Digital Signal Processing
MATLAB HW2 - q5

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Clear recent data

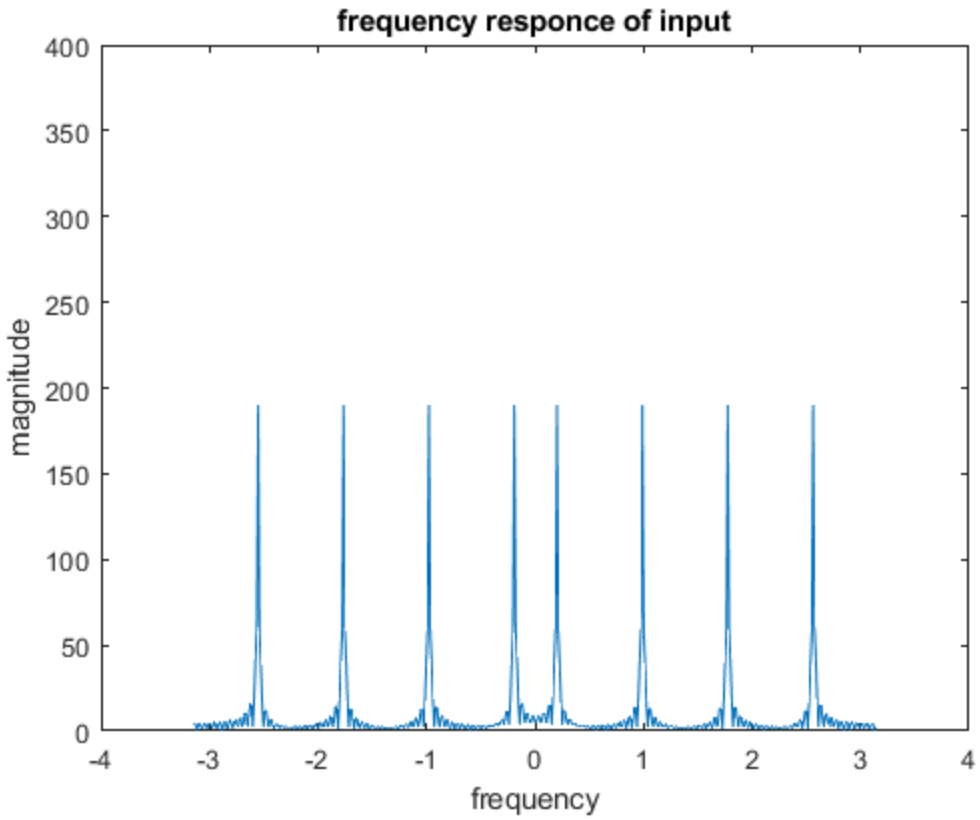
```
clear; close all; clc;
```

Multi-Channel Filters and Perfect Reconstruction

a

define parameters

```
f1 = pi/16;
f2 = 5*pi/16;
f3 = 9*pi/16;
f4 = 13*pi/16;
t = 0: 1/2/pi: 60;
x1 = cos(2*pi*f1*t);
x2 = cos(2*pi*f2*t);
x3 = cos(2*pi*f3*t);
x4 = cos(2*pi*f4*t);
x = x1 + x2 + x3 + x4;
n = 512;
fs = 2*pi;
freq = linspace(-fs/2, fs/2, n);
x_f = fftshift(fft(x,n));
figure(1);
plot(freq,abs(x_f));
title("frequency responce of input");
xlabel('frequency');
ylabel("magnitude");
ylim([0,400]);
```



b

```
filename = 'filters.xls';
delimiterIn = ' ';
headerlinesIn = 1;
B = importdata(filename,delimiterIn);
b_analysis = B.Sheet1;
b_synthesis = B.Sheet2;
```

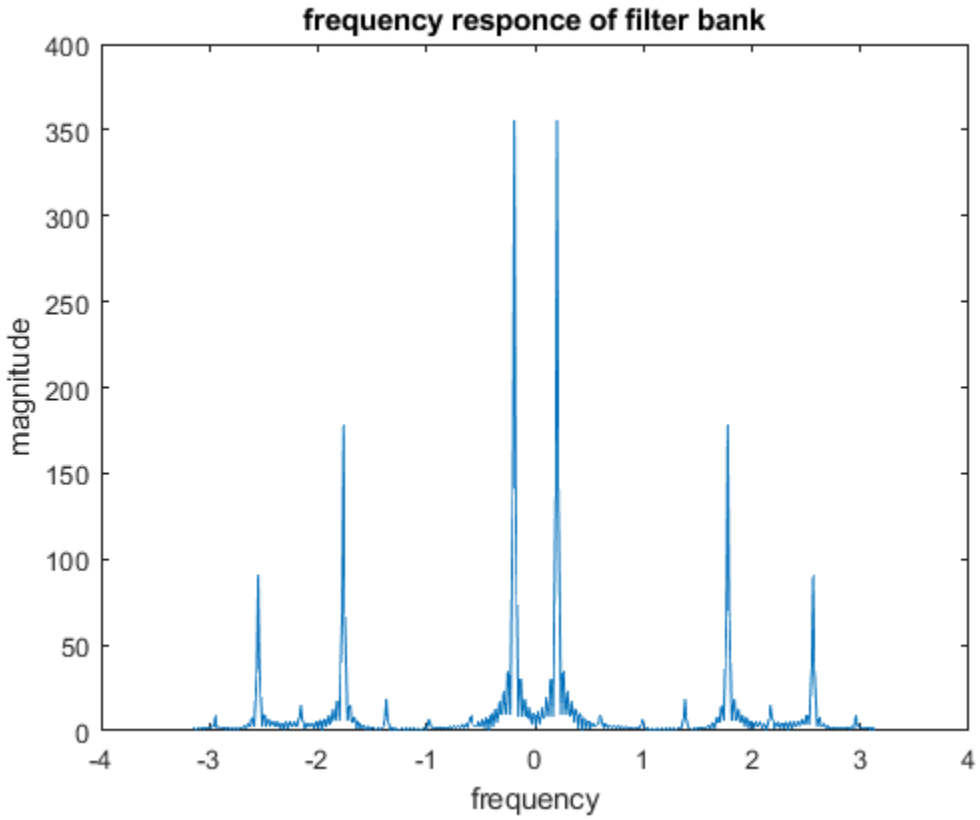
c

double the first Frequency component eliminate the second Frequency component the third Frequency component Remains unchanged attenuate the fourth Frequency component by 0.5 factor

```
change = [2, 0, 1, 0.5];

for k = [1:4]
   step1 = filter(b_analysis(k, :), 1, x);
   step2 = downsample(step1, 4);
   step3 = change(k)* step2;
   step4 = upsample(step3, 4);
   step5(k,:) = filter(b_synthesis(k,:), 1, step4);
end
y = sum(step5(:,:));
```

```
% Plot Output
y_f = fftshift(fft(y,n));
figure(2);
plot(freq, abs(y_f));
title("frequency responce of filter bank");
xlabel('frequency');
ylabel("magnitude");
```



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