BME 313 Lab 5 – Digital Data Filtering/Data Reconstruction

Introduction

This lab was performed to learn how to generate a periodic noisy signal. Once the signal is generated, it was filtered in the frequency domain and reconstructed in the time domain. The software, Matlab, was used to generate, filter, and reconstruct the signal.

Plotting amplitude versus time



A periodic wave function was generated in Matlab using the given function equation and plotted with the amplitude versus time in seconds. The signal was sampled over 4 seconds at a sampling rate of 100 Hz. The second plot visualizes the amplitude spectrum by using the Fourier transform. The Fourier transform is especially useful in this case since it can provide information on what characterizes the signal the most. The amplitude spectrum shown has a peak at 2 Hz and at 4 Hz. The heights of these peaks are 5 and 3 respectively and are the amplitude of the sines of the signal.

Filtering noise from the signals



Random noise was added to the signal by generating random numbers and adding each to the original values of the vertical axis. The Fourier transform was then taken of the noisy signal and the amplitude spectrum was calculated. In the top graph, the peaks and the heights are the same as the plot of the amplitude spectrum of the original signal. The changes we see around the peaks show that the amplitude of the noise is less than the original signal. By using the inverse Fourier transform, the noise can then be filtered out. In this case, all the numbers less than 100 were set to zero; the inverse Fourier transform was taken; and then the imaginary parts were excluded from the plot. The following graph is the plot of the signal with the low amplitude noise removed.

**Filtered Signal**



**Original Signal**



We can see that the filtered signal is very similar to the original and the added noise has now been removed.