CS1031: Lab#2

The second lab we will approximate some functions with sum of sine functions following the Fourier series.

The functions you want to plot are:

1. The square wave:
   build a 6 subplot figure to show the time domain, and use respectively 1, 3, 5, 10, 50, 500 frequencies. Each plot should have overlapped the corresponding real function on a different color. Remember to use a step of minimum 0.01 for the x axis.

   The Fourier series of the square wave is given by $\frac{4}{\pi} * \sum_{k=1,k=odd}^{n} \frac{sin(2\pi kt)}{k}$

   The square wave to be plotted in red is given by '$square(2 * pi * x)$';
   Hint:
   The following Matlab syntax might be useful. If you want to operate a for loop over specific values (say: 1,5, 20, 45) you can use:
   "for i=[1,5,20,45]

   ... code inside the loop that uses the variable i with the values in the bracket above...

   end;"

   The graphs should look like the following:

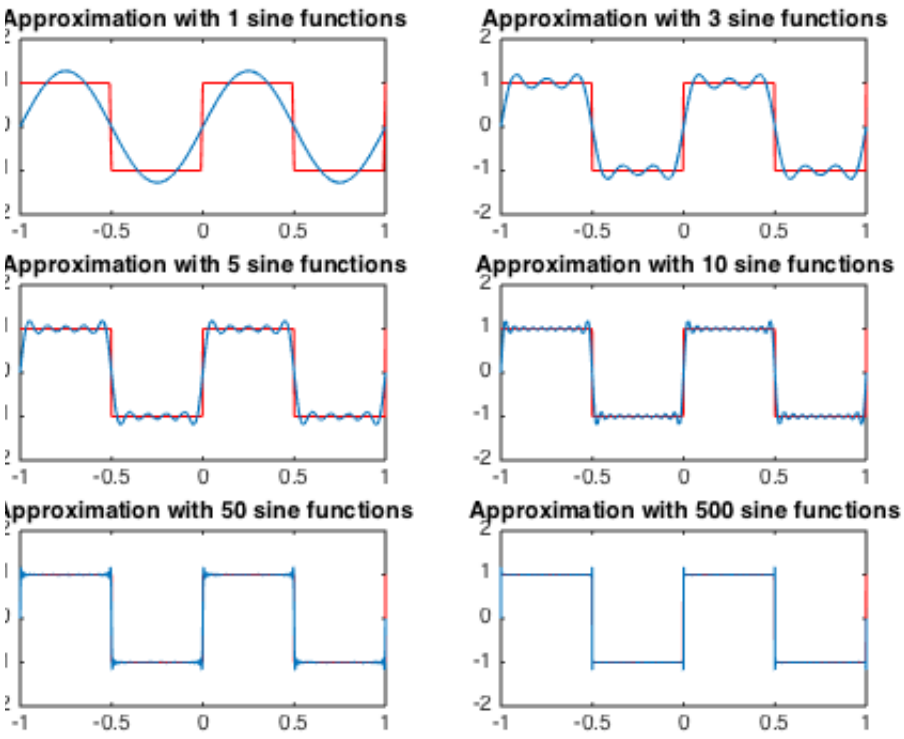

Figure 1: Square wave approximation in time

2. The triangle wave:
   build a 6 subplot figure to show the time domain, and use respectively 1, 2, 3, 5, 10, 50 frequencies (Remember that the first sine starts for n=0). Each plot should have overlapped the corresponding real function on a different color. Remember to use a step of minimum 0.01 for the x axis.

   The Fourier series of the triangle wave is given by $\frac{8}{\pi^2} * \sum_{k=0}^{n} (-1)^k \frac{sin(2\pi(2k+1)t)}{(2k+1)^2}$

   The triangle wave to be plotted in red is given by '$sawtooth(2 * pi * (x + 0.25), 0.5)$'.

   You need to write the code that can display the Fourier series for these functions and plot them for different number of frequencies.

   The graphs should look like the following:

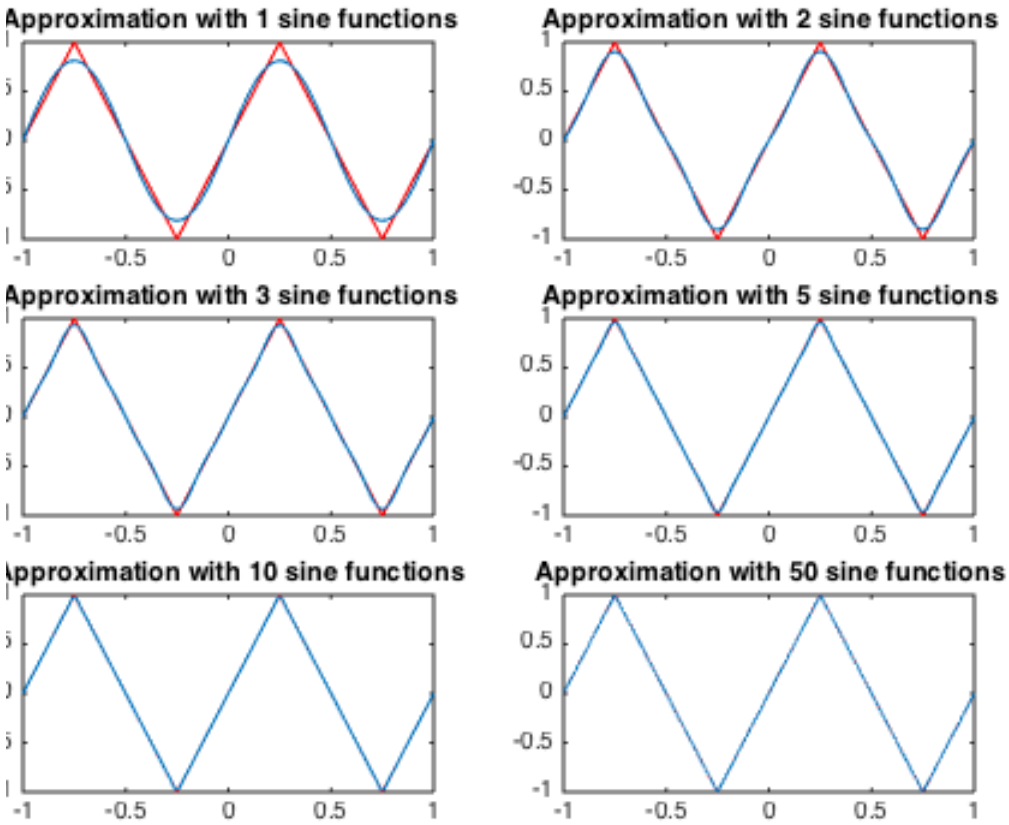

Figure 2: Triangle wave approximation in time

3. Draw the representation in the frequency domain of the square wave approximation in exercise 1). For this you will need to do a stem plot, showing the amplitude of each sine wave that makes up each signal. The graphs should look like the following:

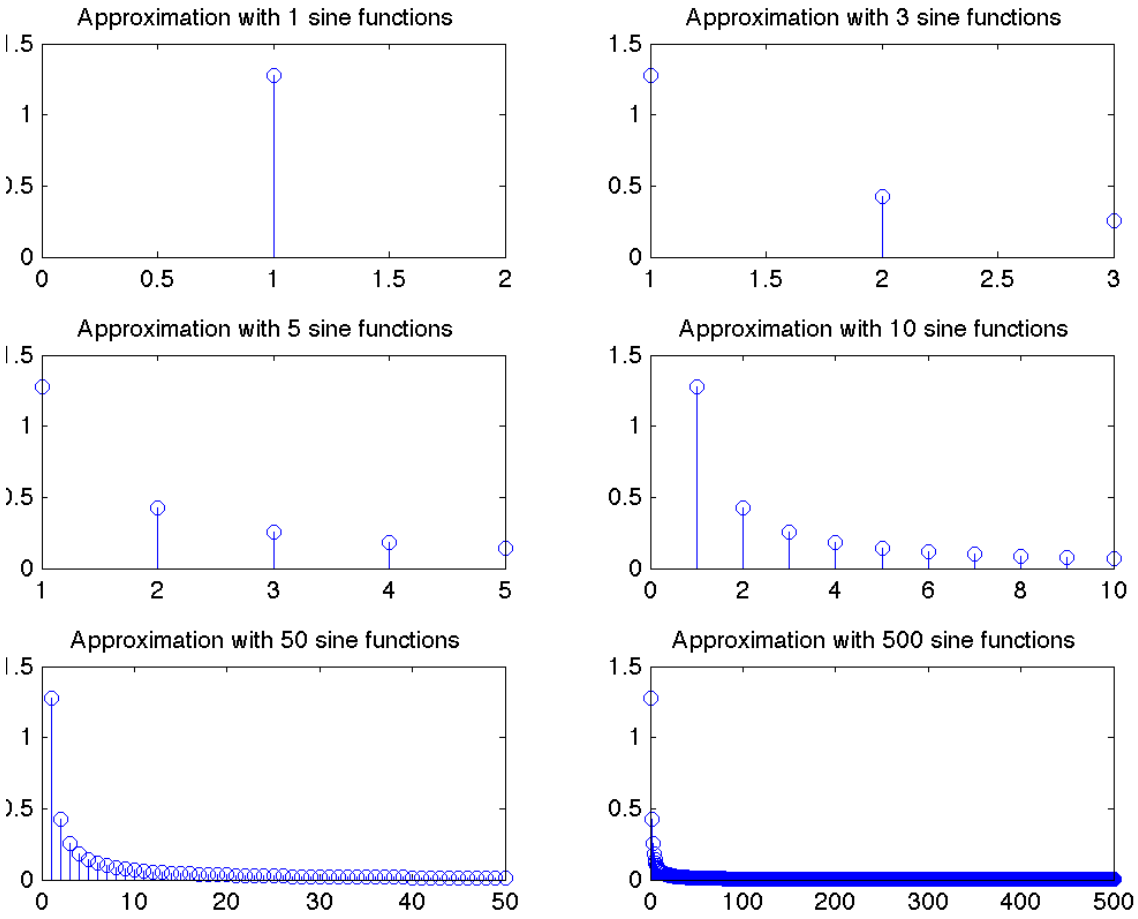

Figure 3: Square wave approximation in frequency