

task_jti0uzudcmg4u22t_with_calculation

Student Group

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Exercise E1.1 Analyzing complex Impedances

(written test, approx. 14 % of a 60-minute written test, WS2022)

2. Calculate the complex impedance $\underline{Z}$ of the circuit shown in Figure 1. The voltage $\underline{U}$ and the current $\underline{I}$ shall be given.

After analysis, the full bridge dimensioned circuit impedance $\underline{Z}$ shall be extracted and brought into the phase $\angle \varphi$ and the magnitude $|\underline{Z}|$ of the impedance $\underline{Z}$ shall be calculated.

... Calculate the physical values of the components.

Solution: $\underline{Z} = \frac{\underline{U}}{\underline{I}} = \frac{10 \angle 0^\circ}{0.24 \angle -2.6^\circ} = 41.67 \angle 2.6^\circ \Omega$

Solution

$\underline{I} = \frac{\underline{U}}{\underline{Z}} \Rightarrow \underline{Z} = \frac{\underline{U}}{\underline{I}}$

The current $\underline{I}$ and voltage $\underline{U}$ are given. The voltage $\underline{U}$ is $10 \angle 0^\circ$ V and the current $\underline{I}$ is $0.24 \angle -2.6^\circ$ A. The impedance $\underline{Z}$ is calculated as:

$$\underline{Z} = \frac{10 \angle 0^\circ}{0.24 \angle -2.6^\circ} = 41.67 \angle 2.6^\circ \Omega$$

The magnitude of the impedance is 41.67Ω and the phase is 2.6° .

With the complex exponent φ comes the physical value φ in degrees.

The phase φ shall be calculated as:

$$\varphi = \arctan \left(\frac{\text{Im}(\underline{Z})}{\text{Re}(\underline{Z})} \right) = \arctan \left(\frac{-4.68}{0.24} \right) = -2.6^\circ$$

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