(6)

$i(t) = 2\sqrt{2}\sin\omega t + 3\sqrt{2}\cos\omega t$

$i(t) = I_m\{\underline{I}(t)\} = I_m\{\sqrt{2}\,\underline{I}\,e^{j\omega t}\} =$

$= I_m\{\sqrt{2}\,I e^{j\psi_i} e^{j\omega t}\} =$

$= I_m\{\sqrt{2}\,I e^{j(\omega t + \psi_i)}\} =$

$= I_m\{\sqrt{2}\,I\cos(\omega t + \psi_i) + j\sqrt{2}\,I\sin(\omega t + \psi_i)\} =$

$= \sqrt{2}\,I\sin(\omega t + \psi_i)$

$i(t) = \sqrt{2}\,I\sin(\omega t + \psi_i)$

$\underline{I}(t) = \sqrt{2}\,\underline{I}\,e^{j\omega t}$

$\underline{I}(t) = \frac{\underline{I}(t=0)}{\sqrt{2}} = I e^{j\psi_i}$

$\underline{I} = A + jB$

$i(t) = \sqrt{2}\sqrt{A^2+B^2}\sin(\omega t + \mathrm{arctg}\frac{B}{A})$

$i(t) = 2\sqrt{2}\sin\omega t + 3\sqrt{2}\sin(\omega t + \frac{\pi}{2})$

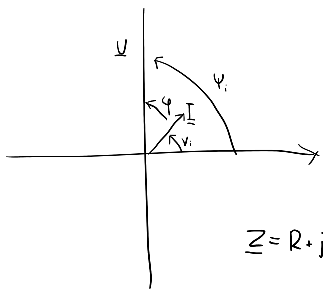
$\underline{I}(t) = 2\sqrt{2}\,e^{j\omega t} + 3\sqrt{2}\,e^{j(\omega t + \frac{\pi}{2})}$

$\underline{I} = \frac{\underline{I}(t=0)}{\sqrt{2}} = 2e^{0} + 3e^{j\frac{\pi}{2}} = 2 + j3$

$u(t) = 200\sqrt{2}\cos\omega t$

$\underline{U}(t) = 200\sqrt{2}\,e^{j(\omega t + \frac{\pi}{2})}$

$\underline{U} = 200\,e^{j\frac{\pi}{2}} = j200$



$\underline{Z} = R + jX$

$\underline{Z} = \frac{\underline{U}}{\underline{I}} = \frac{j200}{2+j3}\left(\frac{2-j3}{2-j3}\right) = \frac{j400+600}{13} = \frac{600}{13} + j\frac{400}{13}$

$R = Re\{\underline{Z}\} = \frac{600}{13}\ [\Omega]$

$X = I_m\{\underline{Z}\} = \frac{400}{13}\ [\Omega]$

(7)

$\underline{U} = 100 - j100 = 100\sqrt{2}\,e^{-j45^\circ}$

$\underline{I} = 3 - j4 = 5e^{-j53^\circ}$

$u(t) = 200\sin(\omega t - 45^\circ)$

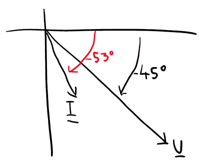
$i(t) = 5\sqrt{2}\sin(\omega t - 53^\circ)$

$\underline{Z} = \frac{100-j100}{3-j4} = \frac{300+j400-j300+400}{25} =$

$= \frac{700}{25} + j\frac{100}{25}$

$\underline{Z} = \frac{100\sqrt{2}\,e^{-j45^\circ}}{5e^{-j53^\circ}} = 20\sqrt{2}\,e^{j8^\circ} =$

$= 20\sqrt{2}\cos(8^\circ) + j20\sqrt{2}\sin(8^\circ)$



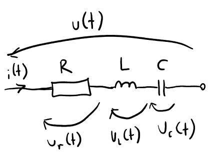
$\varphi = \psi_u - \psi_i = 8^\circ$

(8)

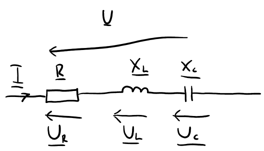
$R = 10\,\Omega$

$L = 40\,mH$

$C = 2{,}5\,mF$



$\Rightarrow$



$\omega L = X_L = 4\,[\Omega]$

$X_C = \frac{1}{\omega C} = 4\,[\Omega]$

$u(t) = u_R(t) + u_L(t) + u_C(t)$

$C = 2{,}5\,mF$

$\omega L = X_L = 4\,[\Omega]$ $\quad X_C = \frac{1}{\omega C} = 4\,[\Omega]$

$i(t) = 10\sin(100t) \rightarrow \underline{I} = \frac{10}{\sqrt{2}} e^{j0^\circ} = 5\sqrt{2}$

$u(t) = u_R(t) + u_L(t) + u_C(t)$

$\underline{U} = \underline{U_R} + \underline{U_L} + \underline{U_C}$

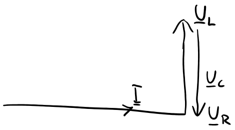
$\underline{U_R} = R\underline{I} = 10 \cdot 5\sqrt{2} = 50\sqrt{2}$

$\underline{U_L} = jX_L\underline{I} = j4 \cdot 5\sqrt{2} = j20\sqrt{2} = 20\sqrt{2}\,e^{j\frac{\pi}{2}}$

$\underline{U_C} = -jX_C\underline{I} = -j4 \cdot 5\sqrt{2} = -j20\sqrt{2} = 20\sqrt{2}\,e^{-j\frac{\pi}{2}}$

$\underline{U} = 50\sqrt{2} + j20\sqrt{2} - j20\sqrt{2} = 50\sqrt{2} \rightarrow u(t) = 100\sin(100t)$

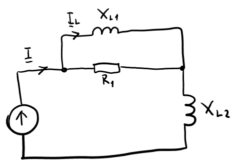
$u_R(t) = 100\sin(100t)$



$u_L(t) = 40\sin(100t + \frac{\pi}{2})$

$u_C(t) = 40\sin(100t - \frac{\pi}{2})$

9



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

$\underline{Z} = \frac{R_1\, jX_{L1}}{R_1 + jX_{L1}} + jX_{L2} = \frac{10 \cdot j10}{10 + j10} + j5 = 5 + j5 + j5 = 5 + j10$

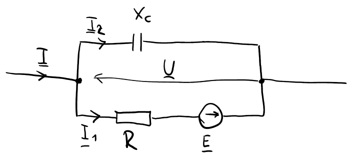
$\underline{U} = \frac{100}{\sqrt{2}} \qquad \underline{I} = \frac{\underline{U}}{\underline{Z}} = \frac{50\sqrt{2}}{5 + j10}$

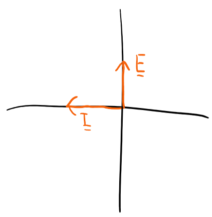
$\underline{I_L} = \underline{I}\,\frac{R_1}{R_1 + jX_{L1}} = \frac{10}{10 + j10} \cdot \left(\frac{50\sqrt{2}}{5 + j10}\right)$

$\underline{I_R} = \underline{I} - \underline{I_L}$

KOLOS: 9/10/11/12/13/14

15





$i_2(t) = \sin(10t - \pi)$

$\underline{I_2} = -\frac{\sqrt{2}}{2}$

$e(t) = \cos(10t) = \sin(10t + \frac{\pi}{2})$

$\underline{E} = j\frac{\sqrt{2}}{2}$

$\underline{I} = \underline{I_1} + \underline{I_2}$

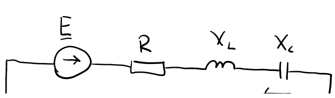
$\underline{U} = -jX_C\underline{I_2}$

$\underline{U} = R\underline{I_1} - \underline{E}$

$R\underline{I_1} - \underline{E} = -jX_C\underline{I_2}$

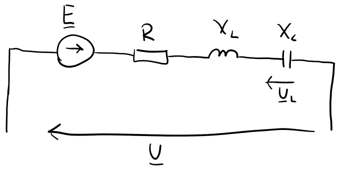
$\underline{I_1} = \frac{-jX_C\underline{I_2} + \underline{E}}{R}$

16



$X_L = \omega L = 2 \cdot 1 = 2$

(16)



$$\underline{U} = \underline{Z}\,\underline{I} - \underline{E} = \left[R + j(X_L - X_c)\right]\frac{\underline{U}_c}{-jX_c} - \underline{E} =$$

$$= \left(2 + j\left(2 - \frac{1}{2}\right)\right)\frac{\frac{\sqrt{2}}{2}}{-j\frac{1}{2}} - j\frac{\sqrt{2}}{2} = A + jB$$

$X_L = \omega L = 2 \cdot 1 = 2$

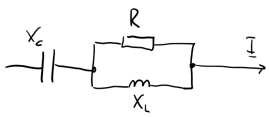
$X_c = \frac{1}{\omega C} = \frac{1}{2 \cdot 1} = \frac{1}{2}$

$u_c(t) = \sin(2t)$

$\underline{U}_c = \frac{\sqrt{2}}{2}$

$e(t) = \cos(2t) \rightarrow \underline{E} = j\frac{\sqrt{2}}{2}$

(17)



$i(t) = 5\sqrt{2}\cos(\omega t - 45^\circ) = 5\sqrt{2}\sin(\omega t + 45^\circ)$

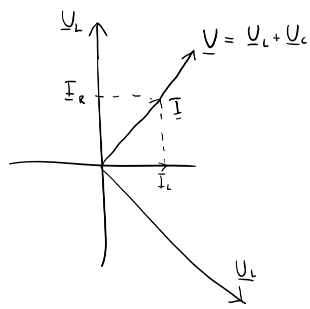
$\underline{I} = 5e^{j45^\circ}$

$R = X_L = 10\,\Omega$

$X_c = 5\,\Omega$

$$\underline{I}_R = \underline{I}\,\frac{jX_L}{R + jX_L} = 5e^{j45^\circ}\,\frac{j10}{10 + j10} = 5e^{j45^\circ}\,\frac{e^{j45^\circ}}{\sqrt{2}\,e^{j45^\circ}} =$$

$$= \frac{5}{\sqrt{2}}\,e^{j90^\circ} = j\,\frac{5\sqrt{2}}{2}$$



$$\underline{U}_c = -jX_c \cdot \underline{I} = -j\,5 \cdot 5e^{j45^\circ} =$$

$$= 5e^{-j90^\circ} \cdot 5e^{j45^\circ} = 25e^{-j45^\circ}$$

$\underline{U}_L = R \cdot \underline{I}_R = 10 \cdot j\frac{5\sqrt{2}}{2} = j25\sqrt{2}$

$\underline{U} = \underline{U}_L + \underline{U}_c = j25\sqrt{2} + 25\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) = 25\frac{\sqrt{2}}{2} + j25\frac{\sqrt{2}}{2}$

$\underline{Z} = -j5 + \frac{10\,j10}{10 + j10} = -j5 + 5 + j5 = 5$

Napięcie jest w fazie z prądem