# HOMEWORK 2 REPORT

**Date:** 27.03.2023

**Student Name:** Harun Durmuş

**Student ID:** 270206025

The MATLAB Code that is written in the .m file, performs signal processing operations such as filtering and analysis of the signal. The report aims to analyze the signal processing operations performed in the code and their effects on the original signal.

In step 1.0, The code generates the original signal and its frequency response, which represents the magnitudes of various frequency components in the signal. The signal is first generated using the combination of sinusoidal waves as mentioned earlier. The length of the signal is determined using the length() function which returns the number of elements in the signal. The frequency response is computed using the fast Fourier transform (FFT) function which takes the signal and the number of data points N as input. Number of data points ( N ) is obtained by using length of the input signal x(t).

In step 1.1, the code designs low-pass, high-pass, and band-pass filters. The Butterworth filter design algorithm is used to design the filters. The filter characteristics, i.e., 1st order or 7th order, and cutoff frequencies, are specified as inputs to the butter() function which returns the numerator and denominator coefficients of the transfer function of the filter. 7th order filter is used because it is much closer to ideal response of filters.

In step 1.2, the low-pass, high-pass, and band-pass filters are applied on the original signal to obtain their low-pass, high-pass, and band-pass filtered versions. This is done using the filter() function which takes the numerator and denominator coefficients obtained earlier as inputs along with the original signal.

The visualization of filtered signals and their frequency responses is done using a single figure with four subplots. The first subplot shows the original signal in the time domain while the next three subplots show the frequency responses of low-pass, high-pass, and band-pass filtered signals respectively.

To conclude, the given MATLAB code performs various signal processing operations on a given signal, including generation, filtering, and analysis. The Butterworth filter design algorithm is used to design low-pass, high-pass, and band-pass filters, and their frequency responses are plotted. The effects of these filters on the original signal are visualized by plotting the filtered signals and their frequency responses. The report provides a detailed explanation of the operations performed in the MATLAB code while analyzing the code step-by-step.

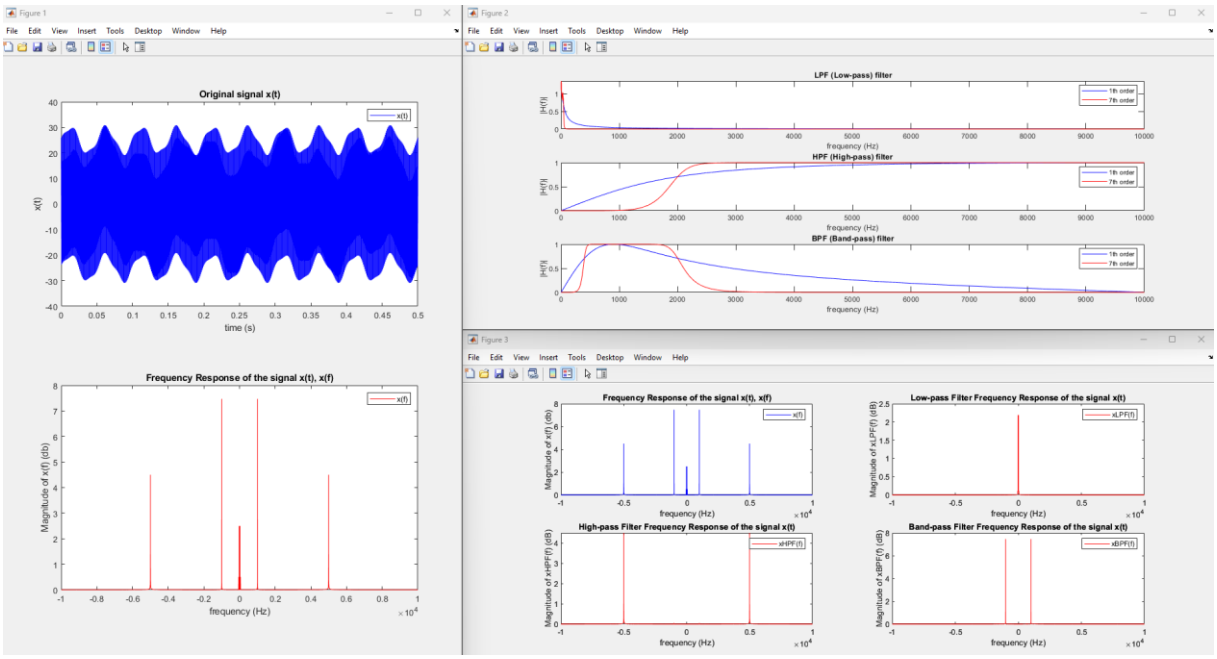


Figure 1: Output Figures