

2. Aufgabe

Achtung:

$$Z = \sqrt{\frac{L}{C}} = 264,6 \Omega$$

folgender Wert in Aufgabenstellung

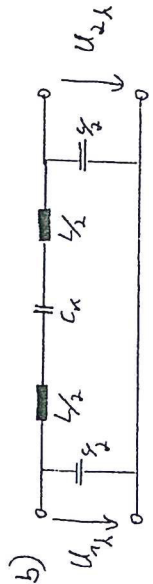
a)  $P_{\text{net}} = 5500 \text{ MW}$

$$P_{\text{net}} = \frac{U_L}{Z}$$

$$Z = \frac{(1150 \text{ kV})^2}{5500 \text{ MW}} = 240,45 \Omega$$

$$S_d = \sqrt{3} U_L I_L = \sqrt{3} \cdot 1150 \text{ kV} \cdot I_L = P_{\text{net}} = 5500 \text{ MW}$$

$$\Rightarrow I_L = \frac{5500 \text{ MW}}{\sqrt{3} \cdot 1150 \text{ kV}} = 2,76 \text{ kA}$$



$$X_L = 0,42 \frac{\Omega}{\text{km}} \cdot 1300 \text{ km} = 546 \Omega$$

$$X_C = 2 \cdot \pi \cdot 50 \text{ Hz} \cdot 7,2 \cdot 10^{-6} \text{ F} = 2,262 \text{ mS}$$

$$X_{\text{ges}} = \omega L - \frac{1}{\omega C_C} = 546 \Omega - 442,1 \Omega = 103,9 \Omega$$

$$U_{2L} = \frac{1150 \text{ kV}}{\sqrt{3}} \approx 664 \text{ kV}$$

$$I_2 = 2,76 \text{ kA} \quad (\text{a})$$

$$I_{C2} = \frac{\omega C}{2} U_{2L} = \frac{\omega C \cdot L}{2} U_{2L}$$

$$= 3 \cdot 10^{-6} \frac{\text{F}}{\text{km}} \cdot 1300 \text{ km} \cdot 664 \text{ kV}$$

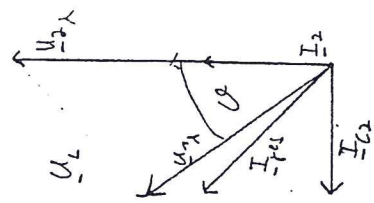
$$= 2,59 \text{ kA}$$

$$I_{\text{ges}} = I_L + I_{C2}$$

$$I_{\text{ges}} = \sqrt{(2,76 \text{ kA})^2 + (2,59 \text{ kA})^2} = 3,78 \text{ kA}$$

$$U_L = I_{\text{ges}} X_{\text{ges}} = 3,78 \text{ kA} \cdot 103,9 \Omega$$

$$= 392,7 \text{ kV}$$



$$\Rightarrow \varphi \approx 36^\circ$$

c)

$$P_{\text{net}} = \frac{U_L^2}{Z}$$

$$Z = \sqrt{\frac{X_{\text{ges}}^2}{\omega C}} = \sqrt{\frac{103,9 \Omega}{6 \cdot 10^{-6} \frac{\text{F}}{\text{km}} \cdot 1300 \text{ km}}} = \sqrt{\frac{103,9 \Omega}{7,8 \text{ ms}}} = 115,4 \Omega$$

$$\Rightarrow P_{\text{net, neu}} = \frac{(1150 \text{ kV})^2}{115,4 \Omega} = 11460,14 \text{ MW}$$