Engr325 Homework #4 Winter, 2020

Sampling and Fourier Series

DUE: Monday, February 3, start of class.

Objective
Understand the basics of sampling, Fourier Series analysis, and the Fast Fourier transform.

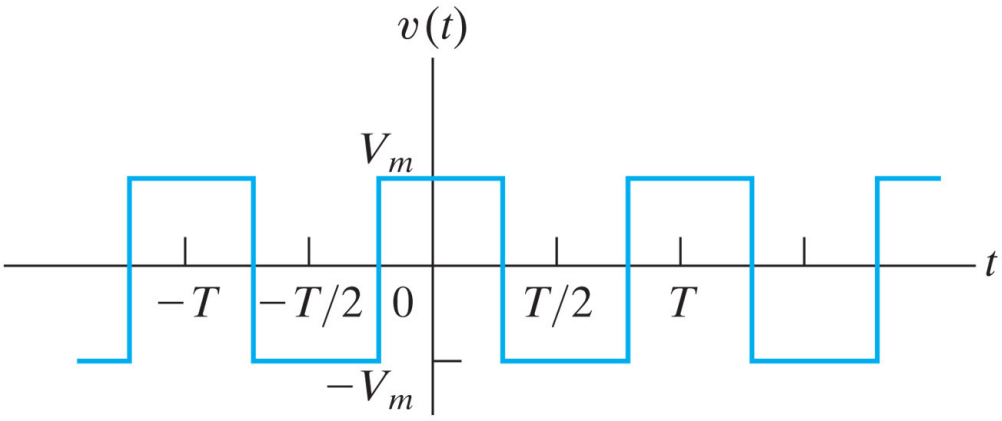
References
Textbook Chapter 2, course web page, lecture notes.

To Do

1) Assume that a 60 Hz sine wave is sampled at a rate of 80 Hz.
   a. Draw the wave and show on the waveform the points where it would be measured. You can draw the plots either by hand or with a program like Matlab.
   b. Observe the points where measurement occurs. What is the apparent frequency of a signal defined by those points?

2) Textbook problem 2.20 – find the Fourier Series for the function shown in Figure 2.24. Then, modify the Matlab function **fourier_series_square.m** from the course web page to plot your Fourier Series. Turn in a graph of the plot as part of your solutions.

3) Find the Fourier series for the function below. Take $T = 2\pi$ and $V_m = 1$. Note that this is the same function that we did in class, just phase shifted by $T/4$. Refer to your textbook and recognize the symmetry of the waveform to reduce your integrations.



4) Modify the **fourier_series_square.m** file yet again to plot your solution to problem #3 above. Next, run a fast fourier transform (fft) on your last equation from your modified .m file and plot the frequency spectra that results. You may refer to the sample Matlab script in the course lecture notes. Turn in a graph of both plots, plus a copy of your Matlab code.

To Turn In
- **This page** stapled to your solutions which are all to be done in accordance with the School of Engineering guidelines found on the course web page. Use minimal but sufficient problem statements for the textbook problems.