238809

1. Let us assume that the resistance of the studied transmission line is 0Ω. Theoretical maximum power flow through the line is achieved when the angle difference between line ends is $\delta = 90°$ and voltage in both ends is constant 1.0 pu. Maximum power flow is $P_{max} = 1.0$ pu.
   a) Prove that reactive power losses in the line are 2.0 pu.
   b) Prove that voltage in the middle of line is $\frac{\sqrt{2}}{2}$ pu.

2. Figure 1 represents 300 km long transmission line where voltage on both ends is $U_{1v}=U_{2v}=$ 400 kV and power flow through line is P = 700 MW. Calculate how large series capacitor needs to be connected in the middle of the line in order to have $Q_1=Q_2= 0$. Parameters of the line are x = 0.33 Ω/km, b = 3.57 μS/km.

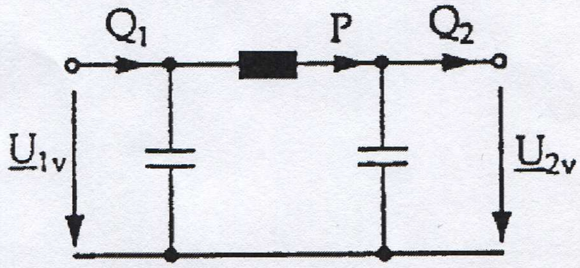

Figure 1.

3. Generator produces P = 80 MW active- and Q = 0 reactive power. Connection point voltage on the high voltage side of the transformer is U = 115 kV and network short-circuit power is S_k = 1000 MVA when voltage is 115 kV. How much the connection point voltage will change if a reactor (U_n = 120 kV, Q_n = 60 Mvar) is connected to same point?

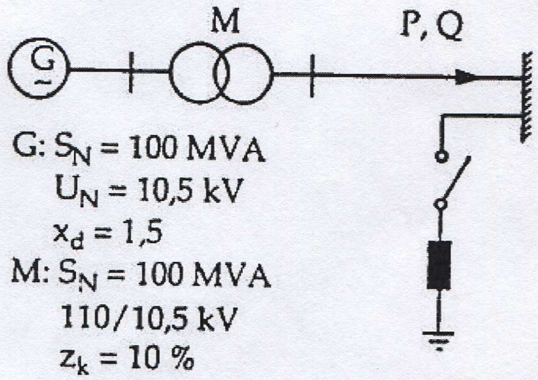

Figure 2.

4. A Generator (300 MVA, 23 kV) is feeding power through a transformer (330 MVA, 23/230 kV, Δ-Y connected, taps on Δ-side, leakage reactance 11 %) to a load (240 MVA, power factor $0.9_{ind.}$, 230 kV). The generator is maintaining the voltage on the high voltage side of the transformer at nominal.
   a) Determine generator active and reactive power when transformer ratio is $1:1\angle 30°$
   b) Determine generator active and reactive power when transformer ratio is $1:1.05\angle 30°$