

# task\_jti0uzudcmg4u22t\_with\_calculation

## Student Group

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complex impedance, exam ee1 WS2022

Exercise E5 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  $\underline{U} = 50 \angle 0^\circ \text{ V}$  and  $\underline{I} = 0.24 \angle -20^\circ \text{ A}$ .

Solution  
.. Calculation of physical values of the components.  
Solution  $R = 4.68 \Omega$  and  $X_L = 2.4 \Omega$

Solution  
$$\underline{I} = \frac{\underline{U}}{\underline{Z}} \quad \&= \quad \frac{50 \angle 0^\circ}{0.24 \angle -20^\circ} = 208.33 \angle 20^\circ \text{ A}$$
  
The current and voltage across the inductor  $X_L$  are  $\underline{U}_L = \underline{I} \cdot X_L = 208.33 \angle 20^\circ \cdot 2.4 \angle 90^\circ = 500 \angle 110^\circ \text{ V}$   
resulting in  $\underline{U} = \underline{U}_L + \underline{U}_R = 500 \angle 110^\circ + 4.68 \angle 20^\circ = 50 \angle 0^\circ \text{ V}$   
The voltage across the resistor  $R$  is  $\underline{U}_R = \underline{I} \cdot R = 208.33 \angle 20^\circ \cdot 4.68 \angle 0^\circ = 975 \angle 20^\circ \text{ V}$   
impedance  $\underline{Z} = R + jX_L = 4.68 + j2.4 \Omega$   
$$\underline{I} = \frac{\underline{U}}{\underline{Z}} = \frac{50 \angle 0^\circ}{4.68 + j2.4} = \frac{50 \angle 0^\circ}{5.2 \angle 26.9^\circ} = 9.6 \angle -26.9^\circ \text{ A}$$
  
The magnitude of the current is  $I = 9.6 \text{ A}$  and the phase is  $\varphi = -26.9^\circ$   
The magnitude of the voltage is  $U = 50 \text{ V}$  and the phase is  $\varphi = 0^\circ$   
The phase  $\varphi$  can be calculated as  $\varphi = \arctan\left(\frac{-X_L}{R}\right) = \arctan\left(\frac{-2.4}{4.68}\right) = -26.9^\circ$

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