ENG-101
Intro Computing Engineers Homework 8

Question 1 (20 Points)

A periodic, continuous signal $x(t)$ is one that repeats over period T. That is: $x(t) = x(t+T)$. A Fourier series is a technique to decompose the signal into a sum of simple sine waves.

$$x(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n cos\left(\frac{2\pi nt}{T}\right) + \sum_{n=1}^{\infty} b_n sin\left(\frac{2\pi nt}{T}\right)$$

The coefficients for to represent a triangle-wave of pulse-width τ are:

$$a_n = \left(\frac{\tau}{T}\right) \text{sinc}^2\left(\frac{n\pi\tau}{2T}\right)$$

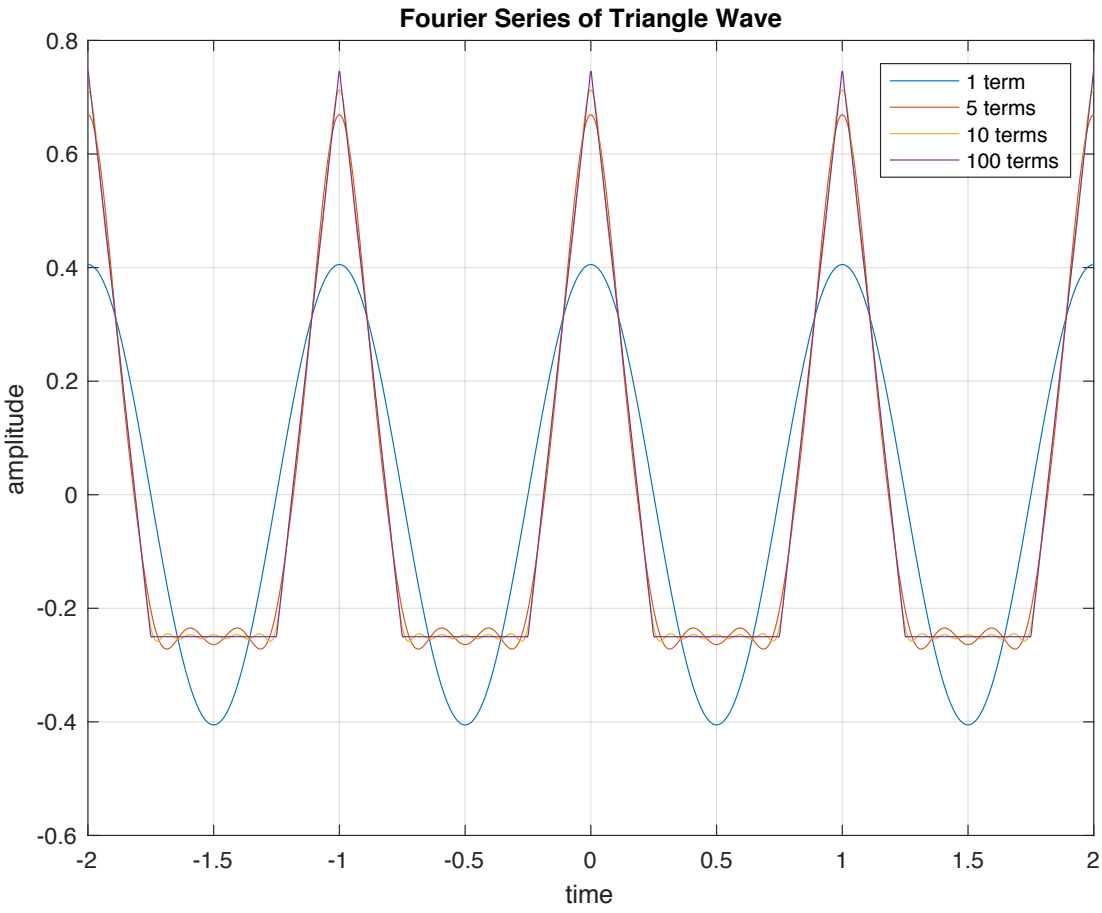
$$b_n = 0$$

where,

$$\text{sinc}(x) = \frac{\sin(x)}{x}$$

Notice that the sinc-function is defined differently than defined in MATLAB's toolbox.

Write well-documented MATLAB scripts (*fourierSeriesTri.m*) to implement these series. Replicate the plot (below) using 5, 10 and 100 terms of the series in the plot *fourierSeriesTri.fig*. Submit your plots in your solution submittal. Your solutions do not need to employ MATLAB vectorizing techniques.


Fourier Series of Triangle Wave
1 term
5 terms
10 terms
100 terms
amplitude
time
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

Question 2 (20 Points)

The outfield wall at Dodger stadium is 330 ft along the left-field foul line. The height of the wall is 8 feet. If a baseball batter hits the ball at 4ft above the ground, and neglecting air resistance, determine the minimum ball speed launch angle combinations required to clear the fence. The equations of motion for the baseball are:

$$x(t) = v_o t\cos\theta$$

$$y(t) = -\frac{gt^2}{2} + v_o t\sin\theta$$

where y it the height, and x is the distance along the third base line. The gravity constant is g=9.8 meter/sec^2. The launch angle is θ.

Your program *dodgerPark.m* should produce the labelled figure *dodger.fig*, which should be included as a pdf in your solution. Your graph should depict the speed (in mph) vs launch angle (degree) for balls to exit the ball field.