

task_jti0uzudcmg4u22t_with_calculation

Student Group

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Table of Contents

Exercise E1.1 Analyzing complex Impedances (written test, approx. 14 % of a 60-minute written test, WS2022)	2
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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 phasor 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 the phasor current \underline{I} in phase (in Z) are $\underline{U} = \sqrt{2} \cdot 10 \cdot \cos(\omega t + 45^\circ)$ V and $\underline{I} = \sqrt{2} \cdot 1 \cdot \cos(\omega t - 45^\circ)$ A.

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

Solution

$\underline{I} = \frac{\underline{U}}{Z} = \frac{10 \angle 45^\circ}{10 + j20} = 1 \angle -45^\circ$ A

The current and voltage across the capacitor are $\underline{U}_C = \underline{I} \cdot (-j20) = -j20 \angle -45^\circ = 20 \angle -135^\circ$ V

resulting in $u_C(t) = 20 \sqrt{2} \cos(\omega t - 135^\circ)$ V

The voltage across the resistor is $\underline{U}_R = \underline{I} \cdot R = 10 \angle -45^\circ$ V

resulting in $u_R(t) = 10 \sqrt{2} \cos(\omega t - 45^\circ)$ V

With the complex exponentials $\underline{U} = 10 \angle 45^\circ$ V and $\underline{I} = 1 \angle -45^\circ$ A

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