

task_jti0uzudcmg4u22t_with_calculation

Student Group

| First Name | Surname | Matrikel Nr. |
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complex impedance, exam ee1 WS2022

Exercise E1.1 Analyzing complex Impedances (written test, approx. 14 % of a 60-minute written test, WS2022)

2. Calculate the phasor voltage \underline{U} and the current \underline{I} in the circuit shown in the figure. The components (R and X_L) shall be given.

After analysis, the full width dimensioned phasor voltage \underline{U} and current \underline{I} in phase (in Z) are $\underline{U} = \sqrt{2} \cdot 10 \cdot \cos(\omega t + 45^\circ)$ V and $\underline{I} = \sqrt{2} \cdot 0.24 \cdot \cos(\omega t - 16.7^\circ)$ A.

Solution
.. Calculation of physical values of the components.
Solution $R = 10 \Omega$, $X_L = 20 \Omega$

Solution

$\underline{I} = \frac{\underline{U}}{\underline{Z}}$
The current and voltage across the capacitor is $\underline{U}_C = \underline{U} \cdot \frac{1}{\sqrt{2}}$

resulting in $\underline{U}_C = 10 \cdot \frac{1}{\sqrt{2}} = 7.07$ V

The voltage across the resistor is $\underline{U}_R = \underline{U} \cdot \frac{R}{\sqrt{R^2 + X_L^2}} = 10 \cdot \frac{10}{\sqrt{10^2 + 20^2}} = 4.47$ V

impedance $\underline{Z} = R + jX_L = 10 + j20 \Omega$

$\underline{I} = \frac{\underline{U}}{\underline{Z}} = \frac{10 \cdot \sqrt{2} \cdot \cos(\omega t + 45^\circ)}{10 + j20} = 0.24 \cdot \sqrt{2} \cdot \cos(\omega t - 16.7^\circ)$ A

With the complex part comes the phase $\varphi = \arctan\left(\frac{-4.68}{0.24}\right) = -10.9^\circ$

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The phase φ can be calculated as $\varphi = \arctan\left(\frac{-4.68}{0.24}\right) = -10.9^\circ$

$\varphi = \arctan\left(\frac{-4.68}{0.24}\right) = -10.9^\circ$

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