ECEN 615 **Problem Set #3** **Fall 2018**
Due 10/11/18

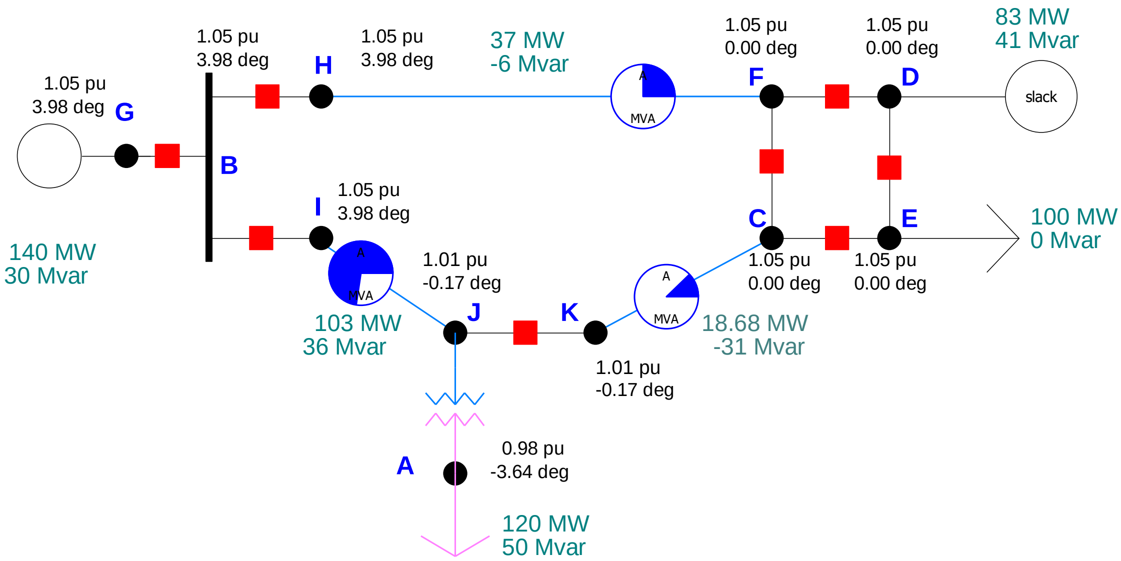
1 Modify your program from Problem Set 2 to allow for an off-nominal transformer turns ratio, t, on the transformer between buses 3 and 4. Assume the off-nominal turns ratio is on the Bus 4 side. Solve your power flow with a value of t=1.02. For this use the original case in which the generator at Bus 3 is regulating its own voltage (i.e., not as modified in question 1). Note, if you compare your results to the PowerWorld results the off-nominal turns ratio in PowerWorld is on the Bus 3 side. In order to check your results use 1/t for the ratio in PowerWorld. 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.

2. Code the LU factorization discussed in class for full matrices, along with the forward/backward substitution. To test your algorithm use it to factor and solve the below matrix. You do not need to code pivoting.

$$\mathbf{A} = \begin{bmatrix} 5 & 1 & 0 & -4 \\ 1 & 4 & 0 & -3 \\ 0 & 0 & 3 & -2 \\ -4 & -3 & -2 & 10 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

3. Modify your power flow program from Poblem Set 2 to use the LU factorization and forward/backward routines you developed for problem 2. Provide a complete listing of your code and verification that your code is working correctly. You should use this code for all future power flow problems (until we replace it with the sparse code in the next problem set).

4. Order the following network using Tinney Scheme 1. Give the permutation vector entries and the number of fills (i.e., twice the number of lines added). Break ties alphabetically (i.e., A before B).


1.05 pu
3.98 deg
G
140 MW
30 Mvar
1.05 pu
3.98 deg
B
H
1.05 pu
3.98 deg
37 MW
-6 Mvar
MVA
1.05 pu
0.00 deg
F
1.05 pu
0.00 deg
D
83 MW
41 Mvar
slack
I
1.05 pu
3.98 deg
MVA
103 MW
36 Mvar
1.01 pu
-0.17 deg
J
K
1.01 pu
-0.17 deg
MVA
18.68 MW
-31 Mvar
C
1.05 pu
0.00 deg
E
1.05 pu
0.00 deg
100 MW
0 Mvar
A
0.98 pu
-3.64 deg
120 MW
50 Mvar