task_jti0uzudcmg4u22t_with_calculation

Student Group

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complex impedance, exam WS2022

Exercise 1 : Analyzing complex Impedances

(written test, approx. 16% of a 60-minute written test, WS2022)

A circuit with an ideal voltage source ($U=50 V$, $f=330 Hz$) and two components (R and $\underline{X}_1$) shall be given.
After analysis, the following formula for the impedance was extracted: \begin{align*} \underline{Z} = \left({{2}\over{3+4j}}+5j \right) \Omega \end{align*}

1. Calculate the physical values of the two components.

Solution

\begin{align*} \underline{Z} &= \left({{2}\over{3+4j}} + 5j \right) \Omega \\ &= \left({{2}\over{3+4j}} \cdot {{3-4j}\over{3-4j}} + 5j \right) \Omega \\ &= \left({{2}\over{9+16}} \cdot (3-4j) + 5j \right) \Omega \\ &= \left(0.24 - 0.32j + 5j \right) \Omega \\ &= 0.24 \Omega + j \cdot 4.68 \Omega \\ \end{align*}

Final result

\begin{align*} t = 1.39 ms \end{align*}

2. Calculate the phase and absolute value of complex current $\underline{I}$ through the circuit.

3. Now an additional component $\underline{X}_2$ shall be added in series to the two components.
This component shall be dimensioned in such a way that the current and voltage are in phase. Calculate these component value!