

**Independent University Bangladesh**

Department of Electrical and Electronics Engineering

**Lab Report** **09**

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Course code: EEE 321L

Couse name: Digital Signal Processing Lab

Lab no: 07

Lab title: Study on DTFT, Circular Folding and Circular Convolution

Date: 13/1/2021

1. Function to compute impulse response of ideal low pass filter

Code:

function hd=ideal\_lp(wc,M)

%Ideal lowpass filter computation

% hd=ideal lowpass impulse response

% wc=cutoff frequency in radians

% M=length of the ideal filter

alpha=(M-1)/2;

n=0:M-1;

m=n-alpha;

fc=wc/pi;

hd=fc\*sinc(fc\*m);

end

1. FIR low pass filter with wp = 0.2π, ws = 0.3π using Hamming window

Code:

%Definition

wp=0.2\*pi;

ws=0.3\*pi;

tr\_width=ws-wp;

M=ceil(6.6\*pi/tr\_width)+1;

n=0:M-1;

wc=(ws+wp)/2; %Ideal LPF cutoff frequency

%Impulse response

hd=ideal\_lp(wc,M);

w\_ham=(hamming(M))';

h=hd.\*w\_ham;

%Frequency response

[H w]=freqz(h,[1],1000,'whole');

H=(H(1:501))';

w=(w(1:501))';

mag=abs(H);

db=20\*log10((mag+eps)/max(mag));

%Plotting

subplot(2,1,1)

stem(n,w\_ham); grid

title('Hamming window');

xlabel('n','fontsize',15);

ylabel('w(n)','fontsize',15);

subplot(2,1,2)

plot(w/pi,db); grid

title('Magnitude response in dB');

xlabel('frequency in pi units');

ylabel('Decibels','fontsize',15);

Outputs:



1. FIR low pass filter with wp = 0.2π, ws = 0.3π and As = 50dB using Kaiser window

Code:

%Definition

wp=0.2\*pi;

ws=0.3\*pi;

tr\_width=ws-wp;

As=50;

M=ceil((As-7.95)/(2.285\*tr\_width)+1)+1;

n=0:M-1;

wc=(ws+wp)/2; %Ideal LPF cutoff frequency

beta=0.1102\*(As-8.7);

%Impulse response

hd=ideal\_lp(wc,M);

w\_kai=(kaiser(M,beta))';

h=hd.\*w\_kai;

%Frequency response

[H w]=freqz(h,[1],1000,'whole');

H=(H(1:501))';

w=(w(1:501))';

mag=abs(H);

db=20\*log10((mag+eps)/max(mag));

%Plotting

subplot(2,1,1)

stem(n,w\_kai); grid

title('Kaiser window');

xlabel('n','fontsize',15);

ylabel('w(n)','fontsize',15);

subplot(2,1,2)

plot(w/pi,db); grid

title('Magnitude response in dB');

xlabel('Frequency in pi units');

ylabel('Decibels','fontsize',15);

Output:



1. FIR high pass filter with wp = 0.4π, ws = 0.5π using Hamming window

Code:

%Definiiton

wp=0.4\*pi;

ws=0.5\*pi;

tr\_width=ws-wp;

M=ceil(6.6\*pi/tr\_width)+1;

n=0:M-1;

wc=(ws+wp)/2;

hd=ideal\_lp(pi,M)-ideal\_lp(wc,M);

w\_ham=(hamming(M))';

h=hd.\*w\_ham;

%Frequency response

[H, w]=freqz(h,[1],1000,'whole');

H=(H(1:501))';

w=(w(1:501))';

mag=abs(H);

db=20\*log10((mag+eps)/max(mag));

%Plotting

subplot(2,1,1)

stem(n,w\_ham); grid

title('Hamming window');

xlabel('n','fontsize',15);

ylabel('w(n)','fontsize',15);

subplot(2,1,2)

plot(w/pi,db); grid

title('Magnitude response in db');

xlabel('Frequency in pi units');

ylabel('Decibels','fontsize',15);

Output:



Assignment:

1. Function definition:

% function to plot LPF impulse response from pass and stopband frequency

function [] = fir\_lp\_hamming(wp,ws)

tr\_width=ws-wp;

M=ceil(6.6\*pi/tr\_width)+1;

n=0:M-1;

wc=(ws+wp)/2;

%Impulse response

hd=ideal\_lp(wc,M);

w\_ham=(hamming(M))';

h=hd.\*w\_ham;

%Frequency response

[H w]=freqz(h,[1],1000,'whole');

H=(H(1:501))';

w=(w(1:501))';

mag=abs(H);

db=20\*log10((mag+eps)/max(mag));

%Plotting

subplot(2,1,1)

stem(n,w\_ham); grid

title('Hamming window');

xlabel('n','fontsize',15);

ylabel('w(n)','fontsize',15);

subplot(2,1,2)

plot(w/pi,db); grid

title('Magnitude response in dB');

xlabel('frequency in pi units');

ylabel('Decibels','fontsize',15);

end

1. Call and output:

Call:

wp = 0.4\*pi;

ws = 0.5\*pi;

fir\_lp\_hamming(wp,ws);

Output:

