HW3 Report

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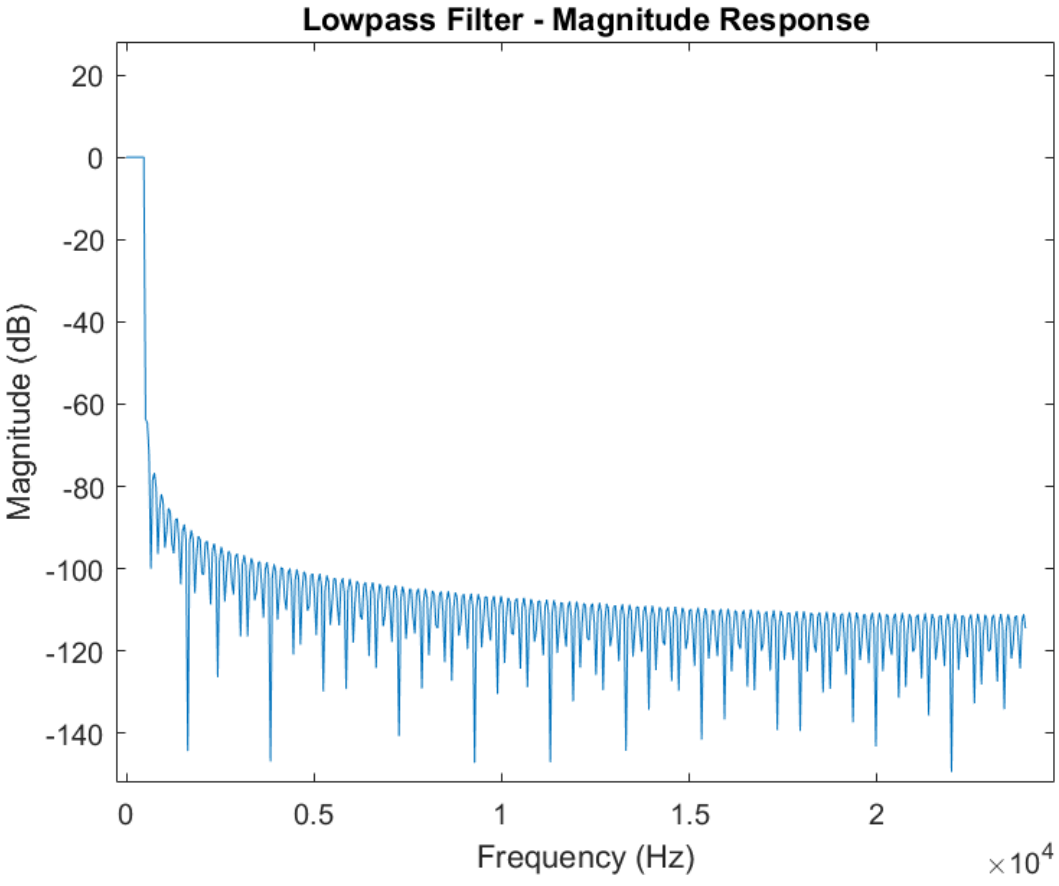
Why I Came Up With These Filters

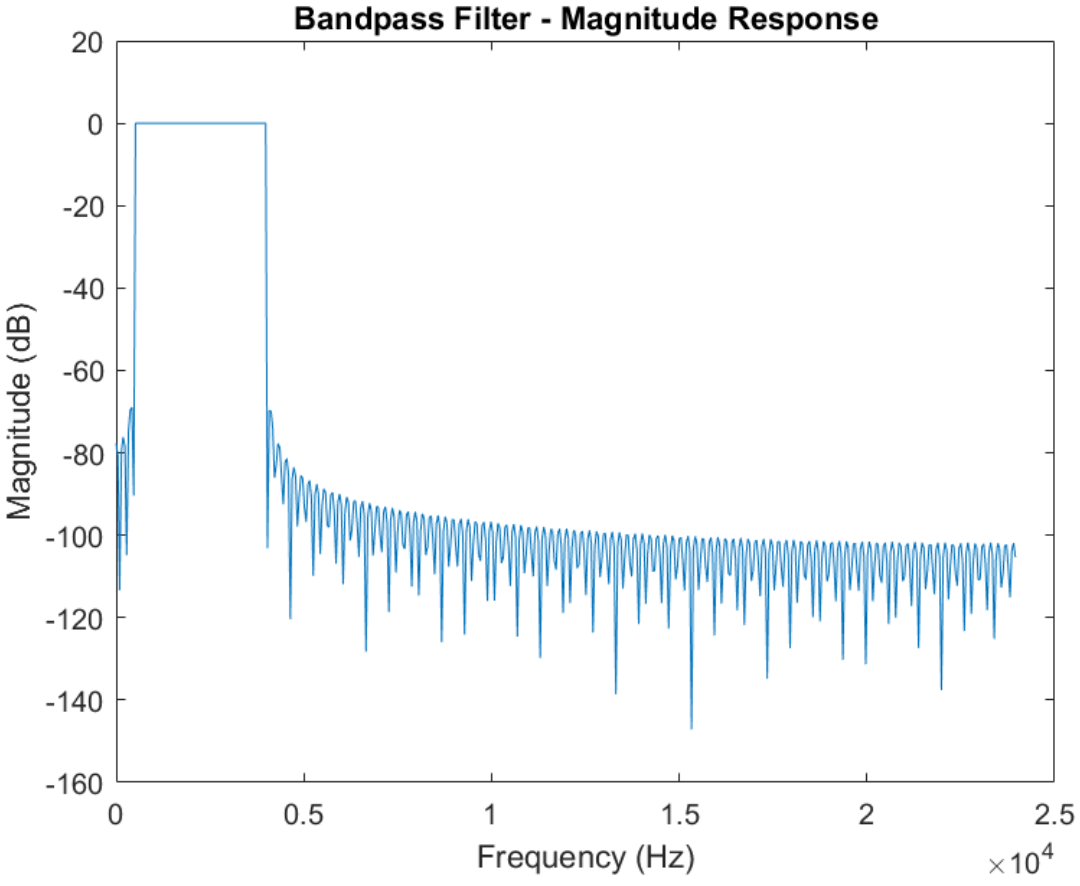
I implemented all 3 filters using designfilt function that is built-in signal processing toolbox. When I was searching for the methods used for filter in matlab, I saw different options for creating filters using signal processing toolbox. I chose “designfilt” function due to its versatility and flexibility in designing various types of filters. It provides a comprehensive set of options for designing filters, including finite impulse response (FIR) and infinite impulse response (IIR) filters. It allows me to specify type, order, cutoff frequencies, and some other parameters as well. The quality of the filters were good enough for me. However, for the bandpass filter, there is a room for improvement.

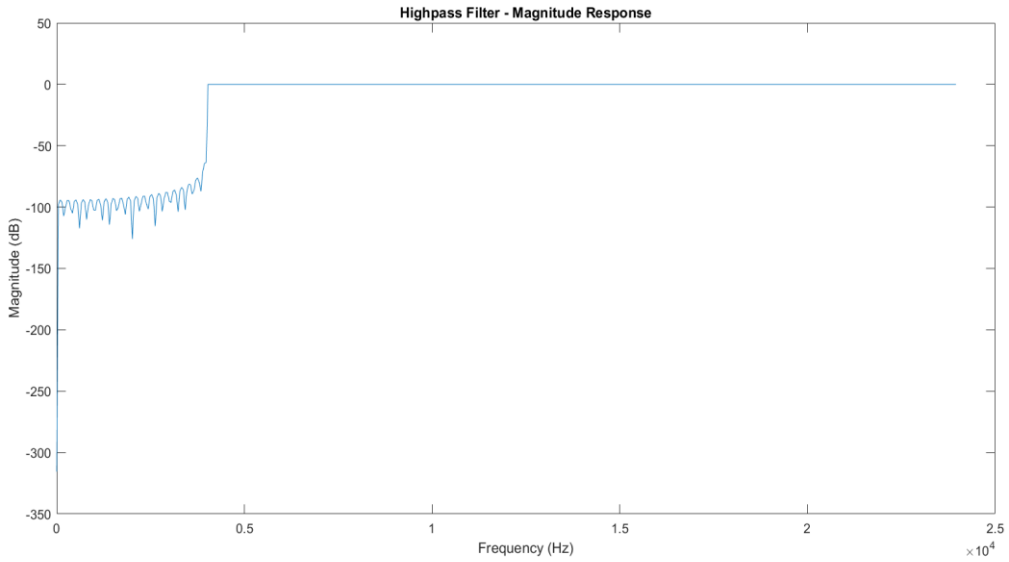
https://www.mathworks.com/help/signal/ref/designfilt.html

Magnitude of the Frequency Response Plots

Please note that in the below images unit on the x axis is not Hz. It is rather 10^4 Hz.


Lowpass Filter - Magnitude Response
Magnitude (dB)
20
0
-20
-40
-60
-80
-100
-120
-140
0
0.5
1
1.5
2
Frequency (Hz)
×10^4


Bandpass Filter - Magnitude Response
Magnitude (dB)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
0.5
1
1.5
2
2.5
Frequency (Hz)
×10^4



Explanation of the Frequency Response Plots

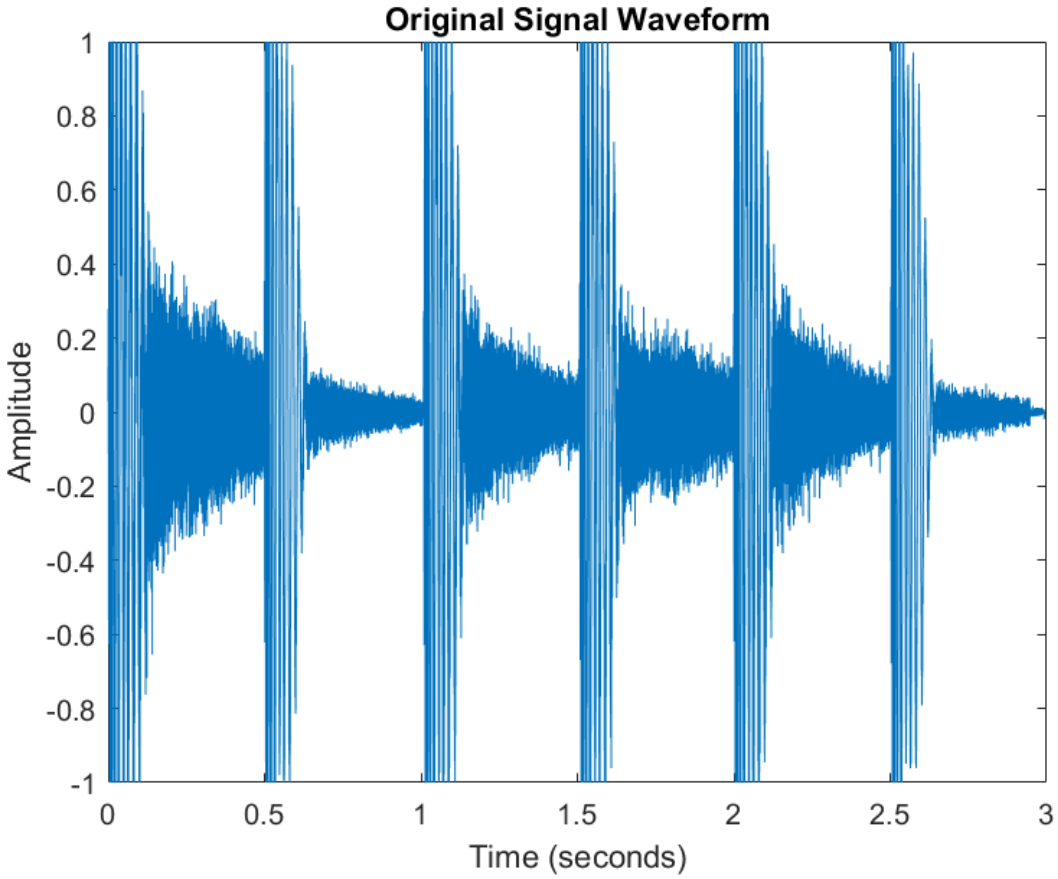
Important note: The graph is plotted in a logarithmic scale. Therefore, 0 indicates that it is preserved completely and corresponds to 1 on a linear scale and -100 means it is almost 0 on a linear scale.

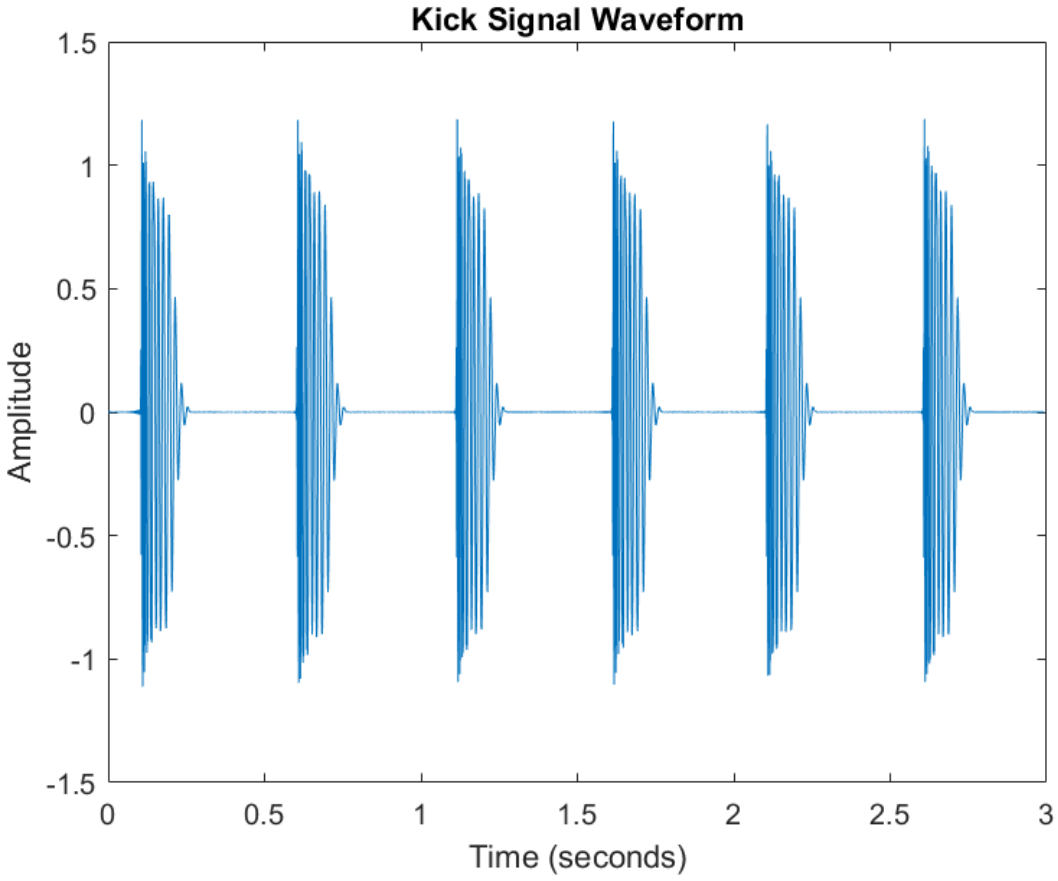
In the low pass filter, frequencies below 500 are preserved as the graph shows. However, there is a sharp decrease after 500Hz which indicates that the other components are not preserved. However, the filter is not ideal and there may still be some minor components of the sounds higher than 500Hz.

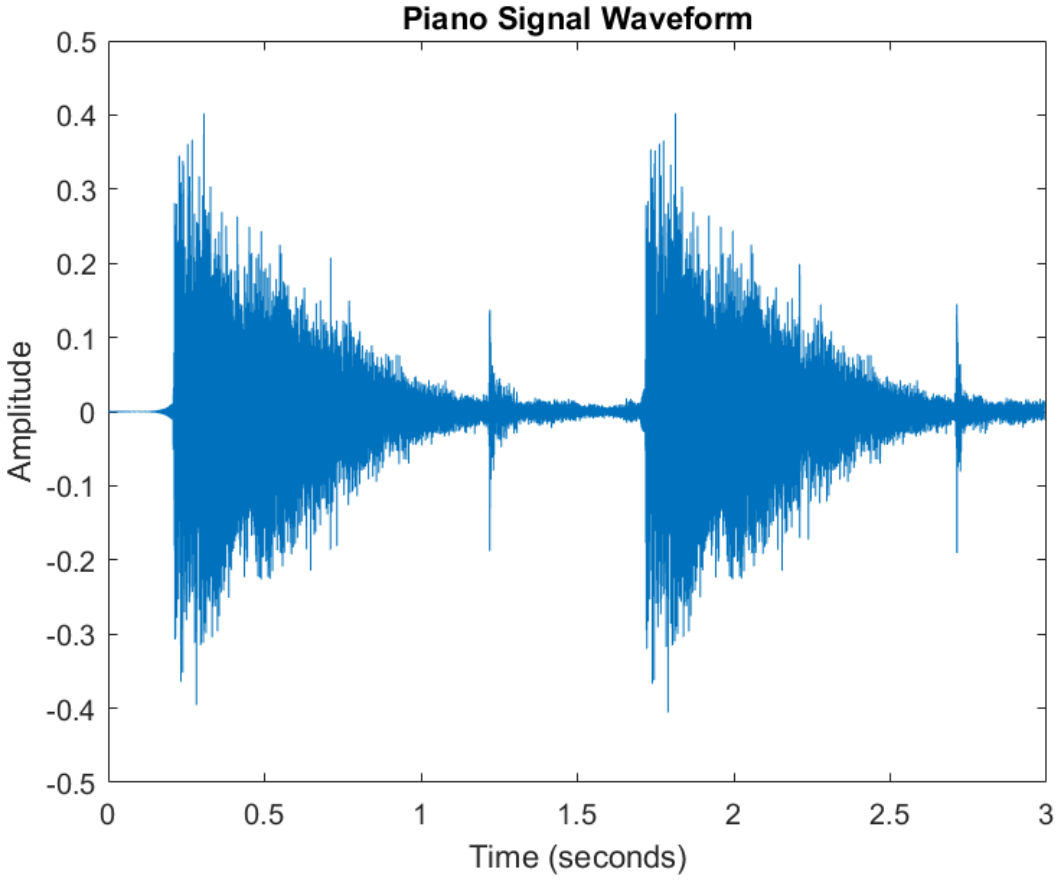
In the band pass-filter same logic applies. There is a sharp decrease for the components which fall outside the range 500-4000 Hz. Frequencies in this range are preserved.

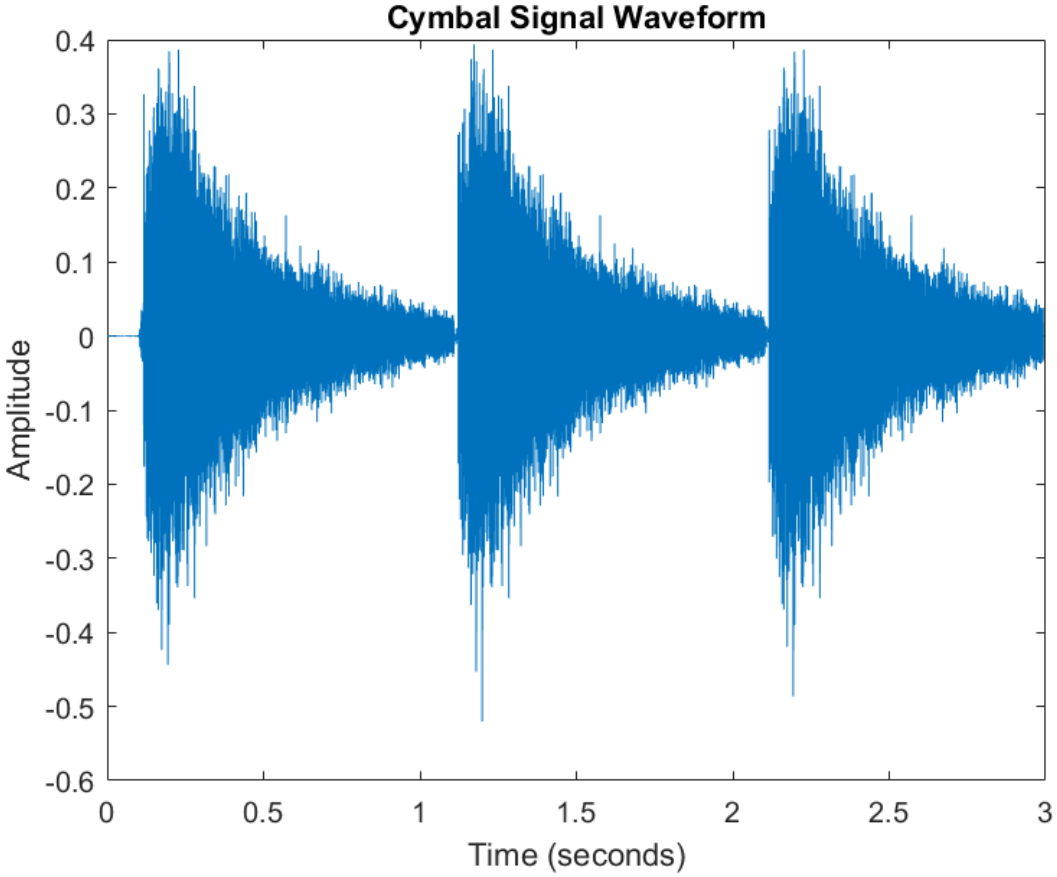
In the high-pass-filter it is similar too. Frequencies above 4000Hz are preserved and lower than 4000Hz are not preserved. However, still there is some noise since it is not ideal and there are minor fluctuations.

Waveform Plots




Kick Signal Waveform
Amplitude
Time (seconds)
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3


Piano Signal Waveform
Amplitude
Time (seconds)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0
0.5
1
1.5
2
2.5
3


Cymbal Signal Waveform
Amplitude
Time (seconds)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
0
0.5
1
1.5
2
2.5
3