task_abh4vhlgczdbni37_with_calculation

Student Group

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Exercise E1 Signal Analysis
(written test, approx. 6 % of a 120-minute written test, SS2021)

a) Determine the amplitude values $\hat{U}$, $\hat{I}$ and the RMS values U, I of the two measured quantities. (independent)
The quantities are available in the consumer arrow system. (hard)

- $u(t) = 50{~\rm V} \cdot \cos (6000 {{1}\over{\rm s}} \cdot t + 4) $
- $i(t) = 30{~\rm A} \cdot \sin (6000 {{1}\over{\rm s}} \cdot t + 5) $

Result

Path

Path

a) Determine the amplitude values $\hat{U}$, $\hat{I}$ and the RMS values U, I

The complex impedance $\underline{Z}$ for a resistive-inductive load (=R-L series circuit) is given as

$$\begin{aligned} \underline{Z} &= {\rm j} \cdot X_{\rm M} + R_{\rm M} \\ &= {\rm j} \cdot 2\pi \cdot f \cdot L_{\rm M} + R_{\rm M} \end{aligned}$$

The Pythagorean theorem can derive the absolute value:

$$\begin{aligned} |\underline{Z}| &= \sqrt{ (2\pi \cdot f \cdot L_{\rm M})^2 + R_{\rm M}^2 } \end{aligned}$$