

# 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 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  $\underline{U} = 10 \sqrt{2} \angle 45^\circ \text{ V}$  and  $\underline{I} = 1 \sqrt{2} \angle 0^\circ \text{ A}$ .

Solution  
.. Calculation of physical values of the components.  
Solution  $R = 10 \sqrt{2} \angle 45^\circ \text{ V}$  and  $X_L = 1 \sqrt{2} \angle 0^\circ \text{ A}$

Solution  
 $\underline{I} = \frac{\underline{U}}{Z} \iff \underline{U} = \underline{I} \cdot Z$   
The current  $\underline{I}$  and voltage  $\underline{U}$  are in phase with the voltage source  $\underline{U}_s = 10 \sqrt{2} \angle 45^\circ \text{ V}$  resulting in  $\underline{U} = 10 \sqrt{2} \angle 45^\circ \text{ V}$  and  $\underline{I} = 1 \sqrt{2} \angle 0^\circ \text{ A}$ .  
The voltage across the component  $Z$  is  $\underline{U}_Z = \underline{U} - \underline{U}_s = 10 \sqrt{2} \angle 45^\circ \text{ V} - 10 \sqrt{2} \angle 45^\circ \text{ V} = 0 \text{ V}$ .  
The impedance  $Z$  is  $Z = \frac{\underline{U}_Z}{\underline{I}} = \frac{0 \text{ V}}{1 \sqrt{2} \angle 0^\circ \text{ A}} = 0 \text{ } \Omega$ .  
The phase  $\varphi$  is  $\varphi = \arctan\left(\frac{\text{Im}(Z)}{\text{Re}(Z)}\right) = \arctan\left(\frac{0}{0}\right) = 0^\circ$ .  
With the complex exponent  $\varphi = 0^\circ$ , the voltage  $\underline{U}$  and current  $\underline{I}$  are  $\underline{U} = 10 \sqrt{2} \angle 45^\circ \text{ V}$  and  $\underline{I} = 1 \sqrt{2} \angle 0^\circ \text{ A}$ .  
The phase  $\varphi$  can be calculated as  $\varphi = \arctan\left(\frac{\text{Im}(Z)}{\text{Re}(Z)}\right) = \arctan\left(\frac{0}{0}\right) = 0^\circ$ .

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