Ćwiczenia 3: zadania 1-6

sobota, 14 kwietnia 2018 19:09

1

$$u(t) = 100\sqrt{2}\,\sin(314t + 45^\circ)$$

$$i(t) = 10\sqrt{2}\,\sin(314t - 15^\circ)$$

$$\underline{U} = 100\,e^{j45^\circ}$$

$$\underline{I} = 10\,e^{-j15^\circ}$$

$$\underline{S} = \underline{U}\,\underline{I}^{*} = 100e^{j45^\circ} \cdot 10e^{-j15^\circ} =$$

$$= 1000\,e^{j60^\circ} = 500 + j500\sqrt{3}$$

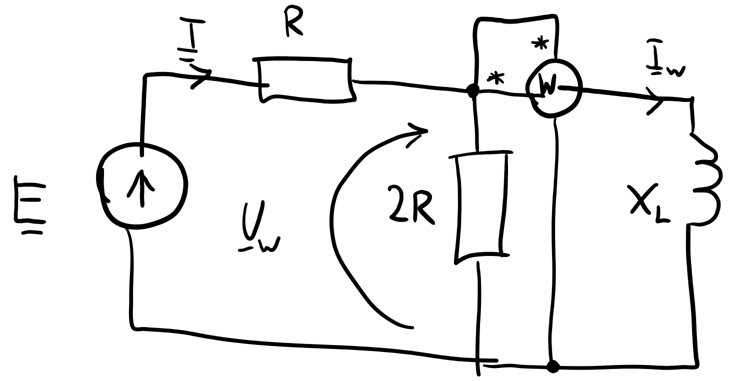
$$S = 1000\,VA$$

$$P = 500\,W$$

$$Q = 500\sqrt{3}\,Var$$

$$\underline{Z} = \frac{\underline{U}}{\underline{I}} = \frac{1000e^{j45^\circ}}{10e^{-j15^\circ}} = 10e^{j60^\circ} = 5 + j5\sqrt{3}$$

2



$$e(t) = \sqrt{2}\sin(\omega t) \qquad R = 20\Omega \quad X_L = 40\Omega$$

$$P_w = R_e\{\underline{U}_w \underline{I}_w^*\}$$

$$\underline{U}_w = \underline{E} - R\underline{I}$$

$$\underline{U}_w = 2R(\underline{I} - \underline{I}_w$$

$$\underline{U}_w = jX_L \underline{I}_w$$

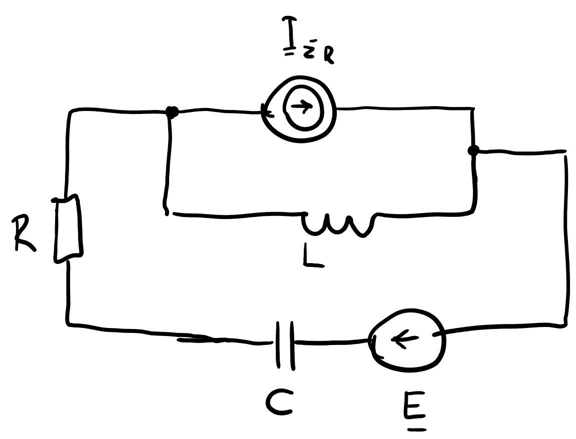
$$\underline{I}_w = \underline{I}\frac{2R}{2R+jX_L} = \frac{2R}{2R+jX_L}\quad\frac{\underline{E}}{R+\frac{2RjX_L}{2R+jX_L}} =$$

$$= \frac{2R\underline{E}}{R(2R+jX_L)+2RjX_L}$$

$$P_w = R_e\left\{\underbrace{\frac{jX_L\,2R\underline{E}}{R(2R+jX_L)+2R+jX_L}}_{\underline{U}}\cdot\left(\frac{2R\underline{E}}{R(2R+jX_L+2R+jX_L)}\right)^*\right\} =$$

$$P_w = R_e\{jX_L\cdot\underline{I}_w\cdot\underline{I}_v^*\} = R_e\{jX_L\}\underline{I}_w^2 = 0$$

3



$$\underline{E} = (100+j50)V \qquad \underline{I}_{źR} = 5A \qquad R = 10\Omega$$

$\underline{E} = (100 + j50)\,V \qquad \underline{I}_{\acute{z}R} = 5A \qquad R = 10\Omega$

$X_c = 20\Omega \qquad X_L = 10\Omega$

$$S_{ODB} = \underline{U}\,\underline{I}^* = \underline{Z}\,\underline{I} \cdot \underline{I}^* = \underline{Z}\,\underline{I}^2$$

$$S_{\acute{z}R} = \underline{E}\,\underline{I}^* + jX_L\,\underline{I}_{\acute{z}R}\,\underline{I}$$

$$\underline{I} = \frac{\underline{E} + jX_L\,\underline{I}_{\acute{z}R}}{R + j(X_L - X_c)} = \frac{100 + j50 + j10 \cdot 5}{10 + j(10 - 20)} =$$

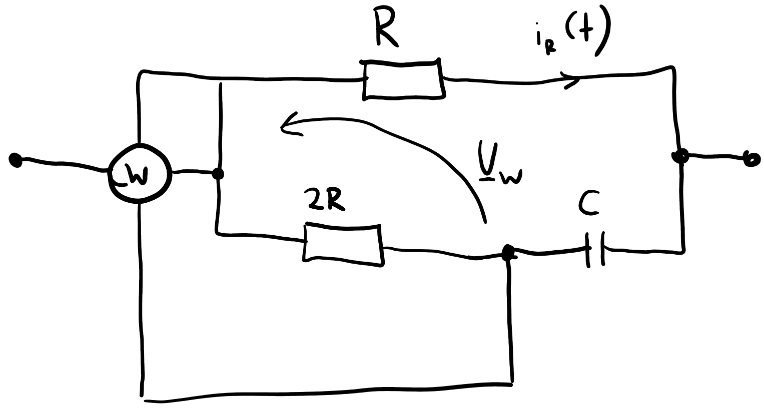
$$= \frac{100 + j100}{10 - j10} = \frac{10\sqrt{2}\,e^{j45^\circ}}{\sqrt{2}\,e^{-j45^\circ}} = 10e^{j90^\circ} = j10$$

$$\underline{S}_{ODB} = \underline{Z}\,\underline{I}^2 = (10 - j10)\,10^2 = 1000 - j1000$$

$$\underline{S}_{\acute{z}R} = (100 + j50)(-j10) + j50(-j10) =$$

$$= -j1000 + 500 + 500 = 1000 - j1000$$

4



$i_R(t) = I_m \cos(\omega t)$ R, C

$\underline{I}_R = j\frac{I_m}{\sqrt{2}}$

$P_w = Re\{\underline{U}_w \underline{I}_w^*\}$ ← na kolosa

$\underline{I}_R = \underline{I}_w \frac{2R - jX_c}{3R - jX_c}$

$\underline{I}_w = \frac{3R - jX_c}{2R - jX_c}$

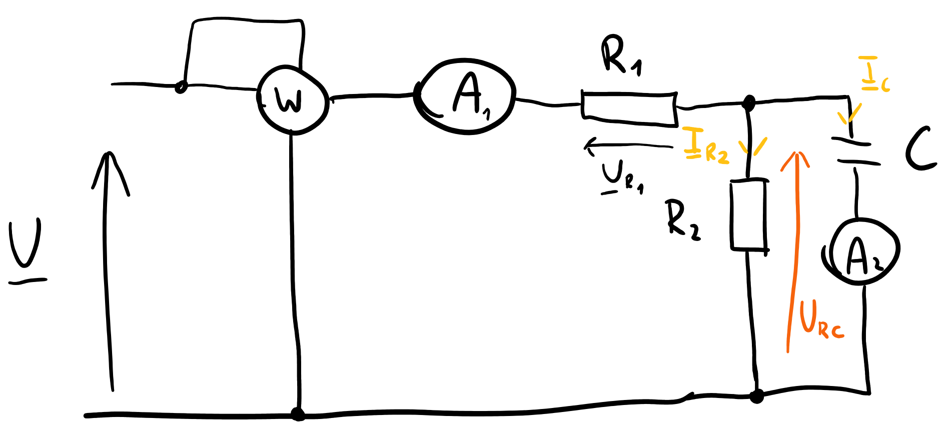
$\underline{I}_w^* = \underline{I}_R^* \frac{3R + jX_c}{2R + jX_c}$

$\underline{U}_w = 2R(\underline{I}_w - \underline{I}_R)$

$$P_w = Re\left\{2R(\underline{I}_w - \underline{I}_R)\underline{I}_R^* \frac{3R + jX_c}{2R + jX_c}\right\} =$$

$$= Re\left\{\frac{2R\underline{I}_w\underline{I}_R^*(3R + jX_c) - 2R\underline{I}_R^2(3R + jX_c)}{2R + jX_c}\right\}$$

6

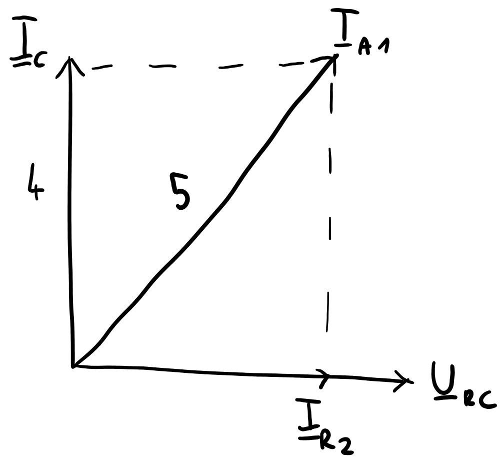


$P = 290W$ $I_{A1} = 5A$ $I_{A2} = 4A$

$R_1 = 8\Omega$

$R_1 = 8\,\Omega$

$R_2 = ?$ $\quad X_c = ?$ $\quad \underline{I}_{R_2} = ?$



$$|\underline{I}_{R_2}| = 3 = \sqrt{I_{A1}^2 - I_{A2}^2} = 3\,[A]$$

$$P_w = R_1 \cdot \underline{I}_{A_1}^2 + R_2 \cdot \underline{I}_{R2}^2 \rightarrow R_2 = \frac{P - R_1 \underline{I}_{R1}^2}{\underline{I}_{R_2}^2} =$$

$$= \frac{290 - 8 \cdot 25}{9} = 10\,\Omega$$

$$\underline{U}_{RC} = R_2 \underline{I}_{R_2} = -jX_c \cdot \underline{I}_{A_2}$$

$$|\underline{U}_{RC}| = R_2 \cdot \underline{I}_{R2} = X_c \underline{I}_{A2}$$

$$X_c = \frac{R_2 \underline{I}_{R2}}{I_{A2}} = \frac{10 \cdot 3}{4} = \frac{30}{4} = \frac{15}{2}$$

$$\underline{U}_{R_1} + \underline{U}_{RC} = \underline{U}$$