

task_ezrkjzifcegttcpc_with_calculation

Student Group

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Exercise E19 Multiphase systems (written test, approx. 4 % of a 120-minute written test, SS2021)

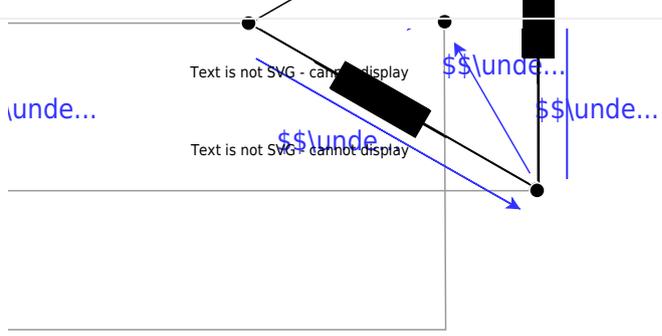
a) Specify the RMS value of the phase voltage U_{RMS} and the RMS value of the line voltage U_{L} . Resulting.

A voltage with the RMS value $U_{\text{RMS}} = 110 \text{ V}$ is applied between the terminals of each winding.

Through each of the windings, there is a current with an RMS value $I_{\text{RMS}} = 5 \text{ A}$ and a phase shift $\varphi = \pm 25^\circ$ compared to the voltage.

b) Draw the circuit diagram. Since $U_{\text{RMS}} = 110 \text{ V}$ is applied between the terminals of each winding, the phase voltage U_{RMS} is the same for all windings. For a three-phase system, the line voltage U_{L} is $U_{\text{L}} = \sqrt{3} \cdot U_{\text{RMS}} = 190.5 \text{ V}$. The power P is $P = 3 \cdot U_{\text{RMS}} \cdot I_{\text{RMS}} \cdot \cos(\varphi) = 1610.88 \text{ W}$. The reactive power Q is $Q = 3 \cdot U_{\text{RMS}} \cdot I_{\text{RMS}} \cdot \sin(\varphi) = 288.8 \text{ var}$. The complex power S is $S = P + jQ = 1610.88 + j288.8 \text{ VA}$. The real power must be zero: $\sum P_i = 0$.

By this (and showing in the example in the image below), One can see, that $I_{\text{L}} = \sqrt{3} \cdot I_{\text{RMS}} = \sqrt{3} \cdot 5 \text{ A}$



one single phase as an example



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