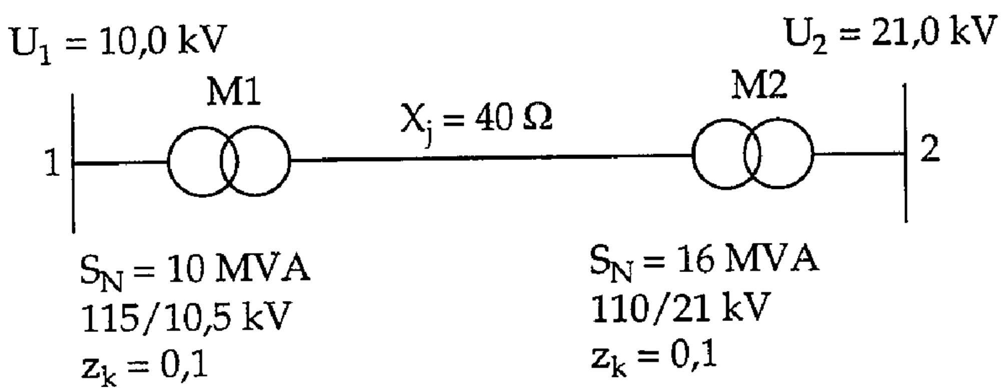
Aalto-yliopisto
Teknillinen korkeakoulu

Exercise Session 4

Power systems

Question 1

- Calculate the maximum active power P_{max} that can be transferred from busbar 1 to busbar 2 using the voltages shown in the picture.



Question 2

- The power that can be transferred by a line is, usually, limited by the reactive power resources. A line has a series reactance X=100 Ω and the voltage at the beginning of the line is U_1=115 kV. The reactive power at the end of the line is Q_2=0. Derive the expressions for power transferred and reactive power Q_1 as the function of voltage angle δ. How much smaller is the maximum transferred power compared to a case where the necessary reactive power could be fed to the end of the line?

Question 3: (for help, see Power System Analysis by Grainger, ch. 16 or other book)

- A generator having H = 6.0 MJ/MVA is delivering power of 1.0 per unit to an infinite bus through a purely reactive network when the occurrence of a fault reduces the generator output to zero. The maximum power that could be delivered is 2.5 per unit. When the fault is cleared, the original network conditions again exist. Determine the critical angle and critical clearing time.

Hint: For clearing time, H= Wk/P & Wk = $\frac{1}{2}J\omega^2$ *if using equation from lecture slides*

Question 4

- A 60-Hz generator is supplying 60% of P_{max} to an infinite bus through a reactive network. A fault occurs which increases the reactance of the network between the generator internal voltage and the infinite bus by 400%. When the fault is cleared, the maximum power that can be delivered is 80% of the original maximum value. Determine the critical clearing angle for the condition described.