$u(t) = U\sqrt{2}\sin(\omega t)$ $\qquad A(t) = A\sin(\omega t)$

$U_m \Rightarrow \boxed{U = \frac{U_m}{\sqrt{2}}}$

R $\quad i(t) = \frac{u(t)}{R} = \frac{U\sqrt{2}}{R}\sin(\omega t) =$

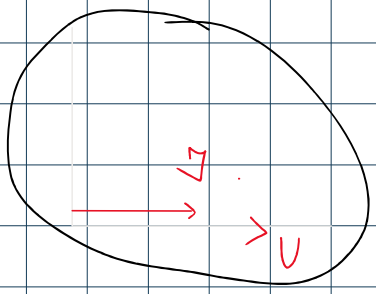
$= I\sqrt{2}\sin(\omega t)$

I_m

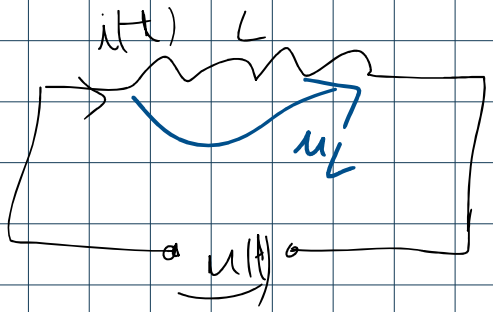
$\omega = 2\pi f = \frac{2\pi}{T}$

$f = \frac{1}{T}$

f - frecventa [Hz]
T - perioada [s]



L $\quad X_L = \omega L \quad [\Omega]$ inductivitate



$u_L = L\frac{di}{dt}$

$i(t) = I_m \sin(\omega t + \varphi)$

$\Rightarrow \frac{di}{dt} = \omega I_m \cos(\omega t + \varphi)$

$$\Rightarrow \frac{di}{dt} = \omega I_m \cos(\omega t + \varphi)$$

$$u = u_L = U_m \sin(\omega t)$$

curentul care trece prin L defazat în urmă față de tensiune cu $\frac{\pi}{2}$

ex. 3.3.3

$R \Rightarrow R$

$L \rightarrow jX_L = j\omega L$

$C \rightarrow -jX_C = \frac{1}{j\omega C}$

$u(t) = 100\sqrt{2}\sin(100\pi t - 60)\ V.$

$X_L = \omega L = 100\pi \cdot \frac{6}{10\pi} =$

$= 60\ \Omega$

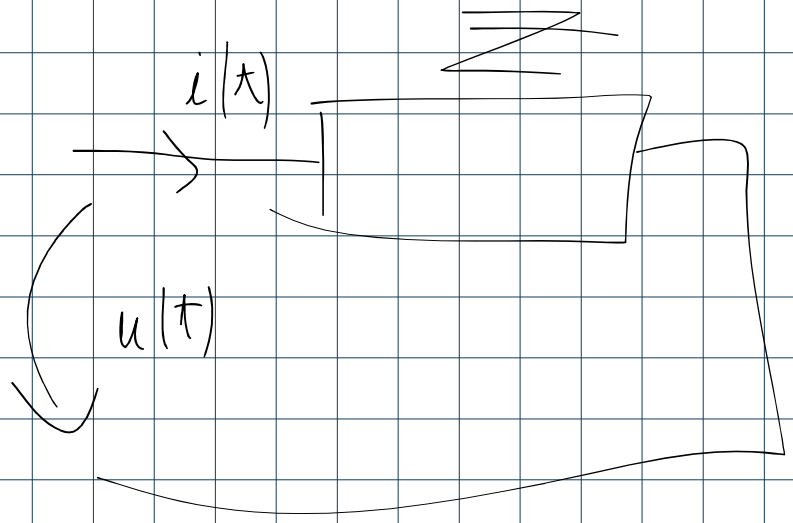
$X_C = \frac{1}{\omega C} = \frac{1}{100\pi \frac{1}{3\pi} \cdot 10^{-3}} =$

$= 3 \cdot 10 = 30\ \Omega$

$$\underline{Z} = \sqrt{R^2 + (X_L - X_C)^2} =$$

$$X$$

$$= 50\angle 0$$



$$U = J \cdot Z$$

$$\Rightarrow J = \frac{U}{Z} = \frac{100}{50} = 2\,A$$

$$X_L > X_C \Rightarrow \text{C. ind.}$$

$$\varphi = \operatorname{arctg} \frac{X}{R} = \operatorname{arctg} \frac{X_L - X_C}{R}$$

$$\varphi = \operatorname{arctg} \frac{30}{40} = 37^\circ$$

$\varphi = \arctg \frac{X_L}{40} = 37°$

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

$= 2\sqrt{2}\sin(100\pi t - 60° - 37°) =$

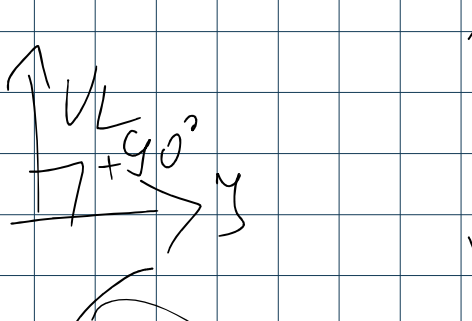
$= 2\sqrt{2}\sin(100\pi t - 97°)$ (A)

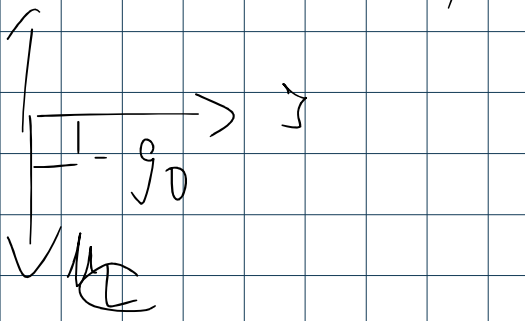
$U_R = I \cdot R = 2 \cdot 40 = 80\,V$

$u_R(t) = 80\sqrt{2}\sin(100\pi t - 97°)$

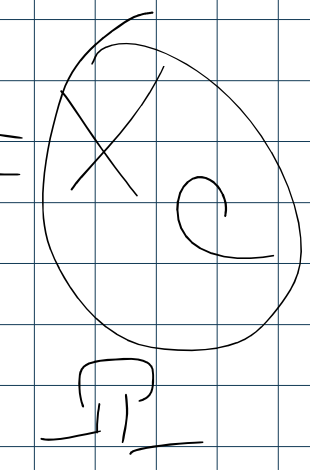
$U_L = I X_L = 120\,V$

$u_L(t) = 120\sqrt{2}\sin(100\pi t - 97° + 90°)$





$U_C = X_C \cdot I = 30 \cdot 2 = 60\,V$



$$u_C(t) = 60\sqrt{2}\,\sin(100\pi t - 97^\circ - 90^\circ) =$$

$$= - \quad - \quad -$$

$$\cos x = \sin\left(x + \frac{\pi}{2}\right)$$

$$-\cos x = \sin\left(x - \frac{\pi}{2}\right)$$

$$u_1(t) = 2\sqrt{2}\cos(\omega t + 30^\circ) =$$

$$= 2\sqrt{2}\,\sin(\omega t + 30^\circ + 90^\circ) =$$

$$= 2\sqrt{2}\,\sin(\omega t + 120^\circ)$$

$$u_2(t) = 5\sqrt{2}\,\sin(\omega t + 30^\circ)$$

$$\Rightarrow \underline{U_1} = \frac{U_m}{\sqrt{2}} e^{j\varphi} = U e^{j\varphi} =$$

$$= 2\, e^{j 120^\circ 30^\circ}$$

$$\underline{U_2} = 5\, e^{j 30^\circ}$$

$$\underline{U} = \underline{U_1} + \underline{U_2} = (\quad e^{j 30^\circ})$$

$$\underline{U} = \underline{U_1} + \underline{U_2} = \left(7 e^{j 30^\circ}\right)$$

$$u(t) = u_1(t) + u_2(t) =$$

$$= 7\sqrt{2} \sin(\omega t + 30^\circ)$$

$$-j \Rightarrow e^{-j 90^\circ}$$

$$j \Rightarrow e^{j 90^\circ}$$

$$\underline{U_1} = 2 e^{j 120^\circ} =$$

$$= 2 (\cos 120^\circ + j \sin 120^\circ) =$$

$$= Re + j Im$$

$$\varphi = \operatorname{arctg} \frac{Im}{Re}$$

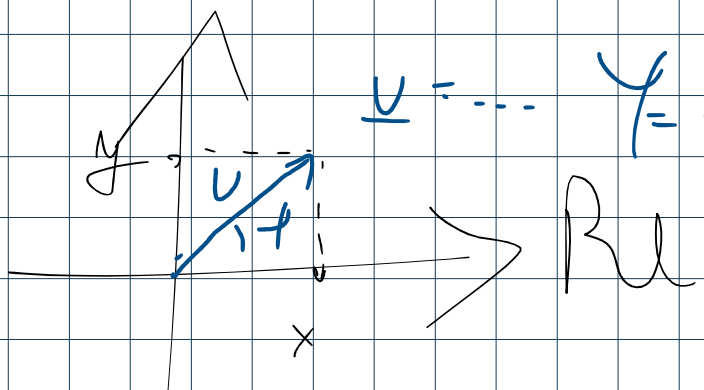
$$\underline{U_2} = 5 e^{j 30^\circ} =$$

$$= 5 (\cos 30^\circ + j \sin 30^\circ) =$$

$Re_1 + j\,Im_1$

$\underline{U} = \underline{U}_1 + \underline{U}_2 = (Re_1 + Re_2) + j(Im_1 + Im_2)$

$Im = \ldots e^{j\ldots}$



$U = \ldots \quad \varphi = \operatorname{arctg} \frac{y}{x}$

$\Rightarrow u(t) = U\sqrt{2}\sin(\omega t + \varphi)$

3.6.

a) $\underline{U} = -10\,e^{j30^0}\ V$ → φ

$u(t) = ?$

$u(t) = -10\sqrt{2}\sin(\omega t + 30^0)$.

$$-\sin(\omega t + \psi) =$$

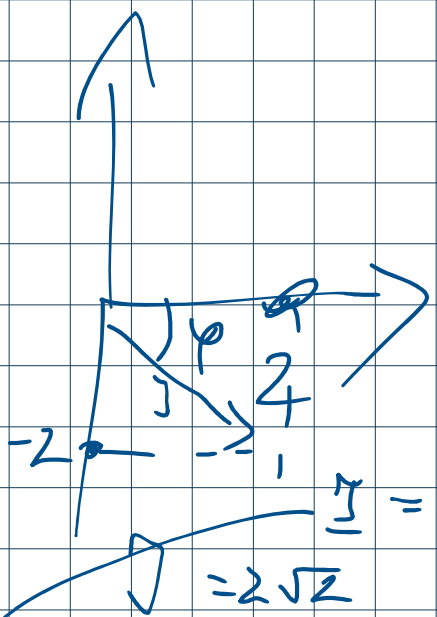
$$\sin(\omega t + \psi - 180^\circ)$$

$$I = \frac{I_m}{\sqrt{2}}$$

b) $\underline{I} = 2\sqrt{2}(\cos 45^\circ - j\sin 45^\circ) =$

$$= 2\sqrt{2}\cdot\frac{\sqrt{2}}{2} - j\,2\sqrt{2}\frac{\sqrt{2}}{2} =$$

$$= 2 - j\cdot 2$$



$$\varphi = \operatorname{arctg}\frac{-2}{2} =$$

$$= \operatorname{arctg}(-1) =$$

$$= -45^\circ$$

$\underline{I} = 2 - j2$

$= 2\sqrt{2}$

$\Rightarrow i(t) = 4\sin(\omega t - 45^\circ)$

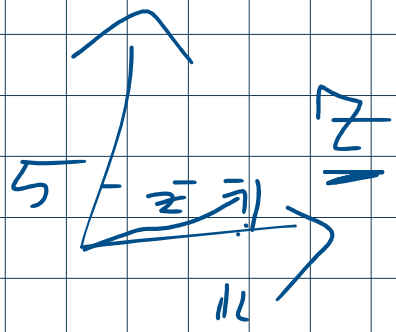
$\Rightarrow \underline{I} = 2\sqrt{2}\,e^{j(-45^\circ)}$

c) $\underline{Y} = \frac{1}{(5 - j12)}$ Ω

$\sqrt{-1} = j$

$\underline{Y} = \frac{1}{5j - (j^2 12)} =$

$= \frac{1}{12 + 5j}$



$\underline{Z} = 12 + 5j$

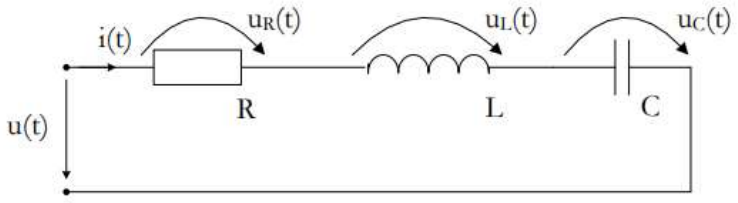
$\varphi = \operatorname{arctg} \frac{5}{12}$

$\sqrt{5^2 + 12^2} = 13$

$\underline{Y} = 13\, e^{j 23^\circ}$

$\Rightarrow i(t) = 13\sqrt{2} \sin(\omega t + 23^\circ)$

3-14 *The circuit parameters for the RLC series circuit below are $R=20\Omega$, $L = 40mH$, $C = 50\mu F$, and the supplying voltage: $u(t) = 200\ sin(1000t - 30^0)V$. Calculate: a) the inductive and capacitive reactances and the circuit impedance, X_L, X_C, Z; b) the rms and the instantaneous value of the current, I, $i(t)$; c) the rms and the instantaneous value of resistance-voltage, U_R, $u_R(t)$; d) the rms and the instantaneous value of inductance-voltage, U_L, $u_L(t)$; e) the rms and the instantaneous value of capacitance-voltage, U_C, $u_C(t)$. Draw the circuit diagram.*



Problem 3-14

a) $\omega = 1000 \frac{rad}{s}$

$X_L = \omega L = 1000 \cdot 40 \cdot 10^{-3} = 40\Omega$

$X_C = \frac{1}{\omega C} = \frac{1}{1000 \cdot 50 \cdot 10^{-6}} = \frac{100}{5} = 20\Omega$

10^{-2}

$Z = \sqrt{R^2 + (X_L - X_C)^2} =$

$= \sqrt{400+400} = 20\sqrt{2}\ \Omega$

b) $i(t)$ Z

$u(t)$

10

$$I = \frac{U}{Z} = \frac{200}{\sqrt{2}} \cdot \frac{1}{20\sqrt{2}} =$$

$$= 5 \text{ A}$$

$$\varphi = \operatorname{arctg}\left(\frac{X_L - X_C}{R}\right) = 45^0$$

$X_L > X_C \rightarrow$ c. ind.

curentul e în urmă cu 45^0

$$i(t) = 5\sqrt{2}\sin(1000t - 30^0 - 45^0) =$$

$$= 5\sqrt{2}\sin(1000t - 75^0) \text{ A}$$

c) $U_R = IR = 100 \text{ V}$

$$u_R(t) = 100\sqrt{2}\sin(\omega t - 75^0) \text{ V}$$

d) $U_L = IX_L = 200 \text{ V}$

d) $U_L = jX_L = 200\ V$

$u_L(t) = 200\sqrt{2}\sin(1000t - 75^0 + 90^0)V$

e) $U_C = -jX_C = 100V$

$u_C(t) = 100\sqrt{2}\sin(1000t - 75^0 - 90^0)V$