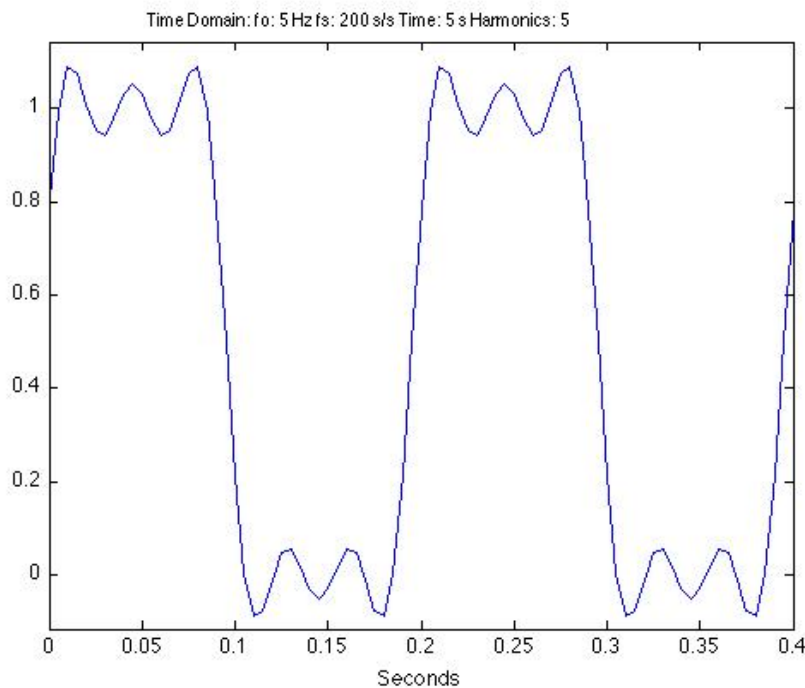


LAB 4

Write a Matlab program to generate the following signals: a square wave, a triangular wave, and a sawtooth wave. To achieve this use Fourier Synthesis for each of these waves. At the start request the user to enter the frequency of the wave, the number of harmonics to use in the Fourier Synthesis, and the time duration to display the wave. To achieve this use the Matlab function input to collect this data. Then ask the user to choose which wave to generate and then you should display the wave versus time you have generated using Fourier Synthesis.

Let first start this program for the square wave and once the program works you will add the other waveforms. Here are the steps to follow:

1. Once the user enters the frequency, determine the sampling rate and time between samples. Use 10 times oversampling.
2. Save the number of harmonics the user enters for use in your Fourier Synthesis algorithm.
3. Once the user enters the time to display the wave, calculate the number of samples for your Fourier Synthesis algorithm.
4. Using the Fourier coefficients, the number of samples to generate, the number of harmonics, frequency, and sampling rate. One way to do this is to use nested loops to achieve this. The inner loop generates the signal from the number of harmonics for a given time (sample number). The outer loop increments times (sample number). For the square wave use $a_0=0.5$, $|a_k|=1/\pi$ for odd harmonics with a angle of $-\pi/2$. For even harmonics $a_k=0$.
5. Once the waveform has been generated, plot it versus time (truncate the plot to show only 2 cycles). Here is an example of the output you should provide.



6. Generate 8 example outputs using 2 different frequencies and 4 different number of harmonic for each of the frequencies.
7. Once this is complete, take the code you used for the Fourier Synthesis and create a Matlab function and add a function call in your main program.
8. Now create 2 other functions for the other two waves: triangular and sawtooth. Use the a_k 's found in your text for these waves.
9. Add an input statement which allows the user to select which wave to select. You can then use a Matlab case statement to add in selecting the proper wave function.
10. Save this program for Lab 5.