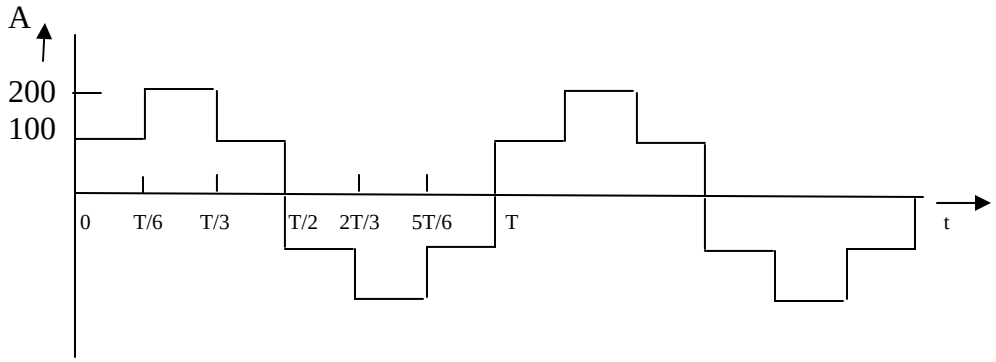
EE 432/537 HW3 Due 3/13

1. For the boost converter that you analyzed in HW 2, develop a state space averaged model. The model should relate output voltage to Input voltage and duty cycle. Assume the following parameters from HW 2

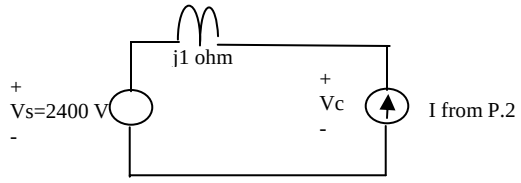
   E=100 V Vo= 125 V
   f = 5 kHz C= 500 uF L = 30 mH Inductor resistance R= 0.1 ohm
   Use Matlab to plot the step response of ouput voltage due to a change in duty cycle.

2. Find the Fourier Series for the current waveform shown below



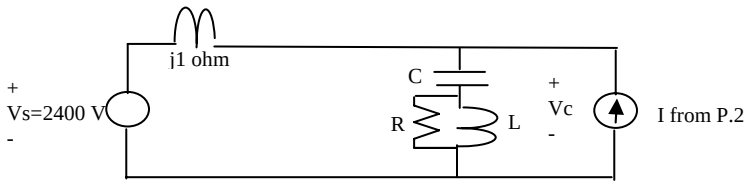
   Calculate the coefficients of the Fourier series and plot the line spectrum. Tell me which harmonics are zero.

3. A converter injects the above current into a power system. On a per phase basis the power system can be represented by a 2400V, 60 Hz source with a short circuit(Thevenin) impedance of j 1 ohm as shown below:



   a. From the Fourier series for current in P.2 Determine the Fourier series for voltage Vc at the converter terminals and plot this voltage as a function of time. Calculate the THD
   b. Design a shunt filter shown below with the resonant frequency set at 10.6x 60 Hz, just below the 11^{th}. Harmonic. Assume R=100 ohm. Plot the

impedance of the filter as a function of frequency. If you don't like the response, change R. Repeat part a.



Mandatory for Graduate Students/ Optional for others

4. For the waveform below determine parameters a, b and c so that the 3rd harmonic is zero.