

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

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

The current $\underline{I}$ and voltage $\underline{U}$ are given. The impedance $\underline{Z}$ is calculated as follows:

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

The magnitude of the impedance is $|\underline{Z}| = 41.67 \Omega$ and the phase is $\angle \varphi = 2.6^\circ$.

With the complex exponent φ and the magnitude $|\underline{Z}|$, the impedance $\underline{Z}$ is calculated as follows:

$\underline{Z} = |\underline{Z}| \cdot e^{j\varphi} = 41.67 \cdot e^{j2.6^\circ} = 41.67 \angle 2.6^\circ \Omega$

The phase φ is calculated as follows:

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

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