

Experiment-8

Aim: Design and implement FIR filter using frequency sampling method.

Theory: (Write on your own)

Algorithm: (Write on your own)

Octave implementation: The impulse response of filter h_n is found using `ifft` function. `H = freqz(hn,1,w)` returns the n complex frequency response vector H of the filter whose coefficients are in vector h_n .

Calculation:

Design an ideal lowpass filter with a frequency response

$$H_d = \begin{cases} e^{-j3w}, & 0 \leq |w| \leq \pi/2 \\ 0 & \pi/2 \leq |w| \leq \pi \end{cases}$$

Find the values of $h(n)$ for $N=7$ and plot the frequency response.

Program:

```
%frequency sampling method

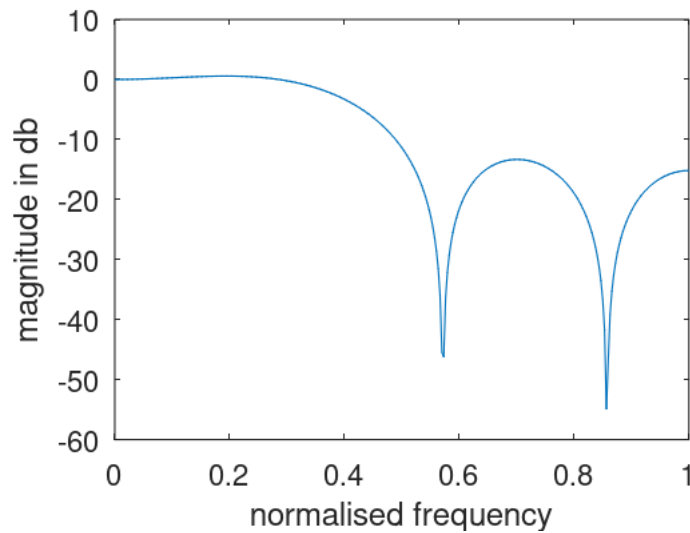
clc;
clear all;
close all;
N=input('enter the order of the filter N=');
alpha=(N-1)/2;
Hrk=[ones(1,2),zeros(1,4),ones(1,1)];
k1=0:(N-1)/2;
k2=(N+1)/2:N-1;
theetak=[(-alpha*(2*pi)/N)*k1,(alpha*(2*pi)/N)*(N-k2)];
Hk=Hrk.*(exp(i*theetak));
w=0:0.01:pi;
hn=real(ifft(Hk,N))
H=freqz(hn,1,w);
plot(w/pi,20*log10(abs(H)))
ylabel('magnitude in db');
xlabel('normalised frequency');
```

Input:

enter the order of the filter N=7

Output:

hn = -0.1146 0.0793 0.3210 0.4286 0.3210 0.0793 -0.1146

**Viva Questions:**

1. What are FIR filters?
2. Mention some design methods available to design FIR filter.
3. What are the merits and demerits of FIR filters?
4. Write the procedure for FIR filter design by frequency sampling method.
5. What are the possible types of impulse response for linear phase FIR filter?
6. What is the reason that FIR filter is always stable?
7. What are the conditions to be satisfied for constant phase delay in linear phase FIR filter?