

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 ($U=50\text{ V}$, $f=330\text{ Hz}$) and two components (R and X_1) shall be given.

After analysis, the following formula for the impedance was extracted:
$$\underline{Z} = \left(\frac{2}{3+4j} + 5j \right) \Omega$$

1. Calculate the physical values of the two components.

Solution

$$\begin{aligned} \underline{Z} &= \left(\frac{2}{3+4j} + 5j \right) \Omega \quad \&= \\ &\left(\frac{2}{3+4j} \cdot \frac{3-4j}{3-4j} + 5j \right) \Omega \quad \&= \\ &\left(\frac{2}{9+16} \cdot (3-4j) + 5j \right) \Omega \quad \&= \left(0.24 - 0.32j + 5j \right) \Omega \\ &\quad \&= 0.24 \Omega + j \cdot 4.68 \Omega \end{aligned}$$

Final result

$$t = 1.39\text{ ms}$$

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

3. Now an additional component 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!

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