

## EE491 Homework 4

**Due September 24 2020 at 9 am**

- 1) Using the  $Y_{\text{Bus}}$  matrices for the following four power systems from Homework 3, write-out the power-flow equations for each system and clearly identify the known and unknown variables at each bus for setting up the power-flow problem.
- 2) Consider the simple power system example discussed in the class. Assume  $x = 0.25$  pu.
  - a) Solve the voltage solutions for the case of unity pf lagging load and plot the PV diagram. What is the static limit value for PL2?
  - b) Solve the voltage solutions for the case of 0.85 pf lagging load and plot the PV diagram. What is the static limit value for PL2?
  - c) Solve the voltage solutions for the case of 0.85 pf leading load and plot the PV diagram. What is the static limit value for PL2?

Hint: As you vary PL2, note that the corresponding QL2 can be found by using  $QL2 = PL2/pf \cdot \sqrt{1-pf^2}$  for any specified pf, and QL2 will be positive or negative depending on lagging or leading pf load respectively.

- 3) Let us consider the first three of the power systems in Homework 3.

For System 1), assume  $PG2 = 1.0$  and  $V2 = 1.04$ ,  $PL2 = 0.3$  and  $QL2 = 0.1$ ,  $PL3 = 0.6$  and  $QL3 = 0.2$ .

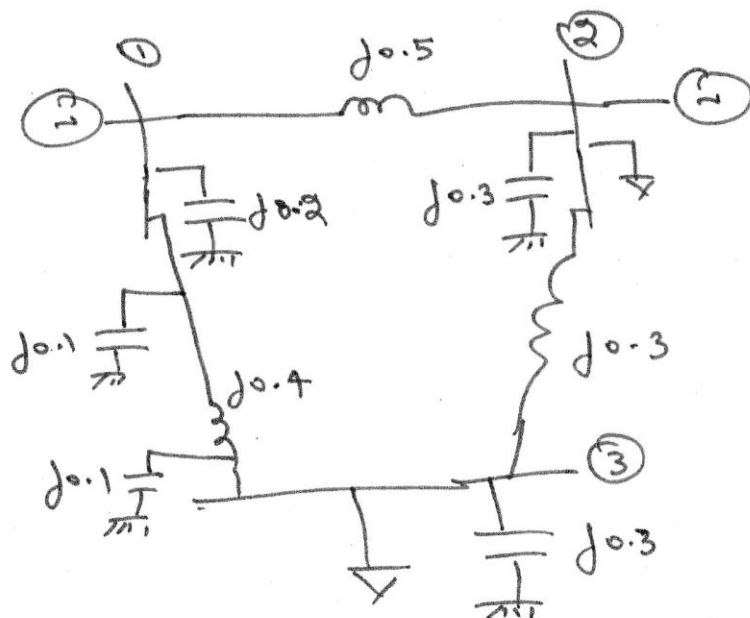
For system 2), assume  $PL2 = 0.6$  and  $QL2 = 0.1$ ,  $PL3 = 0.4$  and  $QL3 = 0.1$ .

For System 3), assume  $PG2 = 1.0$ ,  $V2 = 1.05$ ,  $PL3 = 0.6$ ,  $QL3 = 0.2$ ,  $PL4 = 0.5$  and  $QL4 = 0.1$ .

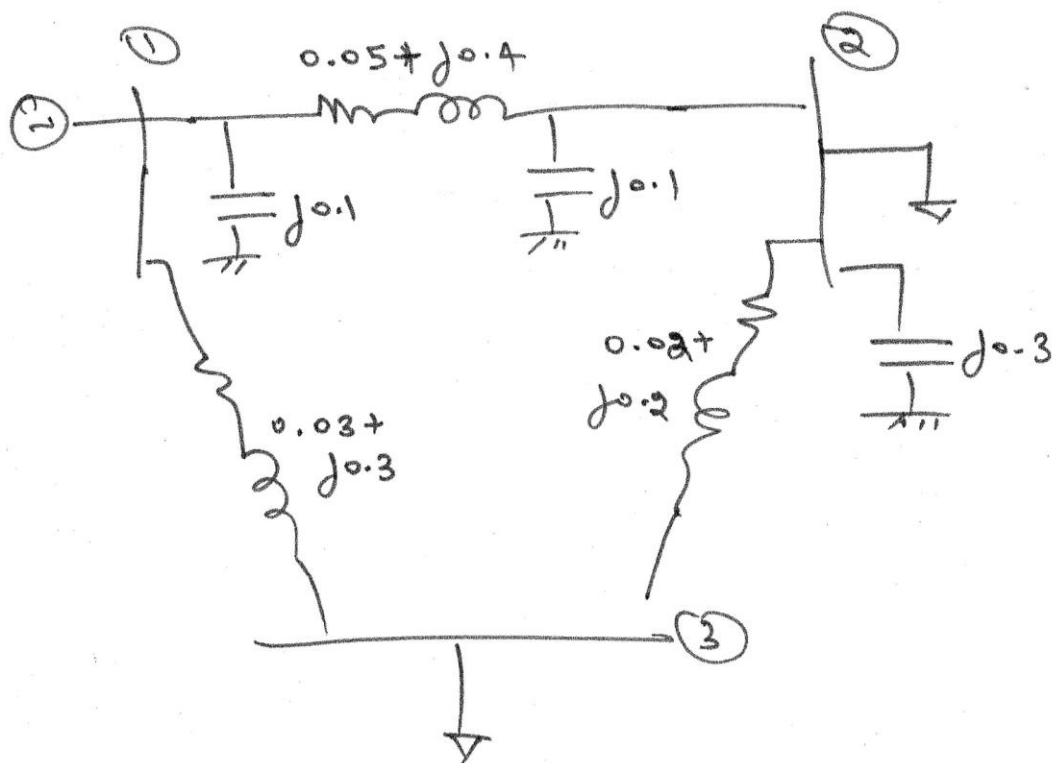
Find the DC power-flow solution for these three power systems and compute the active power-flows in all the transmission lines clearly showing the directions of each flow.

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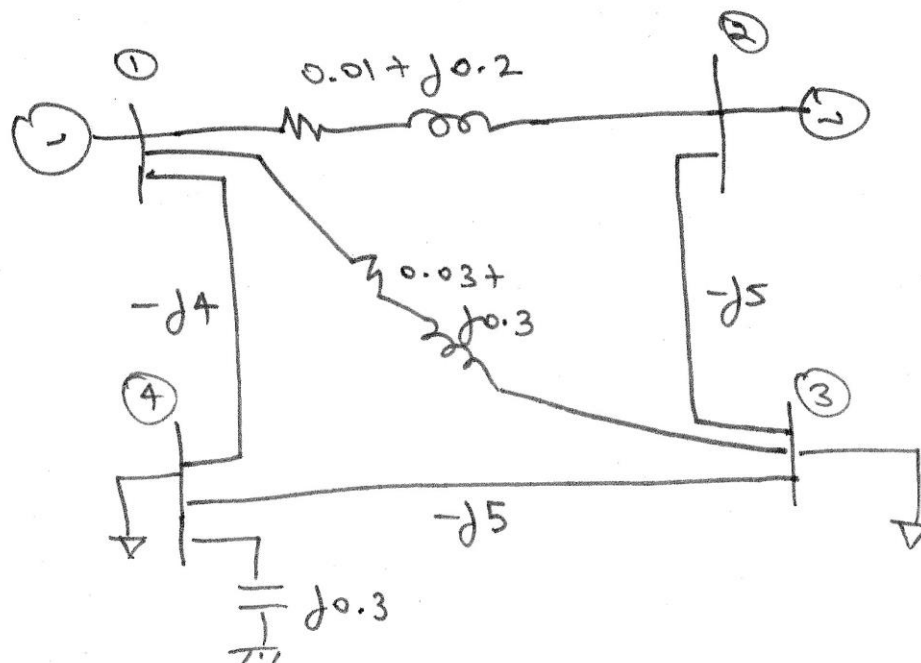
1)



2)



3



4

