%FIR Filter using Frequency Sampling technique low pass

clc;

clear all;

close all;

N = 7;

Hk = [1, 1, 0, 0, 0, 0, 1];

ang = [-pi\*(0:(N-1)/2)/N, pi\*(1:(N-1)/2)/N];

H = Hk .\* exp(1i \* ang);

hn = real(ifft(H));

[h1, w] = freqz(hn, 1);

figure;

subplot(3, 2, 1);

stem(0:N-1, Hk, 'filled');

xlabel('k');

ylabel('|H(k)|');

title('Magnitude of H(k)');

subplot(3, 2, 2);

stem(0:N-1, ang, 'filled');

xlabel('k');

ylabel('Phase of H(k)');

title('Angle of H(k)');

subplot(3, 2, 3);

stem(0:N-1, hn, 'filled');

xlabel('n');

ylabel('h(n)');

title('Impulse Response of FIR Filter');

subplot(3, 2, 4);

plot(w/pi, abs(h1));

xlabel('Normalized Frequency (\times\pi rad/sample)');

ylabel('|H(e^{j\omega})|');

title('Frequency Response of FIR Filter');

fs = 511;

t = 0:1/fs:1;

x = 2\*sin(2\*pi\*50\*t) + 4\*sin(2\*pi\*120\*t) + 8\*sin(2\*pi\*240\*t);

y = fft(x);

f = (0:length(x)-1) \* fs / length(x);

h1 = fftshift(abs(h1'));

yout = y .\* h1(1:length(y));

subplot(3, 2, 5);

stem(f, abs(y), 'filled');

xlabel('Frequency (Hz)');

ylabel('|X(f)|');

title('Frequency Spectrum of Input Signal');

subplot(3, 2, 6);

stem(f, abs(yout), 'filled');

xlabel('Frequency (Hz)');

ylabel('|Y(f)|');

title('Frequency Spectrum of Output Signal');