MATLAB Assignment 7

Spring 2020, Section A

In this assignment, you will reinforce what we did lecture 7 regarding MATLAB's filter toolbox. Please submit this homework as a *.m* file, with suppressed output. Remember that all lectures and homeworks may be found at *github.com/guybaryosef/ECE210-materials*. Homework is due by the end of the semester to guybymatlab@gmail.com.

For each of the following questions, generate filters using either ***filterDesigner*** or the filter design toolbox in the DSP System toolbox. Apply the filter to the signal using ***step*** or ***filter***, depending on how your filter is represented. Lastly, plot the Fourier Transform of the final result using ***fft***, ***fftshift***, and ***plot***. Refer to the notes for the proper way to use ***fft*** and obtain the proper scaling.

1. Generate a signal that consists of a sum of sine waves of frequencies ranging from 1 to 50 kHz. Set t to be from 0 to 2 seconds, using an interval of $0.001s$:

$$signal = \sum_{f=1}^{50000} sin(2\pi f t)$$

2. Create a Butterworth lowpass filter with a sampling frequency of $F_s = 100kHz$, a passband frequency of $F_{pass} = 10kHz$, a stopband frequency of $F_{stop} = 20kHz$, a passband attenuation of $A_{pass} = 5dB$, and a stopband attenuation of $A_{stop} = 50dB$.

3. Create a Chebychev I highpass filter with a sampling frequency of $F_s = 100kHz$, a passband frequency of $F_{pass} = 35kHz$, a stopband frequency of $F_{stop} = 15kHz$, a passband attenuation of $A_{pass} = 2dB$, and a stopband attenuation of $A_{stop} = 40dB$.

4. Create a Chebychev II bandstop filter with a sampling frequency of $F_s = 100kHz$, a passband frequency of below the frequency $F_{pass1} = 5kHz$ and above $F_{pass2} = 45kHz$, a stopband frequency of between $F_{stop1} = 15kHz$ and $F_{stop2} = 35kHz$, a passband attenuation of Apass = 5dB, and a stopband attenuation of Astop = 50dB.

4. Create a Elliptic bandpass filter with a sampling frequency of $F_s = 100kHz$, a stopband frequency of below the frequency $F_{stop1} = 15kHz$ and above $F_{stop2} = 35kHz$, a passband frequency of between $F_{pass1} = 20kHz$ and $F_{pass2} = 30kHz$, a passband attenuation of $A_{pass} = 5dB$, and a stopband attenuation of $A_{stop} = 50dB$.