

HOMework 3 FILTERING AUDIO

STUDENT REPORT

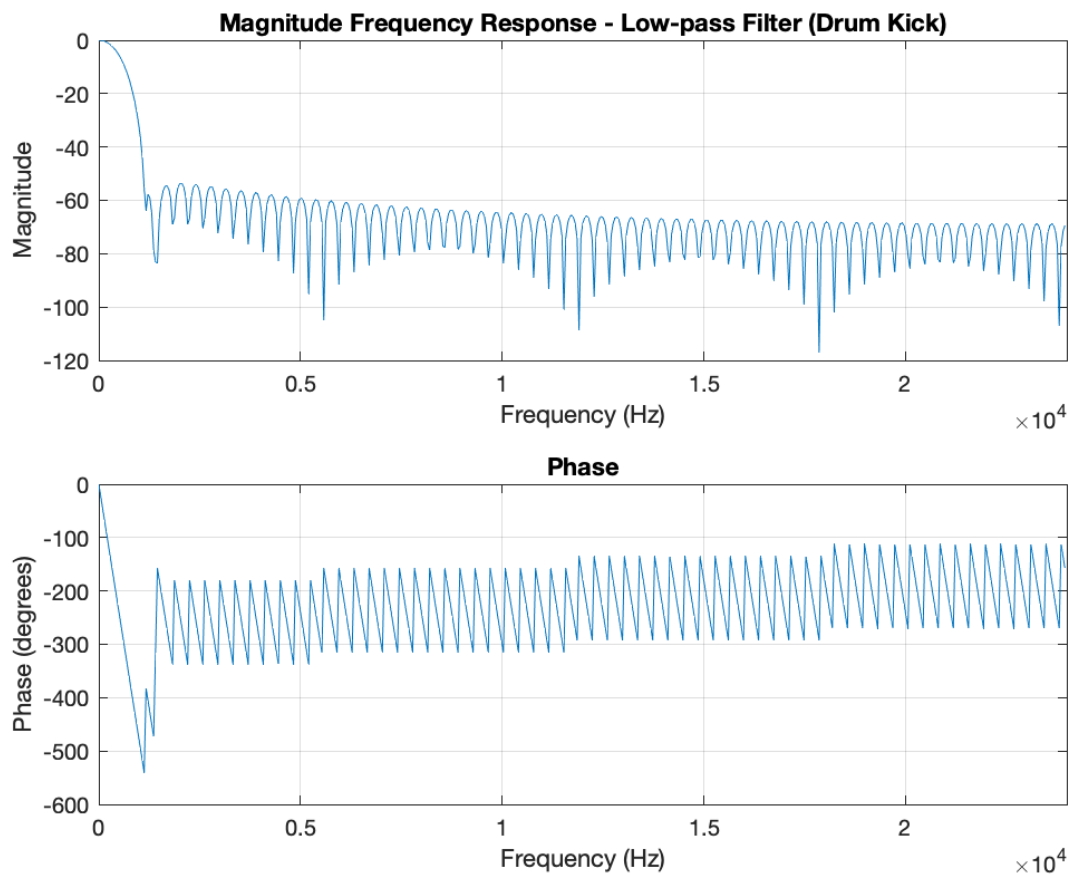
PREPARED BY: VOLKAN OZTURK 2019400033

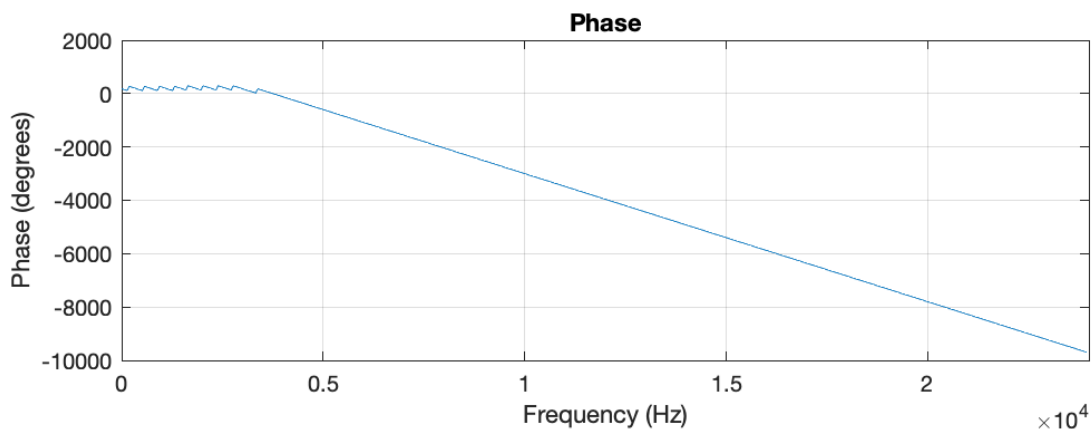
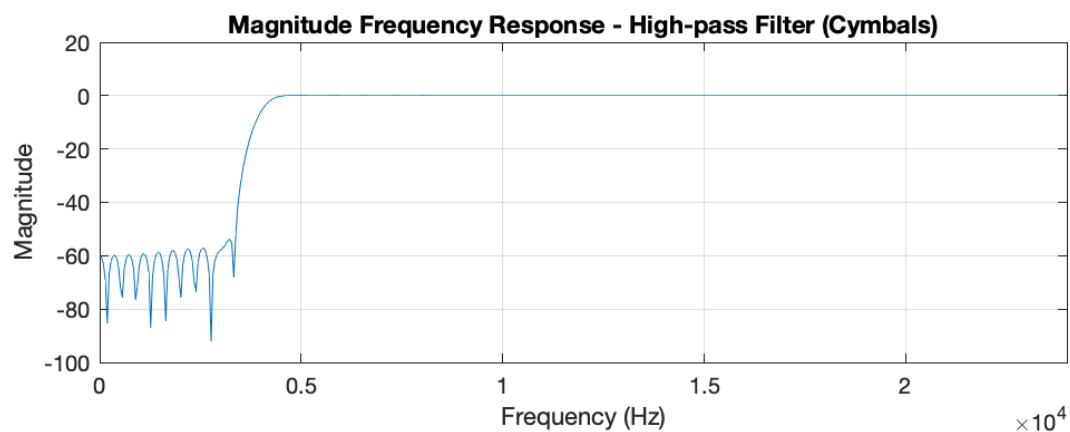
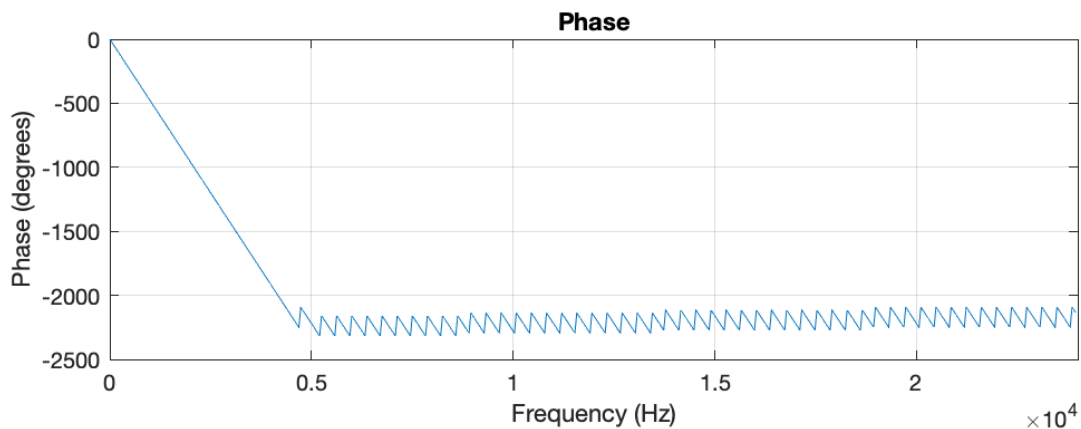
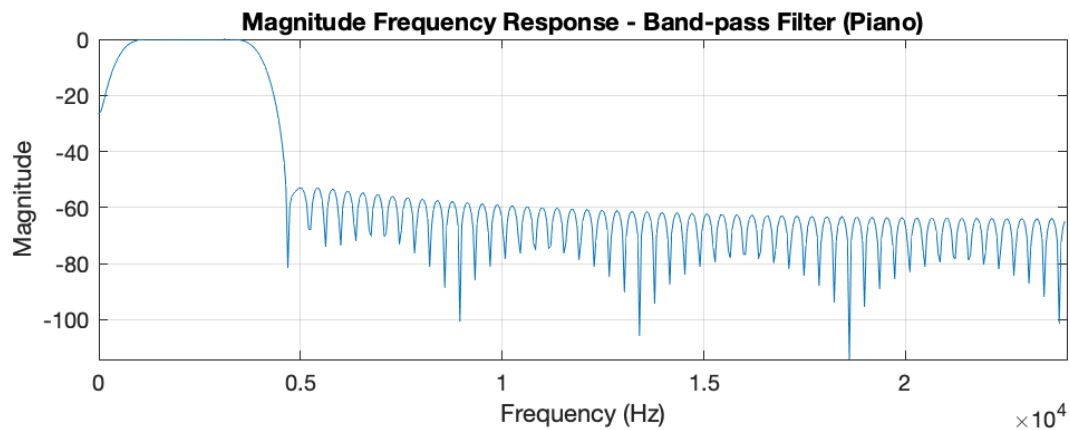
1) Explanation of filters:

MATLAB provides 'fir1' function for Window-based FIR filter design. (Included in the Signal Processing Toolbox). With this function it is very easy to create the filters. As an algorithm, fir1 uses a least-squares approximation to compute the filter coefficients. More information about the function can be found in the official MATLAB documentation:

<https://www.mathworks.com/help/signal/ref/fir1.html#bull9m>

2) Plots of magnitude of the frequency response of each filter:





3) Explanation of filters by looking to the plots:

3.1) Low-Pass Filter (Drum Kick Filter):

The low-pass filter has a cutoff frequency of 500 Hz. In the magnitude response plot, we expect to see high magnitude (close to 0 dB) for frequencies below 500 Hz and decreasing magnitude for frequencies above 500 Hz. This filter allows low-frequency components (below 500 Hz) to pass through while making higher-frequency components get weakened.

By examining the magnitude plot, we can observe a steep roll-off after the cutoff frequency, indicating that it makes frequencies above 500 Hz sharply weakened.

The purpose of this filter is to extract the drum kicks from the audio.

3.2) Band-Pass Filter (Piano Filter):

The band-pass filter allows frequencies between 500 Hz and 4000 Hz to pass through. In the magnitude response plot, we expect to see low magnitudes for frequencies outside the desired range and higher magnitudes within the range of interest.

This filter selectively allows the frequencies associated with the piano chords (between 500 Hz and 4000 Hz) to pass through while making frequencies outside this range get weakened. Examining the magnitude plot, we should observe a passband region with relatively high magnitudes and weakening in the stopband regions.

The purpose of this filter is to extract the piano chords from the audio.

3.3) High-Pass Filter (Cymbal Filter):

The high-pass filter has a cutoff frequency of 4000 Hz. In the magnitude response plot, we expect to see low magnitudes for frequencies below 4000 Hz and increasing magnitudes for frequencies above 4000 Hz.

This filter allows high-frequency components to pass through while making lower-frequency components get weakened. By examining the magnitude plot, we can observe a steep roll-off before the cutoff frequency, indicating that it makes frequencies below 4000 Hz get sharply weakened.

The purpose of this filter is to extract the cymbals from the audio.

4) Waveform Plots:

