1,fc,kaiser(N,beta));

%Compute frequency response

[H,f]=freqz(hn,1,512,Fs);

mag=20\*log10(abs(H));

plot(f,mag);

grid on;

xlabel(' Frequency(Hz) ');

ylabel(' Magnitude response (dB) ');

title(' Frequency response of BPF using kaiser window ');

% impulse response of the filter

n=0:N-1;

figure;

plot(n,hn);