Project 3 – Due April 30, 2022

1. A 3-phase generator is providing source voltages of the form:

   $e_{as} = \sqrt{2}120\cos(377t)$

   $e_{bs} = \sqrt{2}120\cos(377t - 2\pi/3)$

   $e_{bs} = \sqrt{2}120\cos(377t + 2\pi/3)$

   To a 6-diode rectifier. The generator has an ac source inductance of 2 mH. The output of the rectifier has a large dc inductance.

   a. Analytically determine and use Matlab to plot the average output voltage versus current for modes 1, 2, and 3.
   b. For the load resistance that leads to a commutation of 15 degrees, plot the phase-a, b- and c-phase currents versus θ_{ac}.
   c. For the load resistance that leads to a commutation of 60 degrees, and a delay of 15 degrees, plot the phase-a, b- and c-phase currents versus θ_{ac}.
   d. Determine the load that yields the maximum power delivered to the dc load.

2. Using Matlab, simulate the generator/rectifier with a 6 mH dc inductor and resistive loads using a Forward Euler algorithm. First, simulate the circuit for a range of loads that spans Mode 1 and Mode 2. For each of the loads establish the average dc voltage and load current. Plot the resulting current versus voltage relationship and compare the results to those obtained in problem 1a. Next,simulate the circuit for the loads of problem 1b and 1c. For each, plot the phase currents versus θ_{ac} and compare the values with those obtained in problem 1. Make sure to plot versus angle and not time to allow a direct comparison.