ECE 529: Homework #3

Due Session 24 (March 10)

1. Implement a closed loop current control scheme for the three phase VSC from **hw 2,** with the parameters listed below. Implemented the control in the synchronous rotating d-q reference frame. Assume that the source voltage is constant and is a 0 degree reference angle on phase A.

   Use an averaged model for a three phase VSC rated at 2300 V_{AC} and 5 MVA. The converter is connected to an AC source voltage of 2.3 kV (L-L), through an $R = 0.0096\,\Omega$, $X_s = 0.144$ ohm (X/R = 15)

   A. Determine gains k_i and k_p for the closed loop current regulators.
   B. Determine the i_{dref} and i_{qref} such that P=5 MW and Q=0.
   C. Determine the i_{dref} and i_{qref} such that P=4.0 MW and Q=1.9 MVAR.
   D. Determine the i_{dref} and i_{qref} such that P=4.0 MW and Q= -1.9 MVAR
   E. Determine the i_{dref} and i_{qref} such that P= -4.0 MW and Q= -1.9 MVAR
   F. Implement cases B-E using closed loop control in your EMT program using averaged models with fixed current references entered. Verify that currents track the current references with plots and that the real and reacivepower measured at point of common couple matches the desired levels. (If you start from an example case, make sure you update all constants needed for the closed loop controller to use your gains from part A).

2. Repeat problem 1, parts B-E with outer control loops setting Pref and Qref rather than entering Idref and Iqref manually in the simulation. Verify that measured real and reactive power tracks the power references at the point of common couple coupling. Also plot the synchronous reference frame currents and one cycle of the phase domain currents.