

Q1

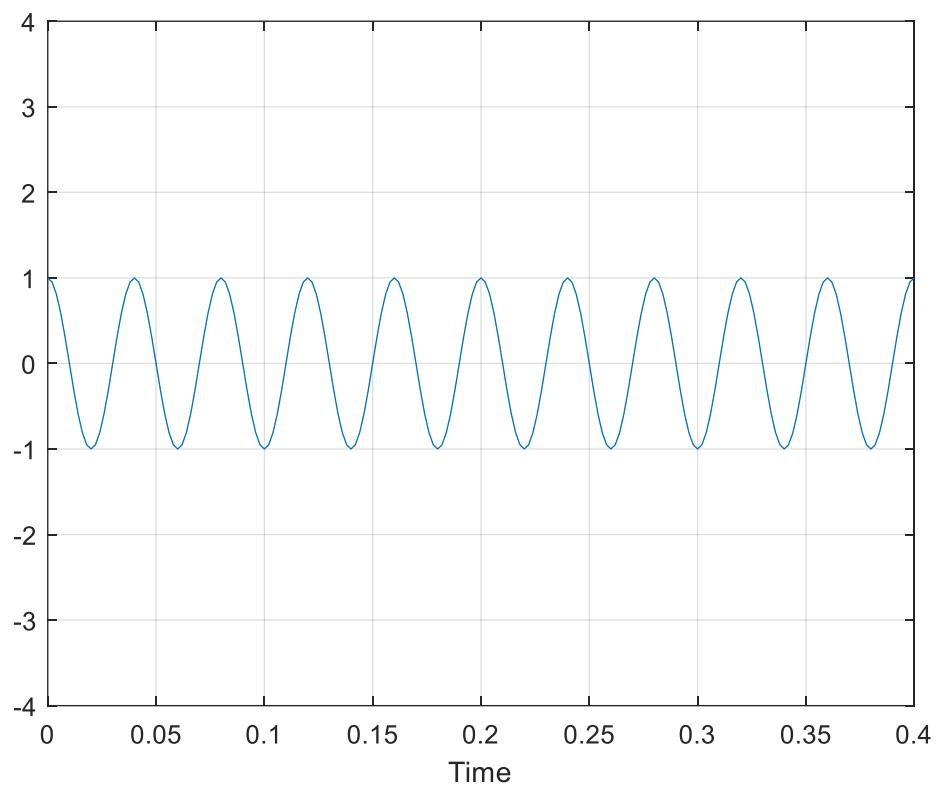


Figure 1 - Sinusoidal Signal (25 Hz)

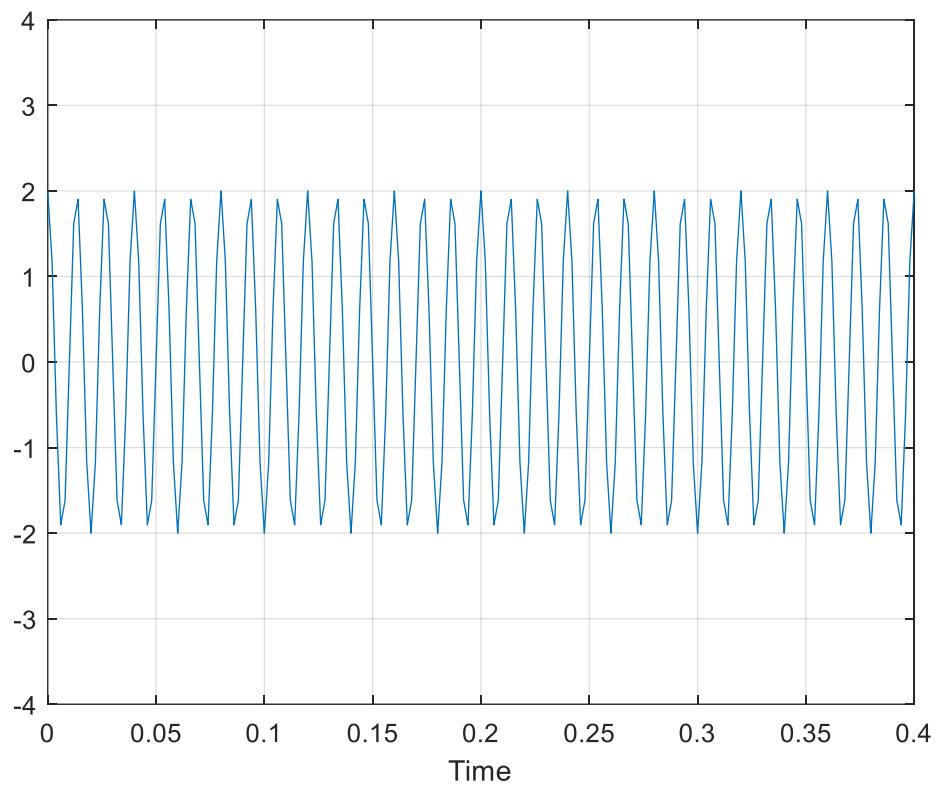


Figure 2 - Sinusoidal Signal (75 Hz)

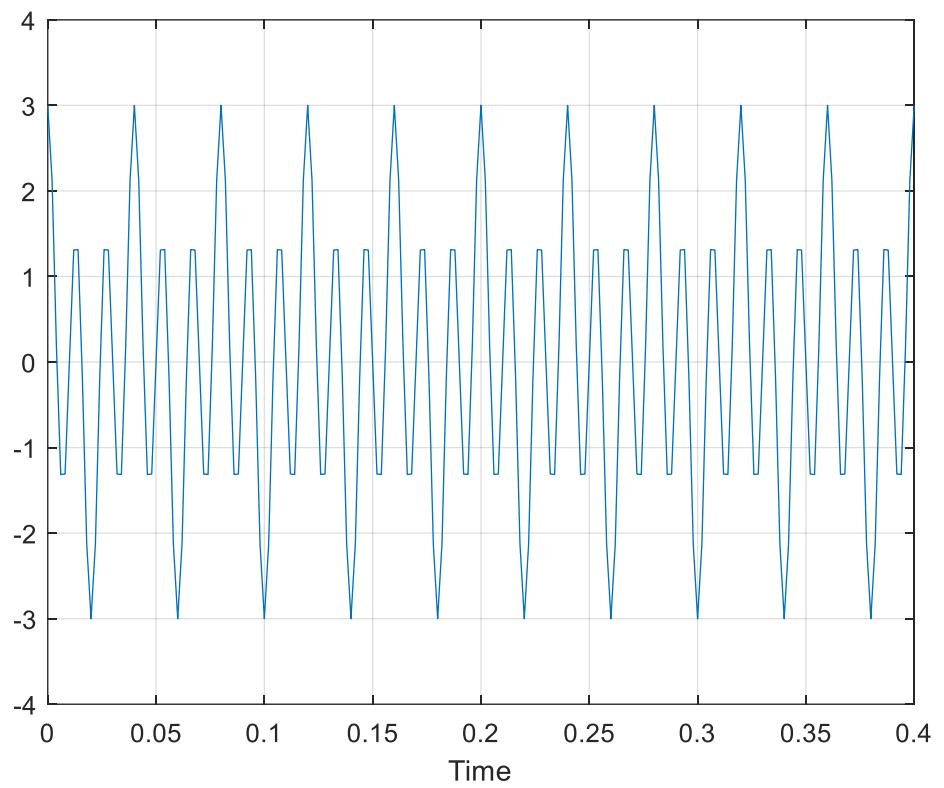


Figure 3 - Signal (25 Hz + 75 Hz)

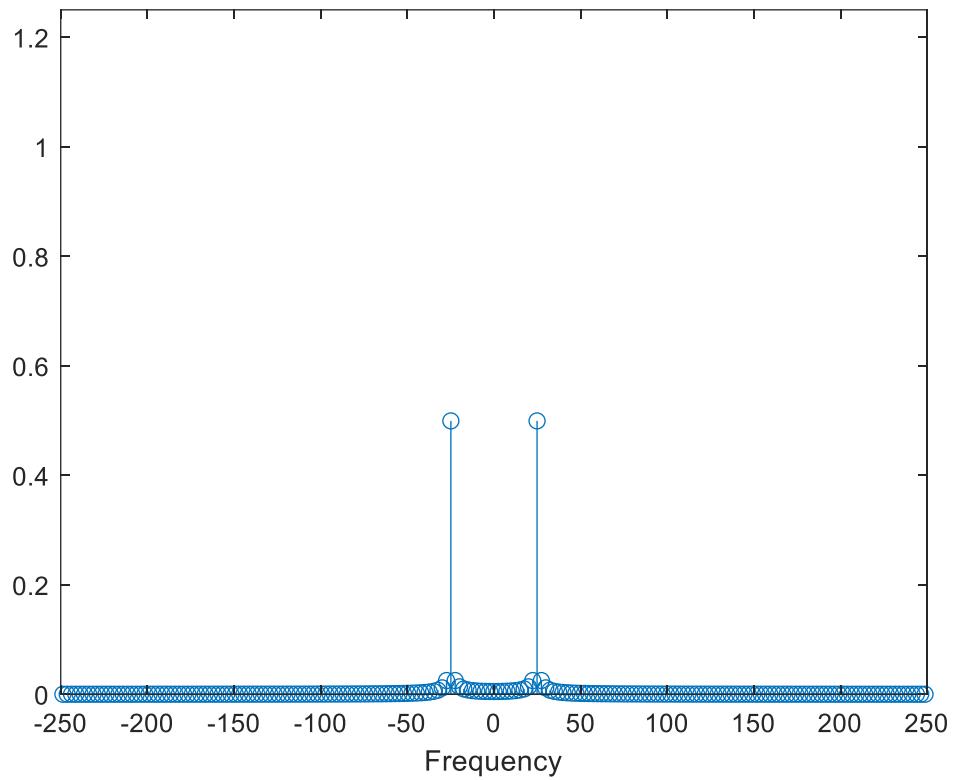


Figure 4 - Frequency of Sinusoidal Signal (25 Hz)

The graph obtained in the frequency domain of a sinusoidal signal with a frequency of 25 Hz shows the expected result, with output amplitudes of 0.5 at only -25 and +25 frequency points.

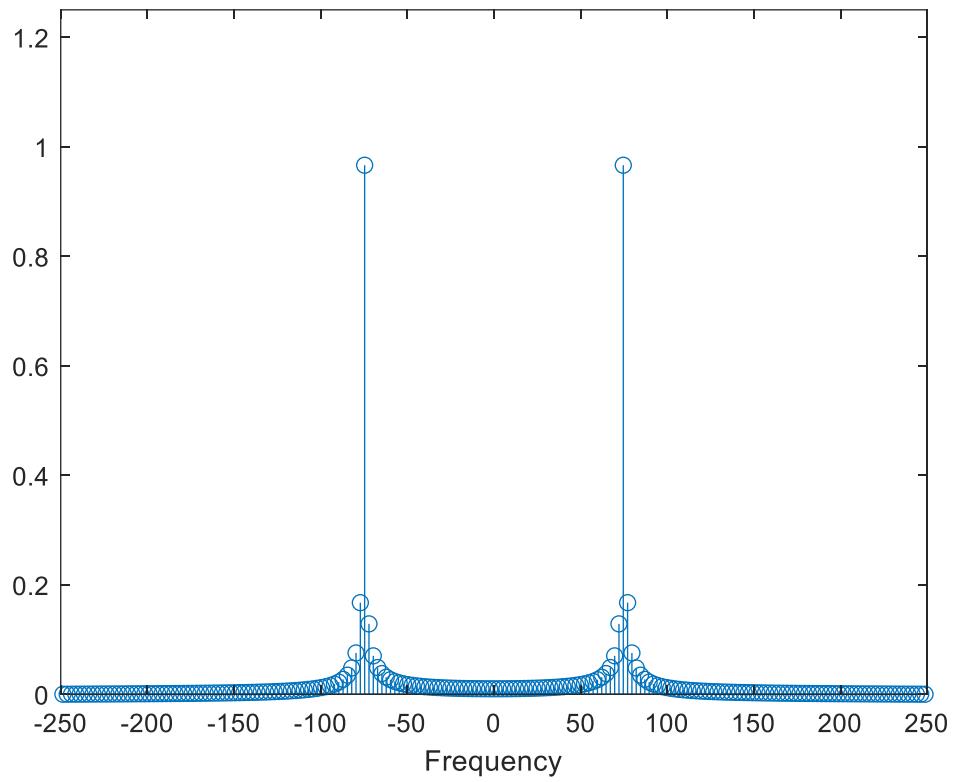


Figure 5 - Frequency of Sinusoidal Signal (75 Hz)

The graph obtained in the frequency domain of a sinusoidal signal with a frequency of 75 Hz shows the expected result, with output amplitudes of 1 at only -75 and +75 frequency points.

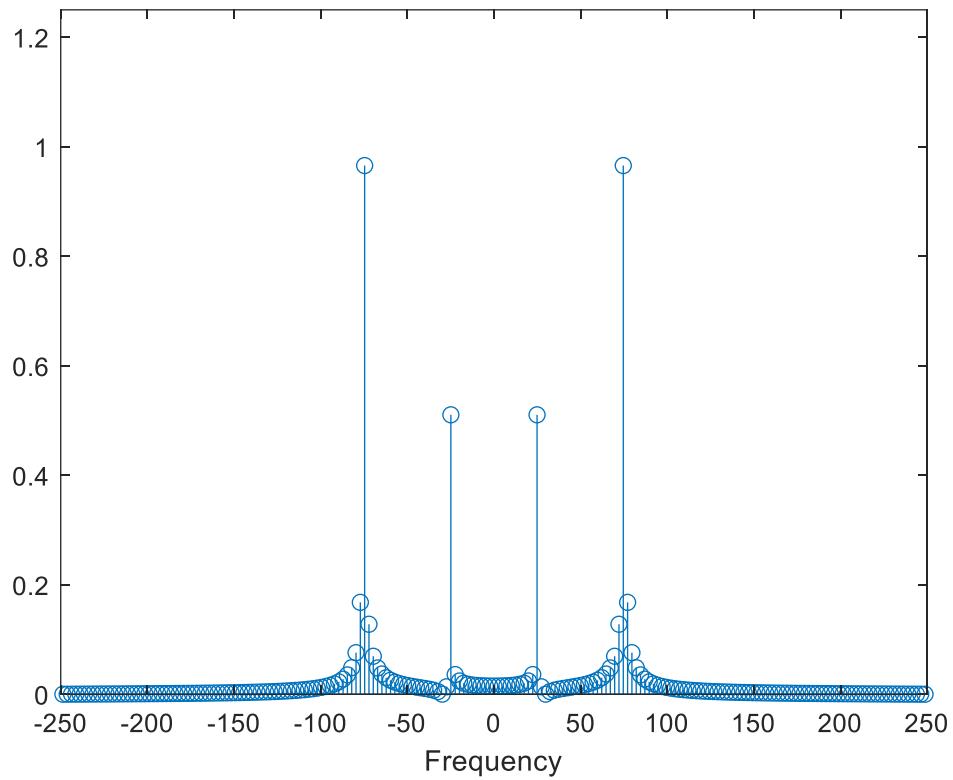


Figure 6 - Frequency of Signal (25 Hz + 75 Hz)

The graph obtained in the frequency domain of a sum of 2 sinusoidal signals with a frequency of 25 Hz and 75 Hz shows the expected result, with output amplitudes of 0.5 at only -25 and +25 frequency points and also output amplitudes of 1 at only -75 and +75 frequency points.

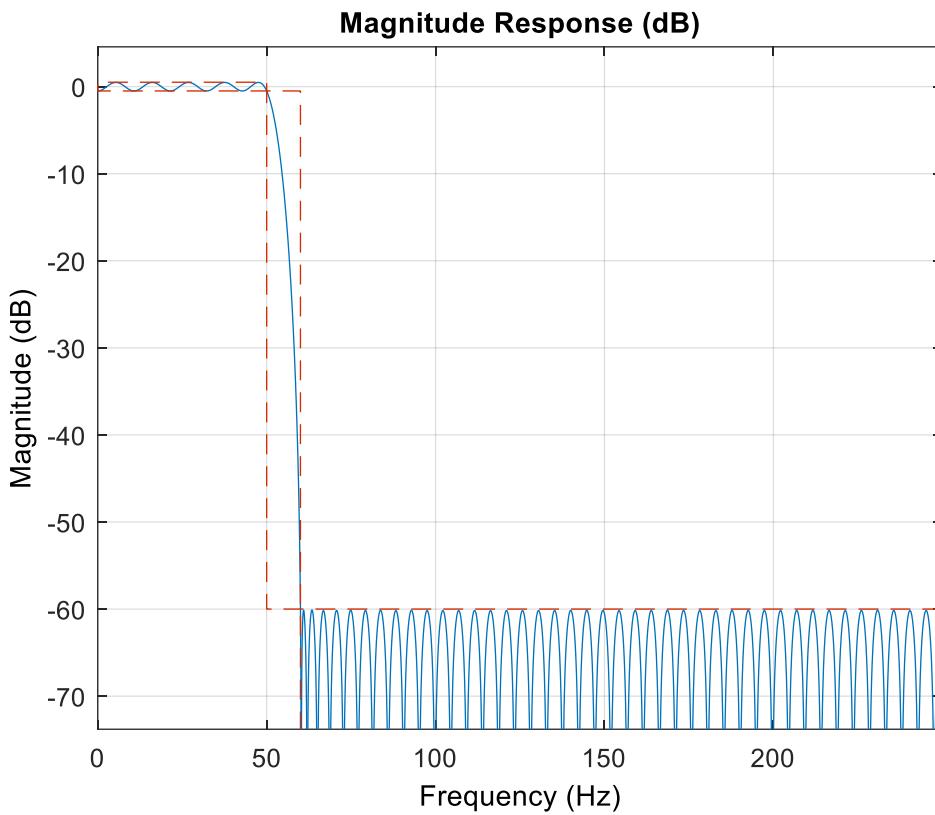


Figure 7 - Low Pass Filter

Looking at the obtained result, it can be understood that low-frequency values are passed while high-frequency values are suppressed. This suppression starts from 50 Hz onwards.

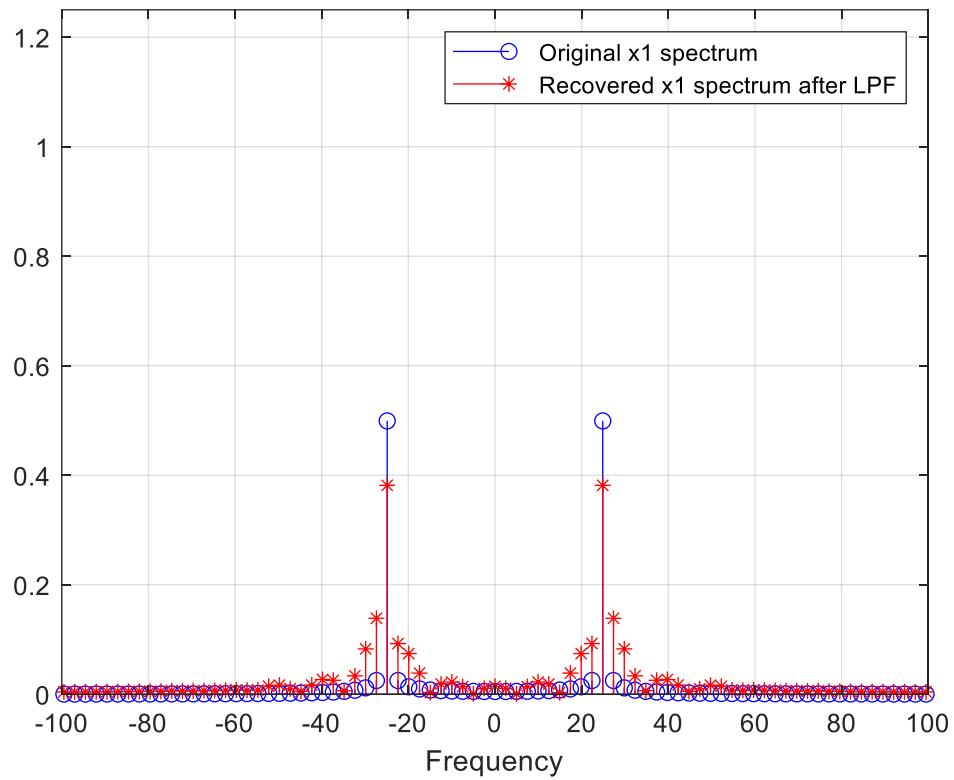


Figure 8 - Frequency of Sinusoidal Signal (25 Hz) and Filtered Signal

As can be seen from the graph, the output of x_1 , the 25 Hz sinusoidal signal, which passed through the low-pass filter, continues to be preserved.

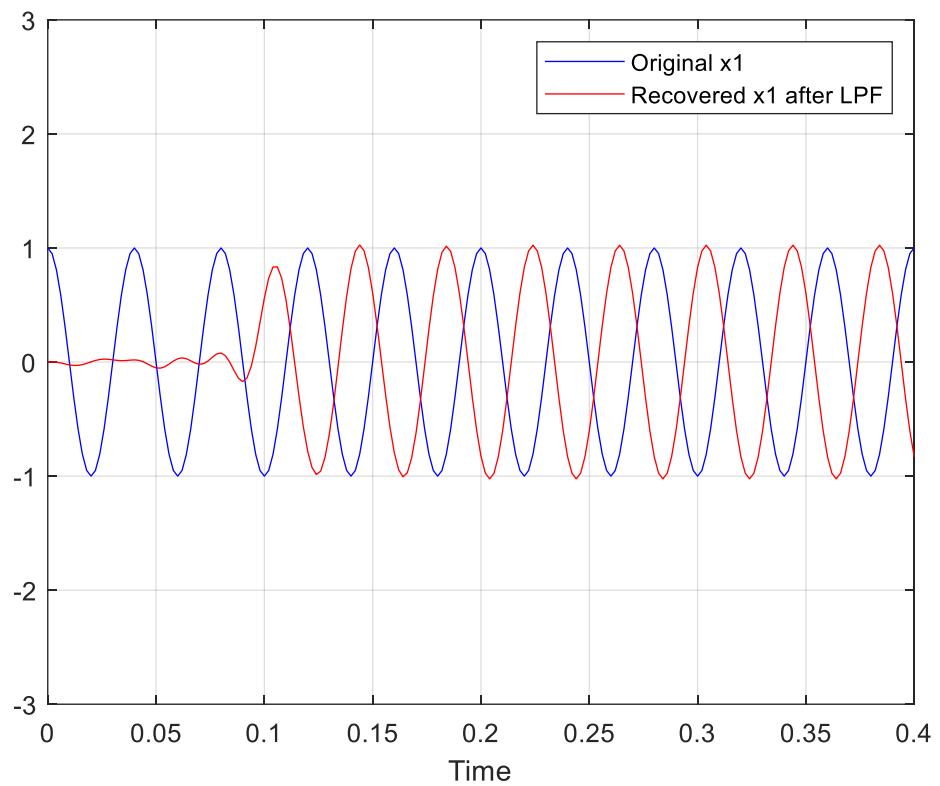


Figure 9 - Sinusoidal Signal (25 Hz) and Filtered Signal

During the suppression of the 25 Hz frequency sinusoidal signal over time, the initial moments involve the process of the filter's transition, during which high-frequency components are detected and eliminated. As a result, the original signal cannot be fully recovered at the beginning.

Q2

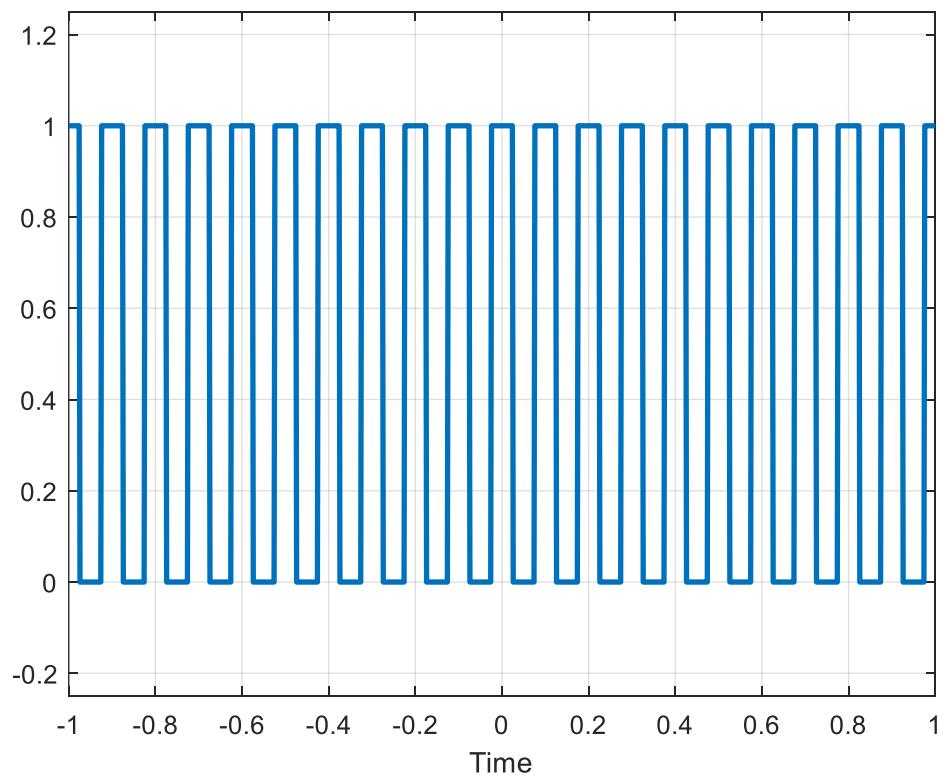


Figure 10 - Square Signal (10 Hz)

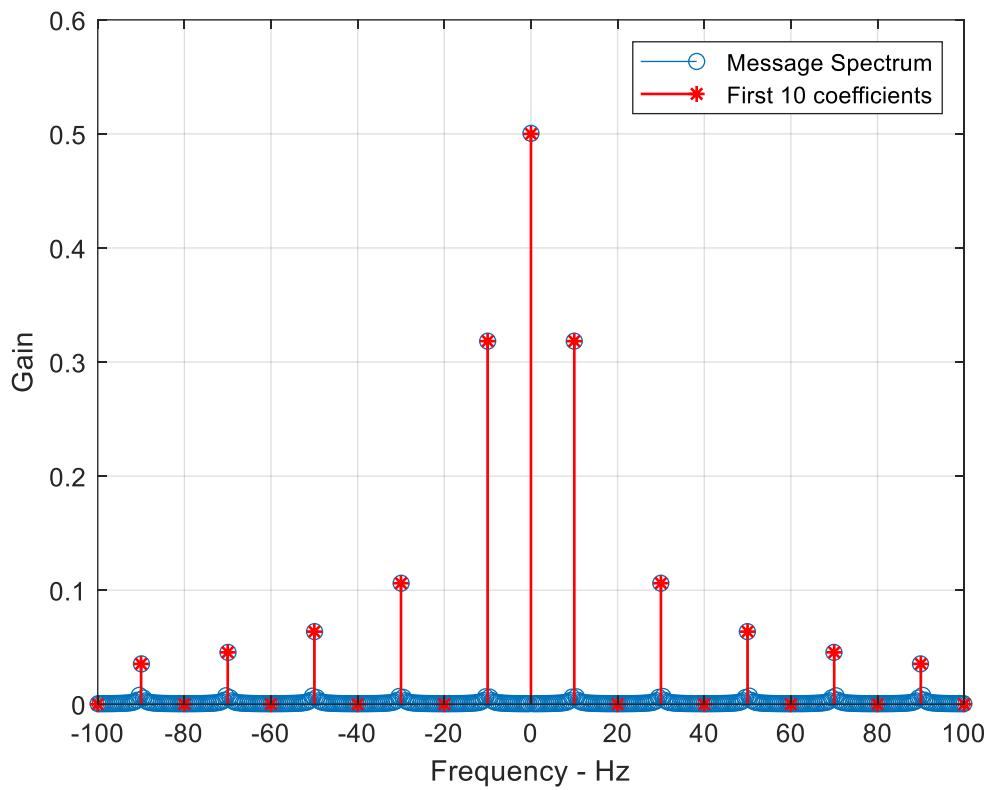


Figure 11 - First 10 Coefficients of Square Signal (10 Hz)

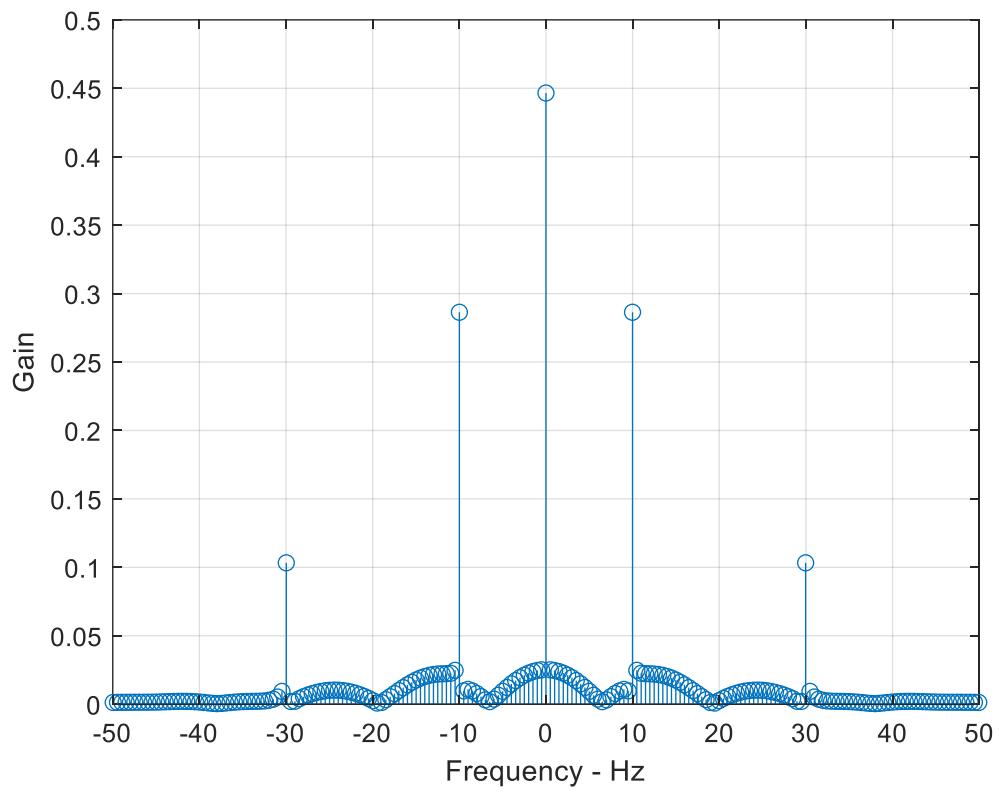


Figure 12 - Frequency of Square Signal after Low Pass Filter

In the original signal, the first 10 coefficients are obtained, while after passing through the low-pass filter, only the first 3 coefficients can be obtained. This results in a decrease in similarity to our original square signal. (Cutoff frequency is 40 and stop frequency is 50.)