Tribhuvan University

Institute of Engineering

Pulchowk Campus

Lab Report on :

FIR FILTERS

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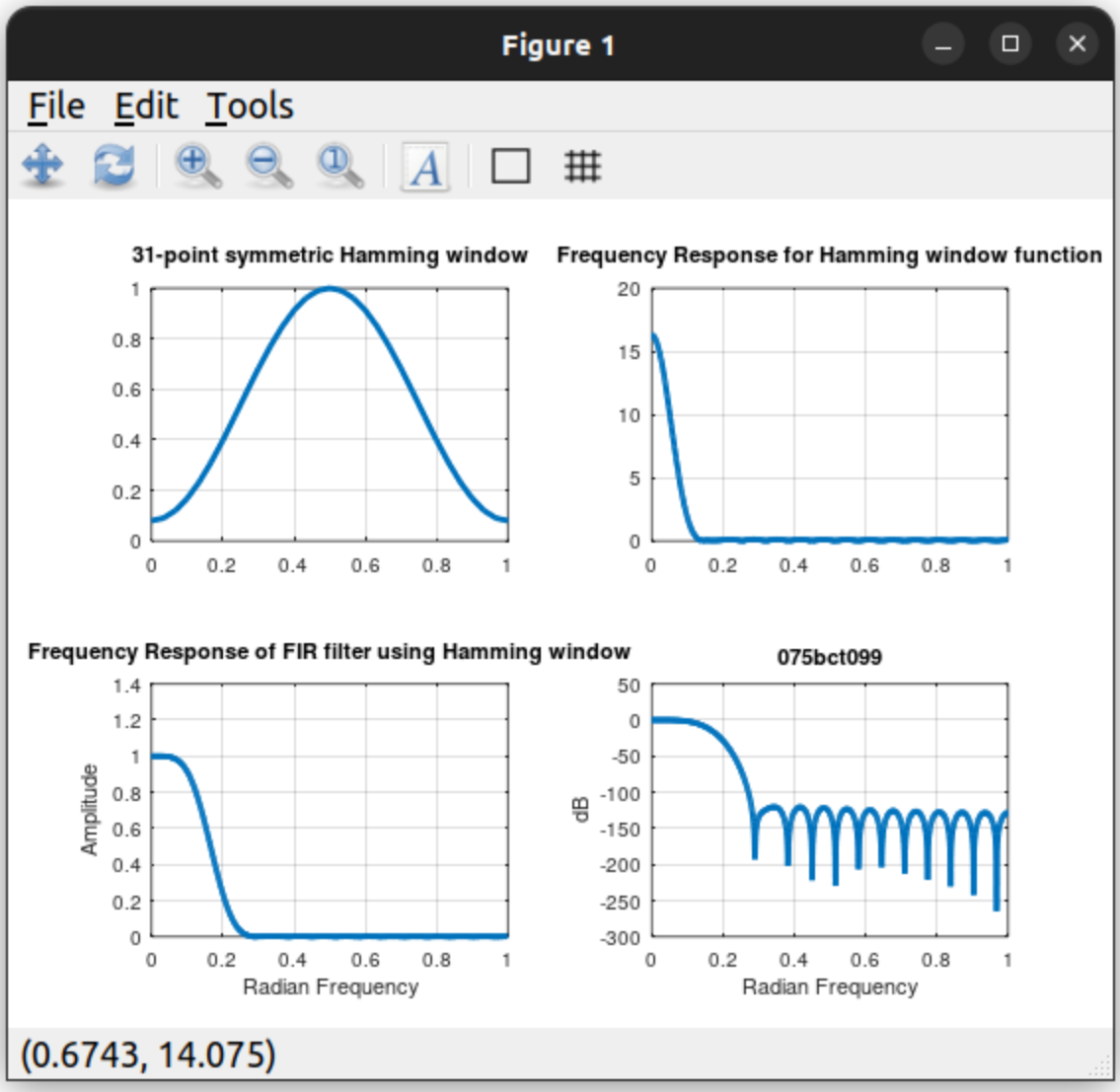
DSAP Lab6 FIR filters

a) **Hamming**

Code:

```
%a
pkg load signal;
pkg load control;
clc;

f = [0 pi/6 pi/6 pi];
H = [1 1 0 0];
M = 31;
w = 0:pi/30:pi;
subplot(2,2,1);
h = hamming(M);
plot(w/pi,h,'linewidth', 2);
grid on;
title('31-point symmetric Hamming window');
subplot(2,2,2);
[H1,w] = freqz(h,1,1024);
plot(w/pi,abs(H1),'linewidth', 2);
grid on;
title('Frequency Response for Hamming window function');
subplot(2,2,3);
B = fir1(M-1,1/6,h); %It uses Hamming window of length M+1 by default
%if not specified
[H2,w] = freqz(B,1,1024);
plot(w/pi,abs(H2),'linewidth', 2);
grid on;
ylabel('Amplitude');
xlabel('Radian Frequency');
title('Frequency Response of FIR filter using Hamming window');
gk = 20*log(abs(H2));
subplot(2,2,4);
plot(w/pi,gk,'linewidth', 2);
grid on;
ylabel('dB');
xlabel('Radian Frequency');
%end
```

Output:



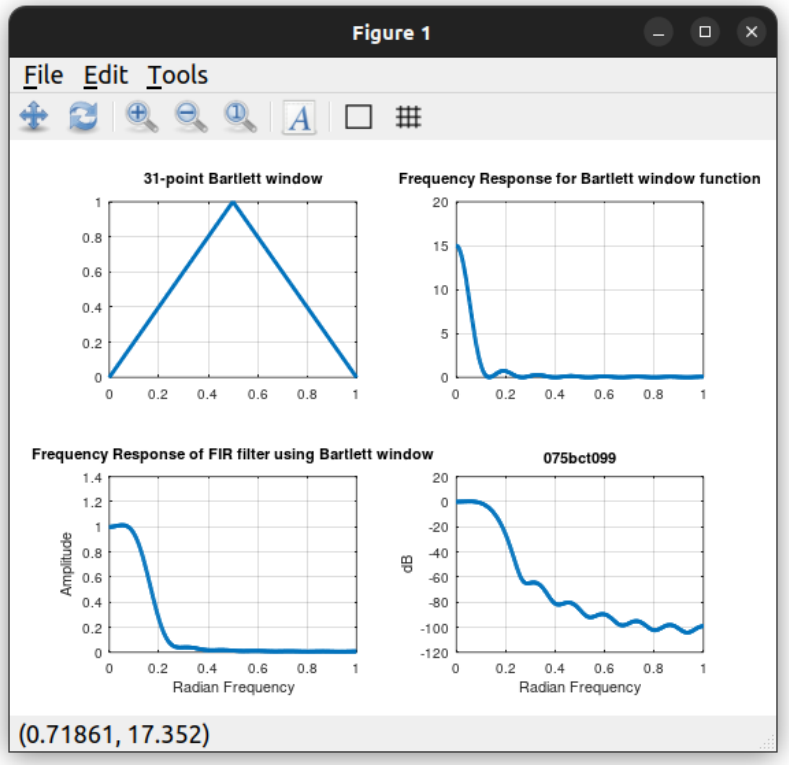
b) Bartlett

Code:

```
pkg load signal;
pkg load control;
clc;

w = 0:pi/30:pi;
M = 31;

subplot(2,2,1);
h = bartlett(M);
plot(w/pi,h,'linewidth', 2);
grid on;
title('31-point Bartlett window');
```

```
subplot(2,2,2);
[H1,w] = freqz(h,1,1024);plot(w/pi,abs(H1),'linewidth', 2);
grid on;
title('Frequency Response for Bartlett window function');
subplot(2,2,3);
B = fir1(M-1,1/6,h); %It uses Hamming window of length M+1 by default
[H2,w] = freqz(B,1,1024);
plot(w/pi,abs(H2),'linewidth', 2);
grid on;
ylabel('Amplitude');
xlabel('Radian Frequency');
title('Frequency Response of FIR filter using Bartlett window');
gk = 20*log(abs(H2));
subplot(2,2,4);
plot(w/pi,gk,'linewidth', 2);
grid on;
title("075bct099")
ylabel('dB');
xlabel('Radian Frequency');
```

Output:

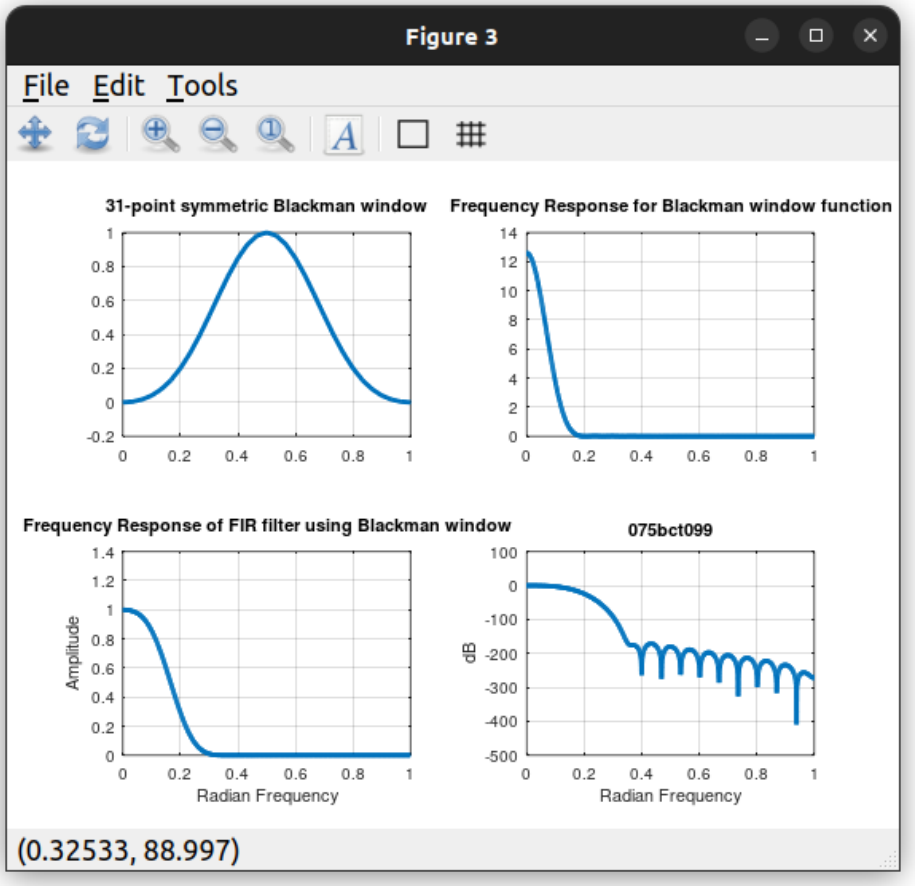


c) Blackman

Code:

```
w = 0:pi/30:pi;
figure(3);
subplot(2,2,1);
h = blackman(M);
plot(w/pi,h,'linewidth', 2);
grid on;
title('31-point symmetric Blackman window');
subplot(2,2,2);
[H1,w] = freqz(h,1,1024);
plot(w/pi,abs(H1),'linewidth', 2);
grid on;
title('Frequency Response for Blackman window function');
subplot(2,2,3);
B = fir1(M-1,1/6,h); %It uses Hamming window of length M+1 by default
[H2,w] = freqz(B,1,1024);
plot(w/pi,abs(H2),'linewidth', 2);
grid on;
ylabel('Amplitude');
xlabel('Radian Frequency');
title('Frequency Response of FIR filter using Blackman window');
gk = 20*log(abs(H2));
subplot(2,2,4);
plot(w/pi,gk,'linewidth', 2);
grid on;
ylabel('dB');
title(“075bct099”)
xlabel('Radian Frequency');
```

Output:



d) Kaiser

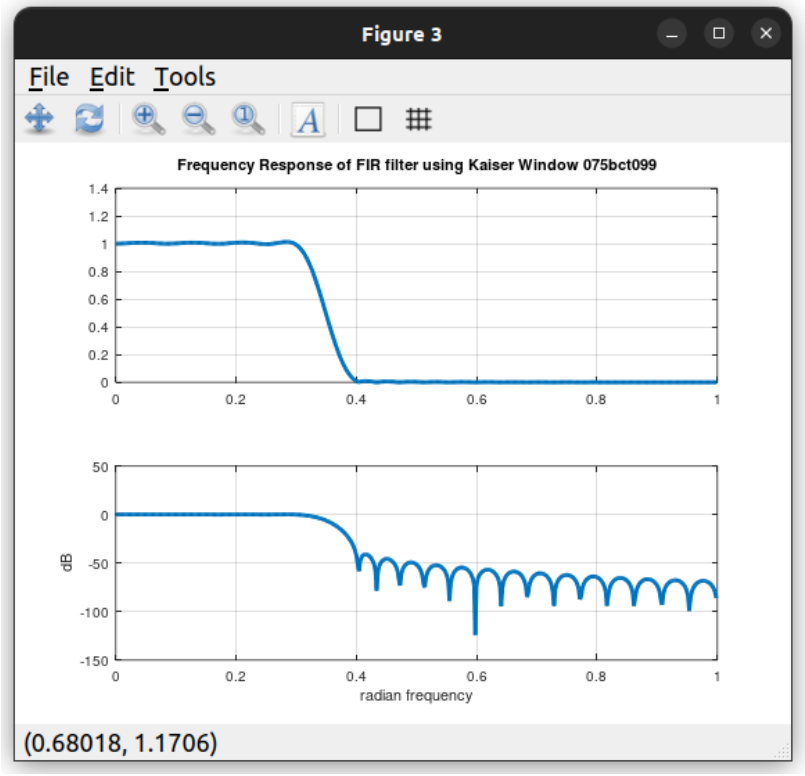
Code:

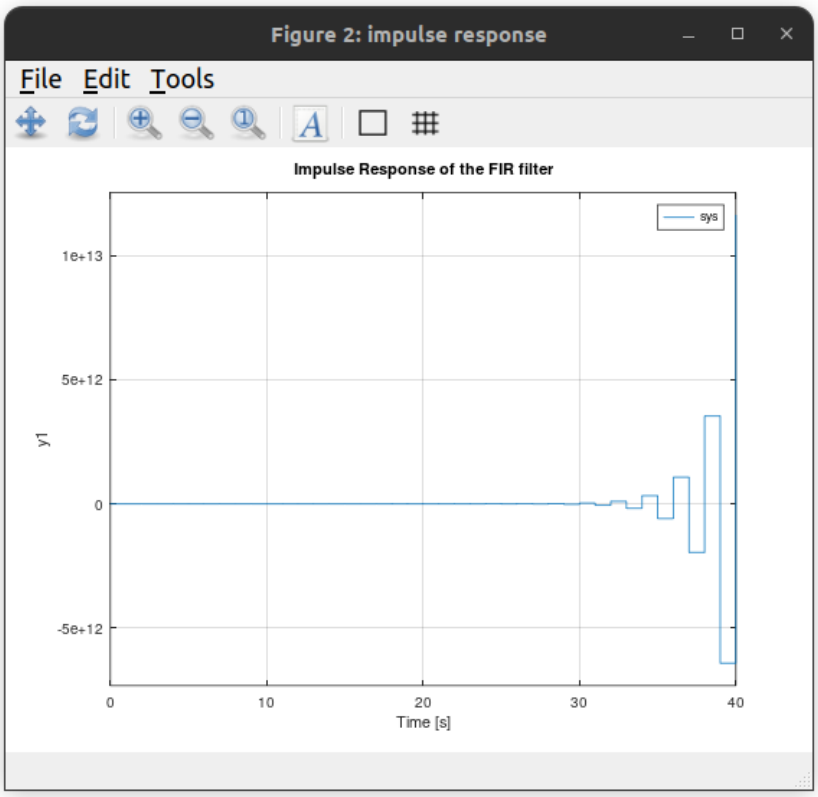
```
pkg load signal;

wsample = 100;
wp = 15;
ws = 20;
wpn = 2*wp/wsample;
wsn = 2*ws/wsample;
wn = (wpn + wsn)/2;
Rs = 40;
beta = 0.5842.*(Rs-21)^0.4+0.07886.*(Rs-21);
dw = (wsn - wpn)/2;
M = ((Rs-7.95)./(14.36*dw)) + 1;
N = round(M);
Kaiser_window_length = N
wk = kaiser(N,beta);
bk = fir1(N-1,wn,wk);
[H,w] = freqz(bk,1,512);
subplot(2,1,1);
```

```
plot(w/pi,abs(H), 'linewidth', 2);
title('Frequency Response of FIR filter using Kaiser Window 075bct099');
grid on;
subplot(2,1,2);
plot(w/pi,20*log10(abs(H)), 'linewidth', 2);
xlabel('radian frequency');
ylabel('dB');
grid on;
figure('Name','impulse response');
nk = 0:N-1;dimpulse(nk,bk);
title('Impulse Response of the FIR filter');
grid on;
```

Output:

Kaiser_window_length = 46





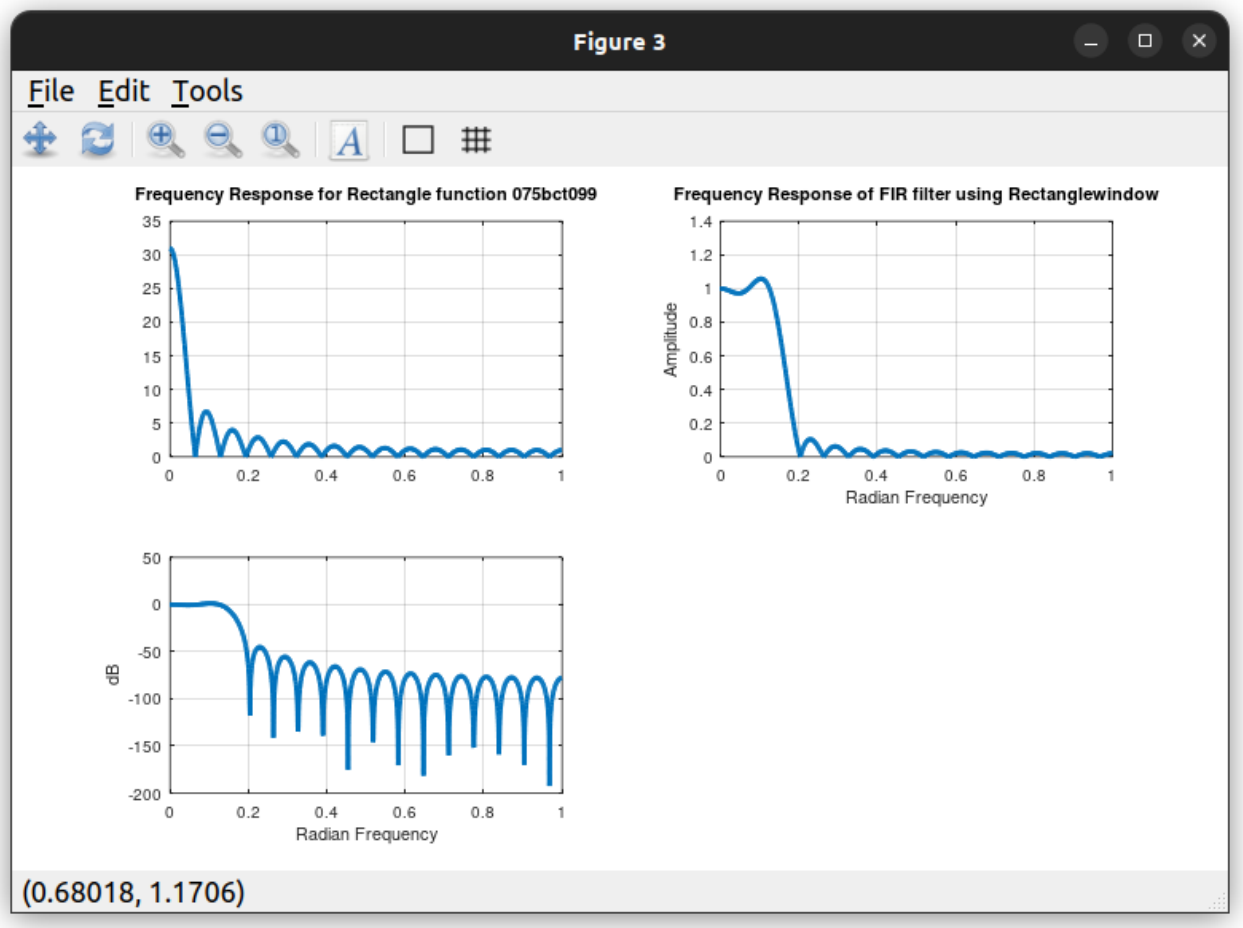
d) Rectangular

Code:

```
pkg load signal;
clc ;
clear all;

w = 0:pi/30:pi;
M = 31;

h = rectwin(M);

plot(w/pi,h,'linewidth' , 2);
grid on;
title('31-point Rectangle window');
subplot(2,2,1);
[H1,w] = freqz(h,1,1024);
plot(w/pi,abs(H1),'linewidth', 2);
grid on;
title('Frequency Response for Rectangle function');
subplot(2,2,2);
B = fir1(M-1,1/6,h); %It uses Hamming window of length M+1 by default
[H2,w] = freqz(B,1,1024);
plot(w/pi,abs(H2),'linewidth', 2);
```

```
grid on;
ylabel('Amplitude');
xlabel('Radian Frequency');
title('Frequency Response of FIR filter using Rectanglewindow');
gk = 20*log(abs(H2));
subplot(2,2,3);
plot(w/pi,gk,'linewidth', 2);
grid on;
ylabel('dB');
xlabel('Radian Frequency');
```

Output:



Conclusion:

Thus in this lab we studied various Finite Impulse Response(FIR) filters .