Experiment 9: Linear Phase F I R Filter Design using Frequency sampling method

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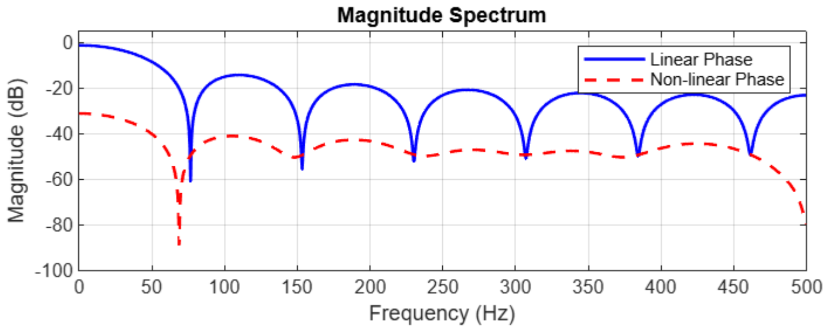
Experiment No.	9

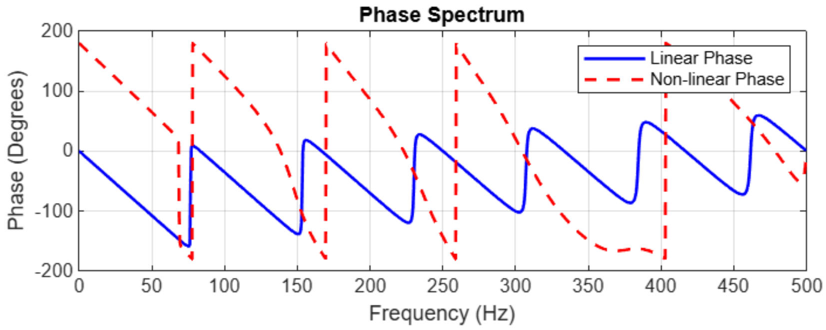
AIM:	FIR Filter design using Frequency Sampling Method.
OBJECTIVE:	The objective of this experiment is to design the digital filter using frequency sampling method.
INPUT SPECIFICATION:	**For LPF / HPF filter Design :** 1. Pass band Attenuation (Ap) 2. Stop band Attenuation (As > 40 dB) 3. Pass band Frequency (Fp) in Hz 4. Stop band Frequency (Fs) in Hz 5. Sampling Frequency in Hz **For BPF / BSF filter Design :** 1. Pass band Attenuation (Ap) 2. Stop band Attenuation (As) 3. Pass band Frequency (Fp1, Fp2) in Hz 4. Stop band Frequency (Fs) in Hz 5. Sampling Frequency in Hz
PROBLEM DEFINITION:	1. Accept the input specifications for two cases ; one for LPF/BPF and second for HPF/BSF. Assume any appropriate value for filter order N. 2. Design Linear Phase as well as Non Linear Phase FIR filter. 3. Plot Magnitude Spectrum and Phase Spectrum and verify the value of Ap and As in pass band and stop band from the spectrum. 4. If the design parameters are not satisfied from the spectrum, change the value of filter order N adaptively.

LPF

```
Select the filter
1
Enter Sampling Frequency (Hz):
1000
Enter Pass Band Attenuation (Ap) in dB:
1
Enter Stop Band Attenuation (As) in dB (> 40):
49
Enter Pass Band Frequency (Fp) in Hz:
0.1
Enter Stop Band Frequency (Fs) in Hz:
0.4
Enter filter Order (N):
12

filter_type = 1
Fs = 1000
Ap = 1
As = 49
Designing Low Pass Filter (LPF)
Fp = 0.1000
Fs_stop = 0.4000
N = 12
```

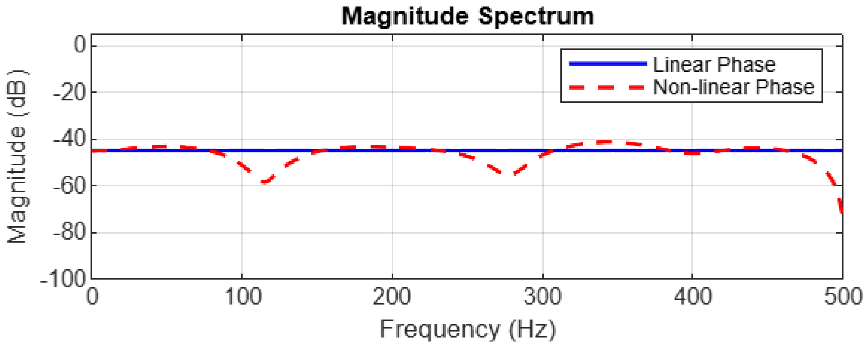


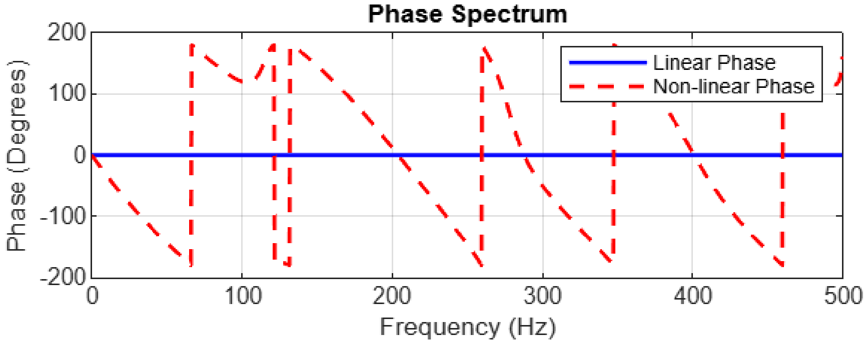


BPF

```
3
Enter Sampling Frequency (Hz):
1000
Enter Pass Band Attenuation (Ap) in dB:
1
Enter Stop Band Attenuation (As) in dB (> 40):
45
Enter Lower Pass Band Frequency (Fp1) in Hz:
0.2
Enter Upper Pass Band Frequency (Fp2) in Hz:
0.3
Enter Lower Stop Band Frequency (Fs_stop1) in Hz:
0.1
Enter Upper Stop Band Frequency (Fs_stop2) in Hz:
0.4
Enter filter Order (N):
12


filter_type = 3
Fs = 1000
Ap = 1
As = 45
Designing Band Pass Filter (BPF)
Fp1 = 0.2000
Fp2 = 0.3000
Fs_stop1 = 0.1000
Fs_stop2 = 0.4000
N = 12
```





CONCLUSION:	1. The phase of the filter is linear in nature which is peculiarity of FIR filter, we verified it through matlab . 2. The value of Digital angular frequency must be -pi to pi and the unit is rad. The value of frequency must be between 0 to 0.5 which has no units. 3. Successfully designed and implemented Linear Phase FIR filters using the windowing method in MATLAB for LPF and BPF 4. Use Frequency Sampling Method when you need precise control over the frequency response. 5. FSM method inherently supports the design of linear phase FIR filters, ensuring minimal phase distortion in signal processing applications.