University of Washington
Department of Electrical Engineering
EE 341, Winter 2017

Report for Lab #5: Digital Filtering

Report by:
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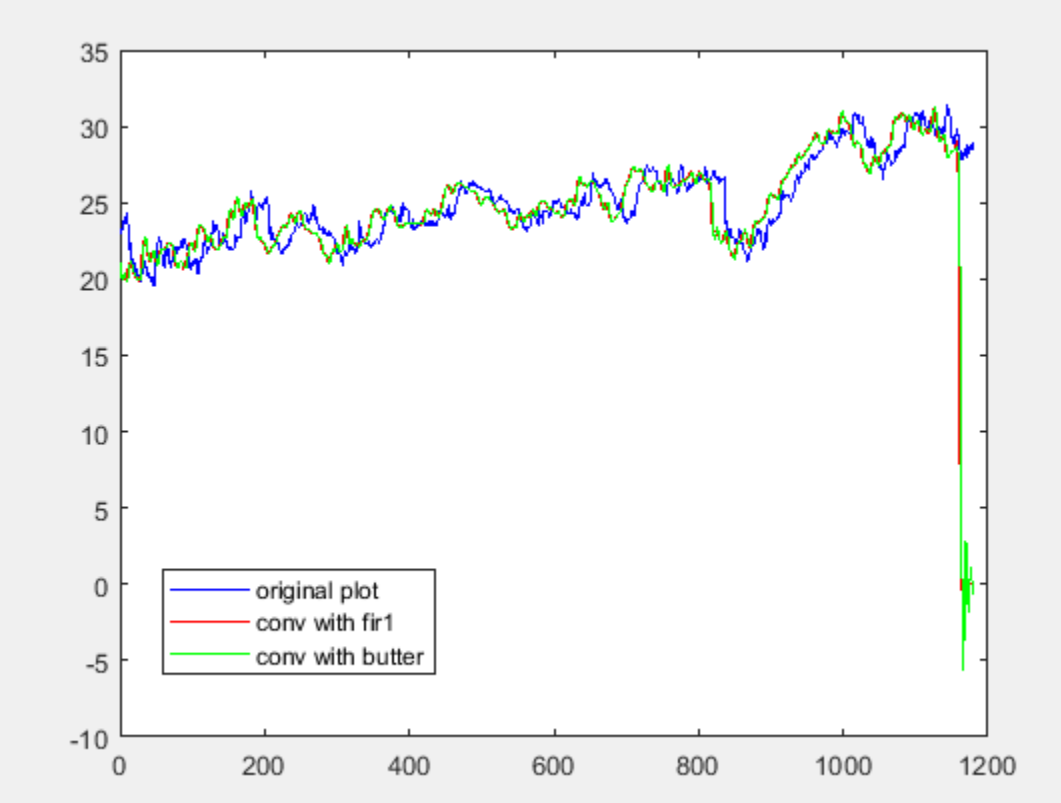
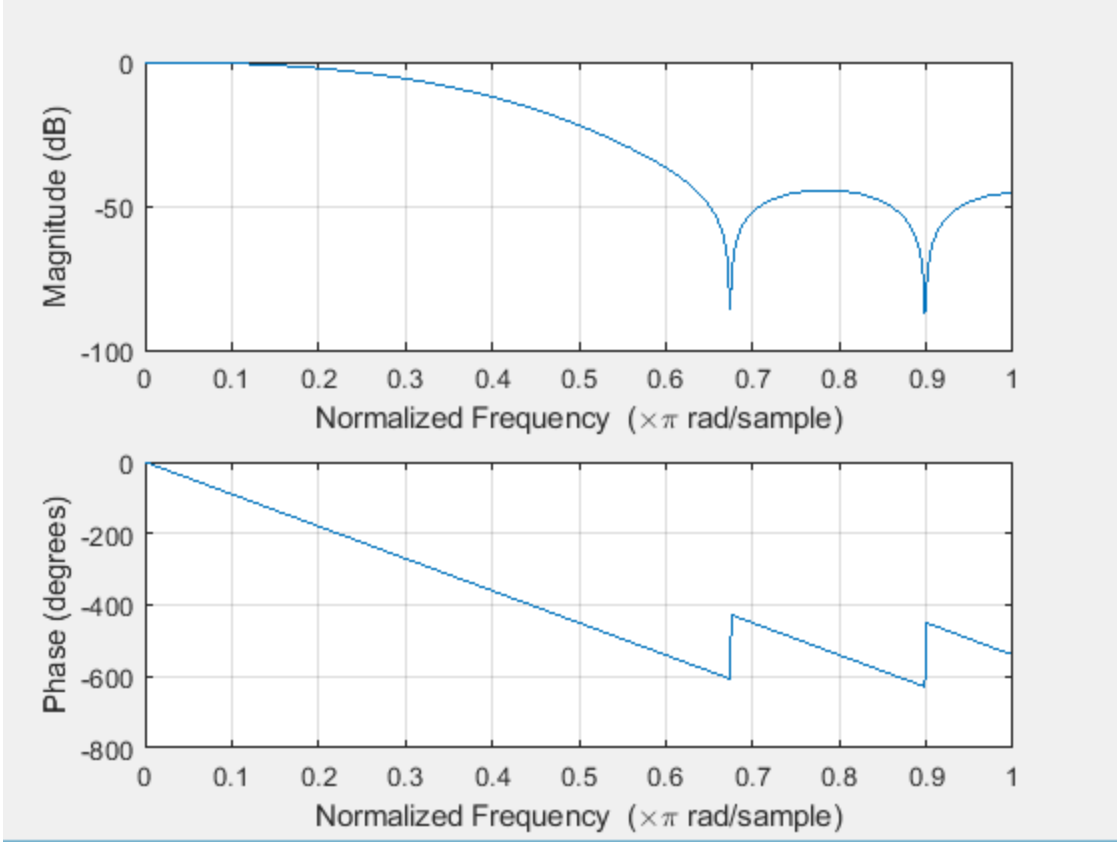
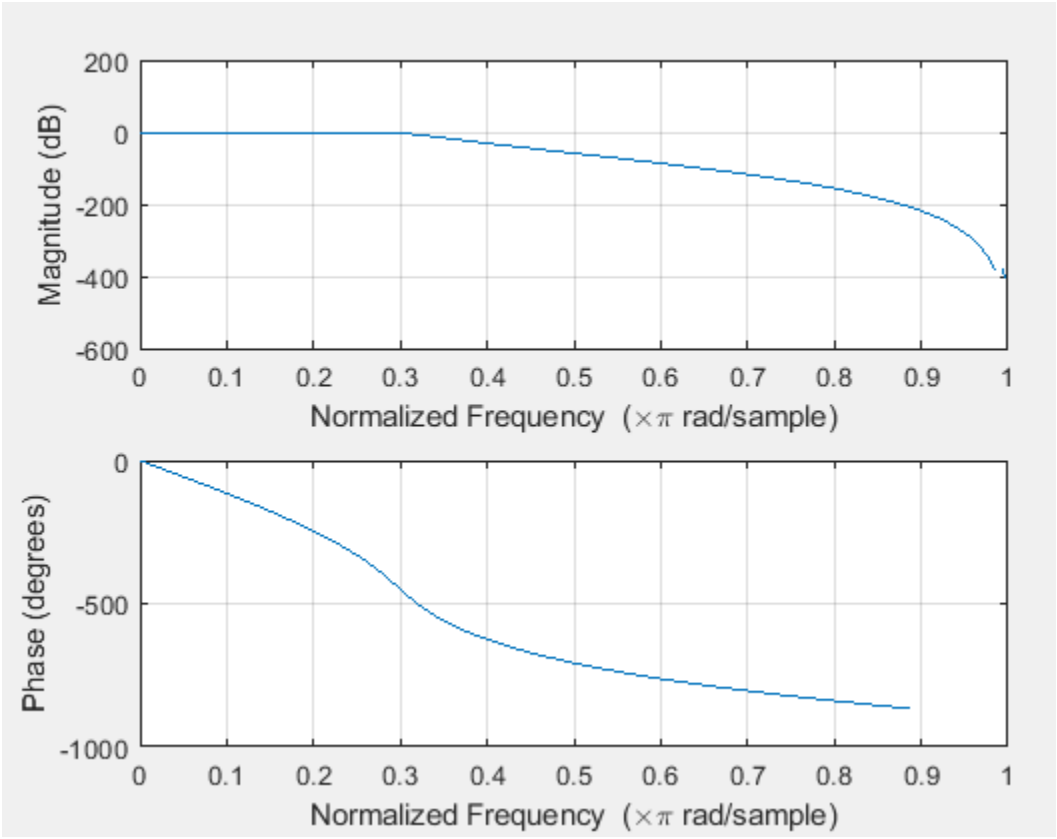
1 ASSIGNMENT II

Q1: Turn in your plots of the filter responses and time-domain plots of the filtered stock market signal comparing the different filters. Comment on the differences in the frequency response of the two filters (magnitude and phase) and how this impacts the outputs. In commenting on frequency responses, consider how close a filter matches an ideal low pass filter.

A1:



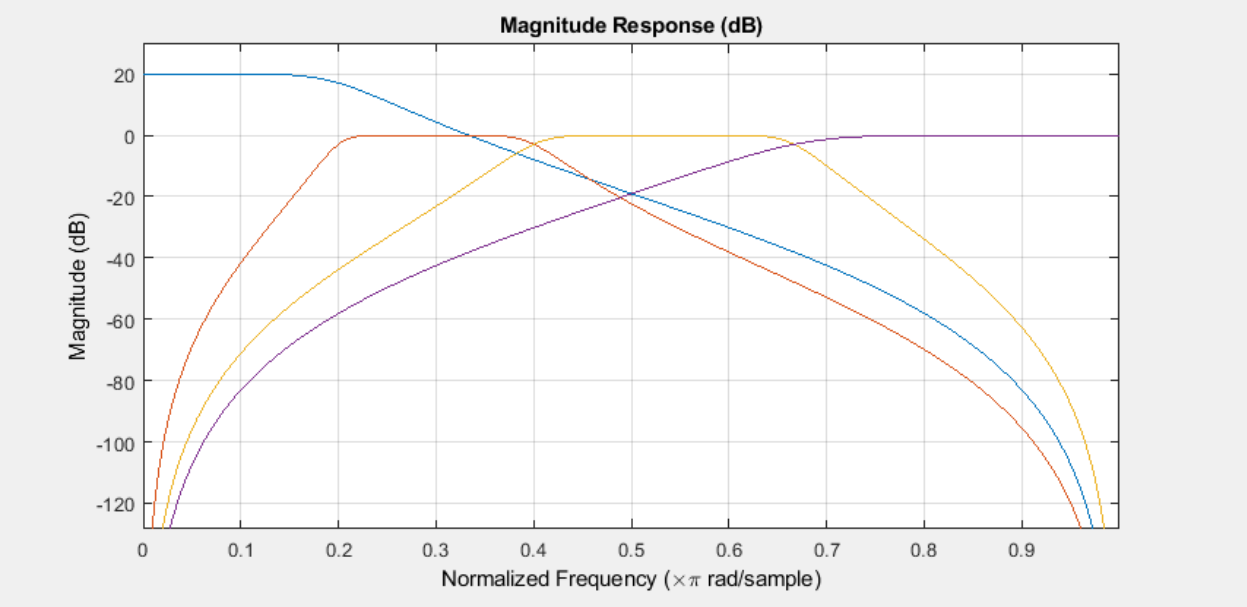

Magnitude (dB)
0
-50
-100
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)
Phase (degrees)
0
-200
-400
-600
-800
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)


Magnitude (dB)
200
0
-200
-400
-600
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)
Phase (degrees)
0
-500
-1000
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Normalized Frequency (×π rad/sample)

The plots above are: The stock plots, The frequency response of fir1 and butter respectively.
The major difference in magnitude of these filters is that fir1 enhances the magnitude in frequency range 0.7 to 0.95, where the magnitude of butters decreases continuously. At frequency 0.67 and 0.9, fir1 has a better smoothing effect than butters. The phase of fir1 has a few zig-zags in range 0.6 – 1 where butter has a much smoother decreasing phase. From these observations, we can see that butter produces a filter that is more similar to ideal LPF.
Since because fir1 enhances the magnitude in frequency range 0.7 to 0.95, the fir1 result would look more rigid than butter's result where the frequency is about 0.8, and fir1 result would look smoother than butter's result at frequency 0.67 and 0.9.

2 ASSIGNMENT III

Q2: Describe the filters you implemented for the music equalizer (give filter coefficients and include frequency response plots) and the mapping of human specified gains to the gain factor in the implementation. Describe the gains used to create your file with the boosted vocals.
A2:



Coefficients: 0.5pi, 0.4pi, 2pi/3
-20 to 20dB corresponds to gain from 0.1 to 10.
We made human specified gain to be 10 for the LPF, which keeps the vocal range frequency.
A gain of 10 would make the vocal range part sound twice louder.