ECEN 615 Problem Set #2 Fall 2025

Due 9/25/25

1. Using a programming environment of your choice (such as Matlab, Scilab or Python) write a Newton-Raphson power flow, and use it to solve the five bus system presented in class except assume all the transmission line and transformer resistance values are zero (this means the **G** matrix values are all zero simplifying your Jacobian calculations) . You can either hard code the five bus system data in your program, or you can input it from, say, text files. The input is the per unit power for the PQ buses, the voltage setpoints for the generators, and the transmission line and transformer π-model parameters. You need to code PQ, PV and (obviously) a slack bus. However, you do not need to code generatror reactive power limits. Use a flat start initial guess, except set the PV bus voltage to the generator setpoint voltage. Your output should be a list of the bus voltage magnitudes and angles at each iteration. Also calculate the reactive power output for the generators and the real power output for the slack bus generator. Use a 100 MVA per unit base, and use a per unit convergence value of 0.1 MVA. Turn in the output and a complete listing of your program.

2. In PowerWorld using the case ECEN615_HW2_37_2025 manually try to minimize the system losses by adjusting 1) the phase shifter at the REED substation, 2) the status of the capacitors, and 3) the LTCs at the TEXAS, WEB, KYLE and RELLIS substations. Turn in your minimum losses and an explanation of the manual procedure that you used to determine the minimum losses. Also, explain why you think your solution actually minimizes the losses. Note several transmission lines are open; do not change their statuses. Also, you may ignore transmission line transformer overloads.