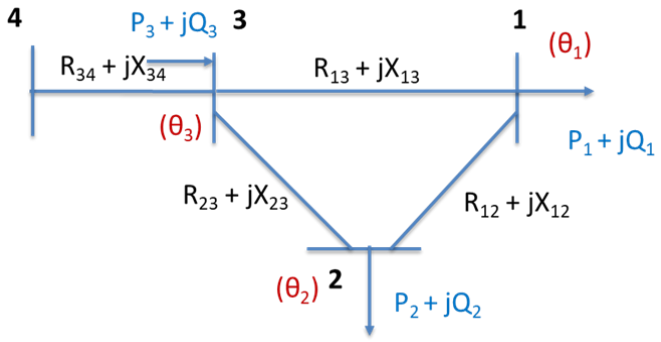
ELK14: Methods and Algorithms for Power Systems

Assignment 4:



Network	
R_{12}	0.0
X_{12}	0.2
R_{13}	0.0
X_{13}	0.1
R_{23}	0.0
X_{23}	0.25
R_{34}	0.0
X_{34}	0.25
Loads	
P_1	-1.25
P_2	-0.4
P_3	-0.6

Figure 1: Example system – all data in PU.

The bus 4 can be used as slack bus (reference).

The calculations will be done on the example system shown in figure 1.

$$\begin{bmatrix} 15 & -5 & -10 \\ -5 & 9 & -4 \\ -10 & -4 & 18 \end{bmatrix} \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \end{bmatrix} = \begin{bmatrix} P_1 \\ P_2 \\ P_3 \end{bmatrix}$$

Part 1: Distribution factors (Lecture 5)

1. Show that the given equation system is the active power flow representation of the system shown in Figure 1. (You don't need to do any programming but you must describe how you build it)
2. Solve the load flow case.
3. Explain the concept of distribution factors and calculate the factors for line 1-2, line 1-3 and line 3-4.
4. What is the change in flow on these lines if the load is increased with 0.5 on bus 1.
5. What is the change in flow on these lines if the load in increased with 0.5 on bus 1 and reduced by 0.3 on bus 2. Compare with load flow and comment.

Part 2: Inverse Matrix Modification Lemma (IMML) (Lecture 6)

1. Please explain the concept of IMML.
2. Find the voltage angles and the power flow for the given case when the line 1-2 is disconnected by using the IMML explained at the previous lecture. Compare with a regular active power flow.
3. Presume that line 1-3 is a double line and we what the check the consequences of outaging one of these lines. The lines are assumed to be identical. Compare with a regular active power flow and comment.