* ЗАДАЦИ ЗБИРКА *

- Једностепена кола простопериодичне струје -

(1) ВРЕМЕНСКИ ДОМЕН

(61) $R = 100\Omega$

$L = 10\,\mu H$

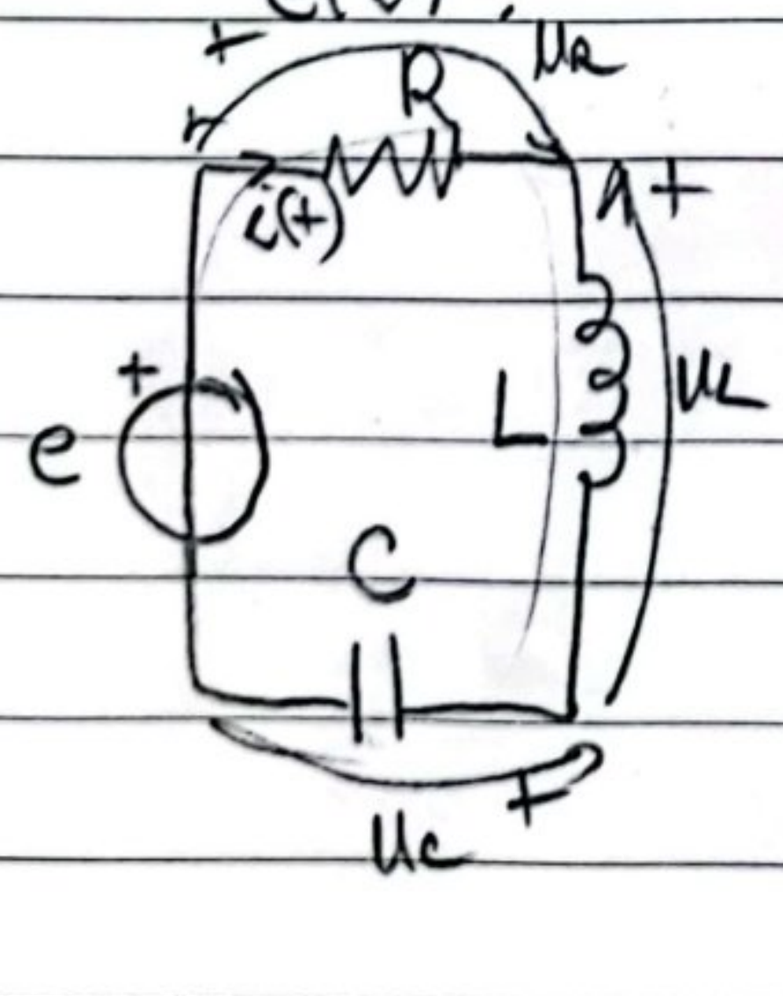
$C = 500\,pF$

$I = 10\,mA$ - ефективна вредност

$\omega = 10^4\,s^{-1}$

$\psi = \frac{\pi}{3}$

$e(i) = 0$



$e(t) = E\sqrt{2}\cos(\omega t + \Phi)$

$\vec{E} = I(Y)$ → импеданса

↑ ефективна струја

$i(t) = I\sqrt{2}\cos(\omega t + \psi)$

$u_R = R \cdot i(t) = RI\sqrt{2}\cos(\omega t + \psi)$ → напон преузет струјом

$u_L = \omega L I\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$

$u_C = \frac{1}{C}\int i(t)\,dt = \frac{1}{\omega C} I\sqrt{2}\sin(\omega t + \psi) + U_0$ напон преузет кондензатором

$= \frac{1}{\omega C} I\sqrt{2}\cos\left(\omega t + \psi - \frac{\pi}{2}\right) + U_0$ ← енергија

$-e(t) + u_R(t) + u_L(t) + u_C(t) = 0$ ∫ II К.З.

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

$e(t) = RI\sqrt{2}\cos(\omega t + \psi) + \omega L I\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right) + \frac{1}{\omega C} I\sqrt{2}\cos\left(\omega t + \psi - \frac{\pi}{2}\right) + U_0$

$U_0 = 0$

$e(t) = RI\sqrt{2}\cos(\omega t + \psi) + \left(\omega L - \frac{1}{\omega C}\right) I\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$

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

$e(t) = RI\sqrt{2}\cos(\omega t + \psi) + \left(\omega L - \frac{1}{\omega C}\right)\left(-\sin(\omega t + \psi)\right)$

$= RI\sqrt{2}\cos(\omega t + \psi) - \left(\omega L - \frac{1}{\omega C}\right) I\sqrt{2}\sin(\omega t + \psi)$

X → реактанса целог кола

$e(t) = RI\sqrt{2}\cos(\omega t + \psi) - X I\sqrt{2}\sin(\omega t + \psi)$

$e(t) = I\sqrt{2}\left(R\cos(\omega t + \psi) - X\sin(\omega t + \psi)\right)$

уврсти са $e(t) = E\sqrt{2}\cos(\omega t + \Theta)$

$\phi = \Theta - \psi \Rightarrow \Theta = \phi + \psi$

$e(t) = E\sqrt{2}\cos((\omega t + \phi) + \psi)$

$= E\sqrt{2}\left(\cos(\omega t + \phi)\cos\phi - \sin(\omega t + \phi)\sin\phi\right)$

$$e(t) = E\sqrt{2}\left(\cos(\omega t+\psi)\cos\phi - \sin(\omega t+\psi)\sin\phi\right)$$

$$e(t) = I\sqrt{2}\left(R\cos(\omega t+\psi) - X\sin(\omega t+\psi)\right)$$

$$e(t) = E\sqrt{2}\cos\phi\cos(\omega t+\psi) - E\sqrt{2}\sin\phi\sin(\omega t+\psi)$$

$$E\cos\phi = RI$$
$$E\sin\phi = XI$$

$$E^2(\cos^2\phi + \sin\phi) = I^2(R^2 + X^2)$$
$$E^2 = I^2(R^2+X^2)$$
$$E = \sqrt{I^2(R^2+X^2)}$$
$$E = I\sqrt{R^2+X^2}$$

$$E = I\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$$E = 10\cdot10^{-3}\sqrt{(100)^2 + \left(10^4\cdot 10\cdot10^{-6} - \frac{1}{10^4\cdot 500\cdot10^{-9}}\right)^2}$$

$$= 10\cdot10^{-3}\sqrt{100^2 + (100-200)^2}$$

$$= 10\cdot10^{-3}\sqrt{100^2 + (-100)^2} =$$
$$= 10\cdot10^{-3}\sqrt{10^2\cdot 1^2}$$
$$= 10\cdot10^{-3}\,100\sqrt{2}$$

$$E = \sqrt{2}$$

$$\varphi = \operatorname{arctg}\frac{X}{R} = \operatorname{arctg}\frac{\omega L - \frac{1}{\omega C}}{R}$$

$$= \operatorname{arctg}\frac{100 - 200}{100}$$

$$= \operatorname{arctg}\frac{-100}{100}$$

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

$$e(t) = \sqrt{2}\cdot\sqrt{2}\cos\left(\omega t + \operatorname{arctg}(-1) + \frac{\pi}{3}\right)$$

(Q2) $G_1 = 5\,mS$

$L = 10\,\mu H$

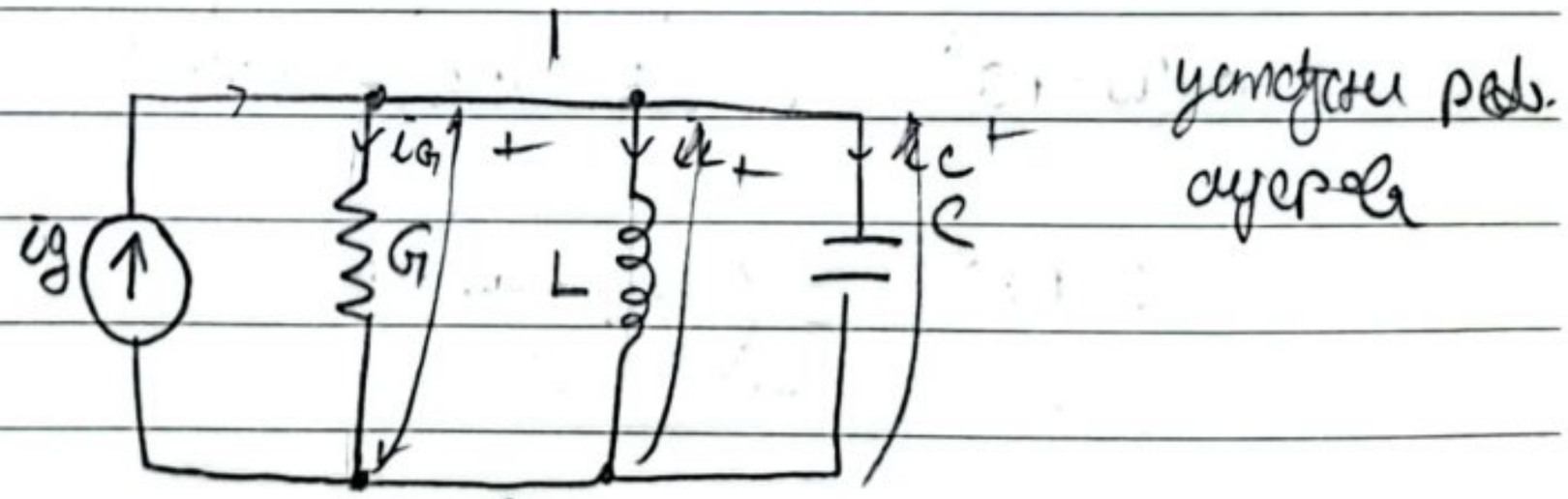
$C = 300\,pF$

$u_{12}(t) \Rightarrow U = 1V$

$\omega = 10^4\,s^{-1}$

$\varphi = \frac{\pi}{6}$

Naći struju idealnog strujnog generatora



usmjeren ka sjeveru

$u_{12}(t) = U\sqrt{2}\cos(\omega t + \varphi)$

$$i_G(t) = G \cdot u(t) = \underline{G \cdot U\sqrt{2}(\cos(\omega t + \Phi))}$$

$$i_L(t) = \frac{1}{L}\int u(t)\,dt = \frac{U\sqrt{2}}{\omega L}\cos\left(\omega t + \psi - \frac{\pi}{2}\right) + I_0$$

$$i_C(t) = C \cdot \frac{du(t)}{dt} = \omega C U\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$$

$$i_g(t) = i_G(t) + i_L(t) + i_C(t)$$

$$= G \cdot U\sqrt{2}\cos(\omega t + \Phi) + \frac{U\sqrt{2}}{\omega L}\cos\left(\omega t + \psi - \frac{\pi}{2}\right) + I_0$$

$$+ \omega C U\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$$

$$I_0 = 0$$

$$i_g(t) = G \cdot U\sqrt{2}\cos(\omega t + \Phi) + \cdots - \sin(\omega t + \psi)$$

$$= G U\sqrt{2}\cos(\omega t + \Phi) + \frac{U\sqrt{2}}{\omega L}\cos\left(\omega t + \psi - \frac{\pi}{2}\right) + \omega C U\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$$

$$= G U\sqrt{2}\cos(\omega t + \Phi) + \left(-\frac{1}{\omega L} + \omega C\right)U\sqrt{2}\cos\left(\omega t + \psi + \frac{\pi}{2}\right)$$

$$= G U\sqrt{2}\cos(\omega t + \Phi) - \left(\omega C - \frac{1}{\omega L}\right)U\sqrt{2}\sin(\omega t + \psi)$$

$$= G U\sqrt{2}\cos(\omega t + \Phi) - B U\sqrt{2}\sin(\omega t + \psi)$$

$$i_g(t) = U\sqrt{2}\left(G\cos(\omega t + \Phi) - B\sin(\omega t + \psi)\right)$$

$$i_g(t) = I\sqrt{2}\cos(\omega t + \varphi)$$

$\frac{\pi}{6} - \frac{\pi}{4}$

$\frac{4\pi - 6\pi}{24}$ $\quad -\frac{2\pi}{24}$ $\quad -\frac{\pi}{12}$

фазна разлика: $\varphi = \Theta - \gamma$

$\gamma = \Theta - \varphi$

α $\quad$ β

$ig(t) = I\sqrt{2}\cos(\omega t + \Theta - \varphi)$

$= I\sqrt{2}\left(\cos(\omega t + \Theta)\cos\varphi + \sin(\omega t + \Theta)\sin\varphi\right)$

$\bar{i}g(t) = I_g\sqrt{2}\cos\varphi\cos(\omega t + \Theta) + I_g\sqrt{2}\sin\varphi\sin(\omega t + \Theta)$

$\bar{i}g(t) = GU\sqrt{2}\cos(\omega t + \Theta) - BU\sqrt{2}\sin(\omega t + \Theta)$

$I_g\cos\varphi = GU$

$I_g\sin\varphi = -BU$

$\varphi = \operatorname{arctg}\frac{-BU}{GU}$

$\varphi = \operatorname{arctg}\frac{-B}{G}$

$\varphi = \operatorname{arctg} 1$

$\varphi = \frac{\pi}{4}$

$I_g^2(\cos^2\varphi + \sin^2\varphi) = U^2(G^2 + (-B)^2)$

$I_g^2 = U^2(G^2 + B^2)$

$I_g = \sqrt{U^2(G^2 + B^2)}$

$I_g = U\sqrt{G^2 + B^2}$

$G = \frac{1}{6}$

$\bar{I}_g = y \cdot \bar{U} \quad \Rightarrow \quad y = \sqrt{G^2 + B^2}$

$I_g = 1 \cdot \sqrt{5^2 mS + \left(\omega C - \frac{1}{\omega L}\right)^2}$

$= \sqrt{5^2(mS)^2 + \left(10^4 \cdot 500 \cdot 10^{-12} - \frac{1}{10^4 \cdot 10 \cdot 10^{-6}}\right)^2}$

$= \sqrt{(5mS)^2 + \left(10^{-5} \cdot 500 - 10^{-2}\right)}$

$= \sqrt{(5mS)^2 + \left(5 \cdot 10^{-3} \cdot 10^{-2}\right)} = \sqrt{(5mS)^2 + (-5 \cdot mS)^2}$

$= \sqrt{5mS^2 + (5mS)^2}$

$= 5\sqrt{2}\ mS$

$i(t) = 5\sqrt{2}\cdot\sqrt{2}\cos(\omega t + \Theta - \varphi)$

$= 10\cos(\omega t + \frac{\pi}{6} - \frac{\pi}{4})$

$= 10\cos(\omega t - \frac{\pi}{12})$

63

$R = 51\,\Omega$

$L = 0{,}2\,H$

$u = U_m \cos(\omega t + \Omega)$

$U_m = 155\,V$

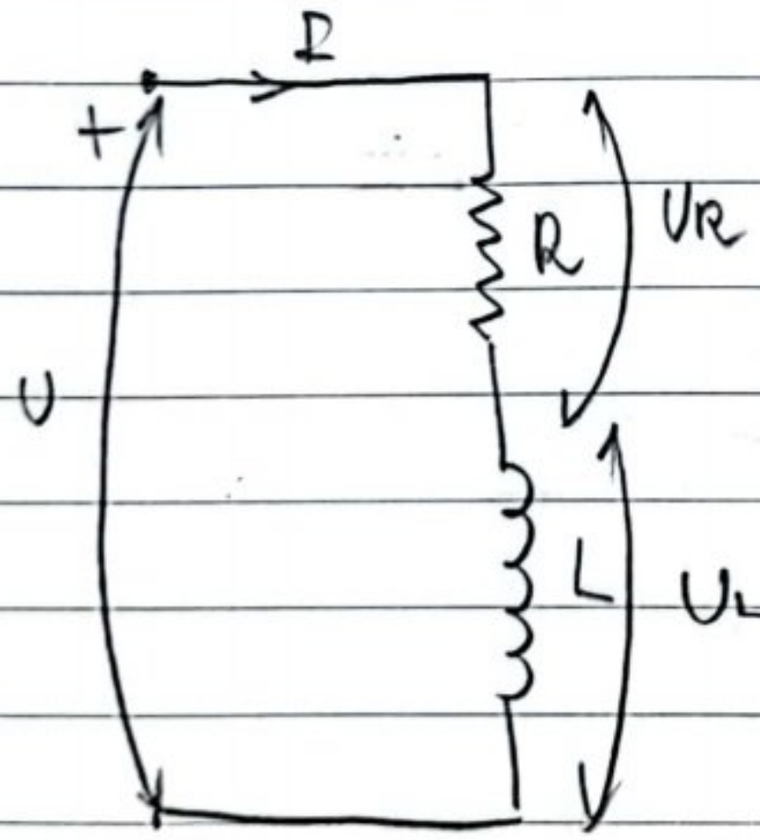
$f = 50\,Hz$

$\Omega = ?$

a) Израчунати импедансу редне везе отпорника и калема,

б) ефективну струјну и напонску фазу

в) ефективну и максималну снагу отпорника и калема



$\omega = 2\pi f$

$= 2 \cdot \pi \cdot 50\,Hz$

a) $Z = \sqrt{R^2 + (\omega L)^2} = \sqrt{51^2 + (2\pi \cdot 50 \cdot 0{,}2)^2}$ ← 63

$= \sqrt{51^2 + 63^2} \approx 81\,\Omega$

δ) $i(t) = I\sqrt{2}\cos(\omega t + \psi)$

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

$U_m = U\sqrt{2}$

$U = \frac{U_m}{\sqrt{2}} = \frac{155}{\sqrt{2}} = \underline{109,6\ V}$

$I = \frac{109,6}{81} = \underline{1,35\ A}$

фазна разлика: $\varphi = \Theta - \psi$

$\psi = \Theta - \varphi$

$\varphi = \text{arctg}\frac{\omega L}{R} = \text{arctg}\frac{63}{51} = \underline{\text{arctg}\,1,23}$

$\psi = 180° - \text{arctg}\,1,23$

б)

$U_R = I \cdot R = 51 \cdot 1,35 = 68,85\ V$

$U_L = I\ \omega L = I \cdot 2\pi f L = 1,35 \cdot 2 \cdot 3,14 \cdot 50\ 0,2 = \underline{84,78 V}$

64. $R = 20\,\Omega$

$C = 15\,\mu F$

$U = 110V \rightarrow$ ефективна вредност

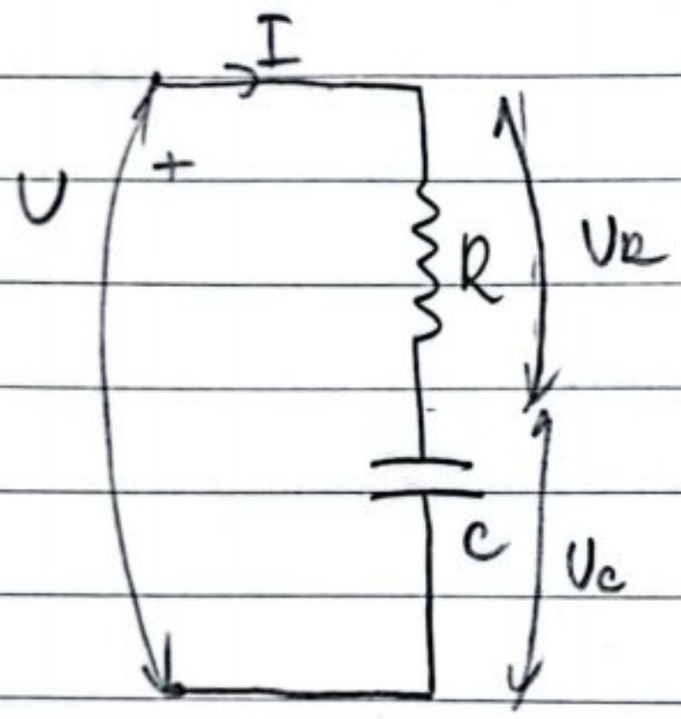
$f = 400Hz$; $\varphi = 0$ $\quad i(t)$

а) Одредити тренутну јачину струје у кол

б) Израчунати ефективну вредност напона

између и напона кондензатора

в) Израчунати фазну разлику напона кондензатор и напона U



$\omega = 2\pi f = 2512$

a) $\underline{I} = \frac{U}{\underline{Y}}$ $\quad \underline{Y} = \sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2}$

$\underline{Y} = \sqrt{20^2 + \left(\frac{1}{2512 \cdot 15 \cdot 10^{-6}}\right)^2} = 33{,}2\,\Omega$

$I = \frac{110}{33{,}2} = 3{,}31\,A$

$\varphi = 0 \quad \Phi = \varphi - \psi \quad \Phi = -\psi \Rightarrow -\Phi = \psi$

$\Phi = -\operatorname{arctg}\frac{\frac{1}{\omega C}}{R} = -\operatorname{arctg}\frac{\frac{1}{2512 \cdot 15 \cdot 10^{-6}}}{20} = \operatorname{arctg}\frac{1}{2512 \cdot 15 \cdot 10^{-6} \cdot 20}$

$= \operatorname{arctg} 1{,}32 = 53^\circ$

$\psi = 53^\circ$

$i(t) = 3{,}31\sqrt{2}\cos(\omega t + 53°)$

д) $U_R = \underline{I} \cdot R$

$U_R = 66{,}2\,V$

$U_C = \frac{1}{\omega C} I$

$U_C = \frac{1}{3512 \cdot \sqrt{5} \cdot 10^{-6}} \cdot 3{,}31 = 84{,}8\,V$

в) фазна разлика између кондензатора и отпорника U

фазна разлика између и струје кондензатора је

$\theta_c - \psi_c = -\frac{\pi}{2}$

$\phi_c = -\frac{\pi}{2}$

$\psi_c = \psi$

$\phi = \theta - \psi$

$\psi_c = \theta_c - \phi_c$

$\psi = \theta - \phi$

$\psi = \theta_c - \phi_c = \theta - \phi$

$\theta_c - \theta = \phi_c - \phi = -90° - (-53°)$

$= -90° + 53°$

$= \underline{-37°}$

Напон U_c фазно касни за струјом I за $37°$

(65) $R = 5\,\Omega$

$L = 20\,mH$

$U = 220\,V$ ef. vr.

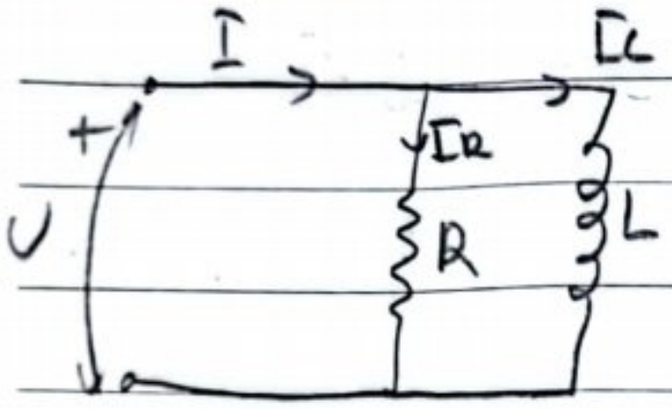
$f = 50\,Hz$

$\varphi = \frac{\pi}{6}$

a) Naći $i(t) = ?$

d) efektivne vrijednosti struja I_R, I_L

e) fazni pomeraj struje kroz i napona



$I = \frac{U}{y}$ $\quad y = \frac{1}{z}$

$$y = \sqrt{\left(\frac{1}{5}\right)^2 + \left(\frac{1}{2\pi 50 \cdot 20 \cdot 10^{-3}}\right)^2}$$

$$= \sqrt{0{,}04 + 0{,}025}$$

$$= \sqrt{0{,}065} = 0{,}255\,/$$

$I = U \cdot y$

$= 220 \cdot 0{,}253 = 56\,A$

$\varphi = \Theta - \psi$ $\quad \psi = \Theta - \varphi$

$\varphi = \operatorname{arctg}\left(\frac{\frac{1}{\omega L}}{\frac{1}{R}}\right) = \operatorname{arctg}\frac{R}{\omega L}$

$= \operatorname{arctg}\frac{5}{2\pi 50 \cdot 20 \cdot 10^{-3}}$

$$\varphi = \operatorname{arctg}\left(\frac{5}{2\pi 50\cdot 20}\cdot 10^{3}\right) \approx 0{,}672159$$

$$\Theta \approx 0{,}523599$$

$$\gamma = 0{,}523599 - 0{,}672159 = -0{,}1047\pi$$

$$= -0{,}105\ \angle$$

$$i(t) = 56\sqrt{2}\,(\cos(\omega t - 0{,}05\pi))$$

б)

$$I_R = \frac{U}{R} \qquad I_L = \frac{U}{\omega L} = \frac{220}{2\pi\cdot 50\cdot 20\cdot 10^{-3}}$$

$$I_R = \frac{220}{5} = 44A \qquad = 35{,}03\,A$$

в) ФАЗНА РАЗЛИКА СТРУЈЕ КАСКАДЕ И СТРУЈЕ НАПОЈНЕ ГРАНЕ

СТРУЈА КАСКАДЕ ФАЗНО КАСНИ ЗА НАПОНОМ $\frac{3\pi}{2}$

→ знати просторни статор

$$\varphi_L = \Theta - \gamma_L = \frac{\pi}{2} \quad \text{→)} \quad \Theta = \varphi_L + \gamma_L$$

$$\varphi = \Theta - \gamma$$

$$\Theta = \varphi + \gamma$$

$$\varphi + \gamma = \varphi_L + \gamma_L$$

$$\varphi - \varphi_L = \gamma_L - \gamma \qquad \gamma_L - \gamma = -0{,}29\,\pi$$

$$0{,}672159 - 1{,}5408$$

(66) $R = 30\,\Omega$

$C = 5\,\mu F$

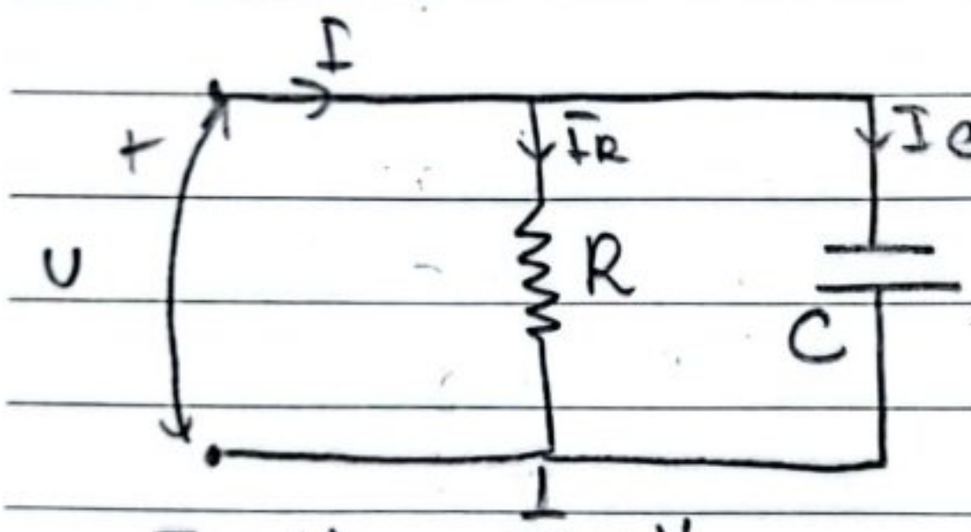
$U = 110V$ → ефективна вредност

$f = 800Hz$

$\Omega = \frac{IV}{4}$

а) Израчунати ефективне вредности струја свих грана

б) Нар. фазор фазног струје напона и струје кондензатора



$\underline{I} = \frac{\underline{U}}{\underline{Y}}$ $\quad \frac{1}{\underline{Z}} = Y$

$\underline{I} = Y \cdot U$

$$Y = \sqrt{\frac{1}{R^2} + (\omega C)^2} = \sqrt{\frac{1}{30^2} + \left(2\pi \cdot 800 \cdot 5 \cdot 10^{-6}\right)^2}$$

$$= 0{,}0414 \cdot 1000 = 41{,}4\ mS$$

$$\underline{I} = 41{,}4 \cdot 10^{-3} \cdot 110 = \boxed{3{,}59A}$$

$I_R = \frac{U}{R}$ $\quad$ $I_C = \omega C \cdot U$

$= \frac{110}{30}$ $\quad$ $= 5 \cdot 10^{-6} \cdot 110 = 5{,}5 \cdot 10^{-4} A \cdot \omega$

$= 3{,}67A$ $\quad$ $= 2{,}46A$

ц) фазна разлика струје и напона

$\Phi = \Theta - \psi$

$\Phi = \operatorname{arctg} \left(\frac{\omega C}{\frac{1}{R}}\right) = \operatorname{arctg} (\omega C R)$

$= \operatorname{arctg} (2\pi \cdot 800 \cdot 5 \cdot 10^{-6} \cdot 30)$

$= 0{,}646045 \approx 0{,}20\pi$

Знамо да струја кондензатора фазно предњачи напону за $\frac{\pi}{2}$

$\Phi_C = \Theta - \psi_C = -\frac{\pi}{2}$ $\quad$ и $\quad$ $\Phi_C = \psi_C - \Theta = \frac{\pi}{2}$

напон касни за струјом

$\Theta = \Phi + \psi$

$\Theta = \Phi_C + \psi_C$

$\Phi + \psi = \Phi_C + \psi_C$

$\psi - \psi_C = \Phi_C - \Phi$

$= -\frac{\pi}{2} - 0{,}20\pi \approx -2{,}19$

I касни за I_C

64) $R = 4\Omega$

$L = 10\,mH$

$C = 20\,\mu F$

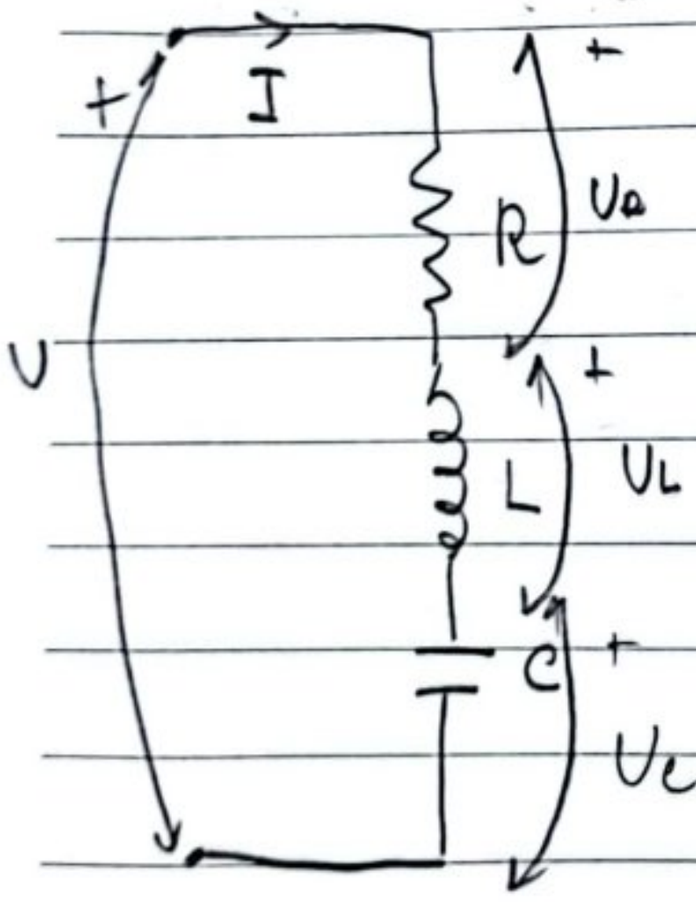
$U = 100V$

$\omega = 25\Omega\ s^{-1}$

$\varphi = -\frac{\pi}{3}$

a) Израчунати ефективну вр. и почетну фазу струје I

c) ефективне фазне разлике напона R, L, C



a) $I = \frac{U}{Z}$ $\quad Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

$= \sqrt{4^2 + \left(2512 \cdot 1010^{-3} - \frac{1}{2512 \cdot 20 \cdot 10^{-6}}\right)^2}$

$= \sqrt{4^2 + (25{,}12 - 19{,}98)^2}$

$$= \sqrt{4^2 + (3{,}22)^2} = \sqrt{16 + 24{,}24} = 6{,}54\ \Omega$$

$$I = \frac{100}{6{,}54} = 15{,}2\ A$$

$\varphi = ?$

$$\phi = \theta - \varphi$$

$$\varphi = \theta - \phi$$

$$\phi = \operatorname{arctg} \frac{\omega L - \frac{1}{\omega C}}{R} = \operatorname{arctg} \frac{5{,}22}{4} = 0{,}29\pi\ rad$$

$$\varphi = -\frac{\pi}{2} - 0{,}29\pi = -2{,}48 =$$

$$i(t) = 15{,}2\sqrt{2}\cos(250t - 2{,}48)$$

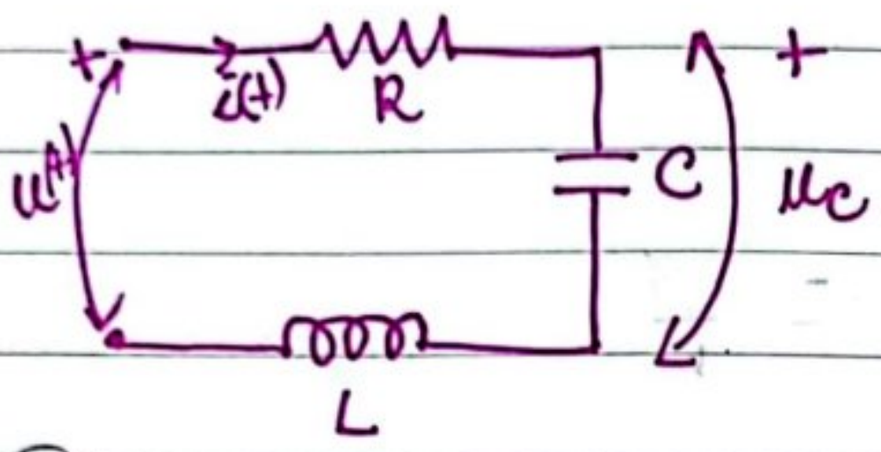
d)

$$U_R = I \cdot R = 15 \cdot 4 = 60{,}8\ V$$

$$U_R = I \cdot \omega L = 15 \cdot 10 \cdot 10^{-3} \cdot 250 = 381{,}82\ V$$

$$U_C = I \frac{1}{\omega C} = 15{,}2 \cdot \frac{1}{250 \cdot 20 \cdot 10^{-6}} = 302{,}5\ V$$

(68) За кружну са слике познато је R, L, C и напон кондензатора $u_c(t) = U_c\sqrt{2}\cos(\omega t + \Theta_c)$
Одредити извор за напон $u(t)$ између крајева кружне



Треба одредити струју $i(t)$

$$i(t) = I\sqrt{2}\cos(\omega t + \Psi)$$

$$I = \omega C \cdot U_c$$

$\Psi = ?$

знамо да струја касни фазом напона за $\frac{\pi}{2}$

$$\Phi_0 = \Theta_c - \Psi$$

$$\Theta_c - \Psi = -\frac{\pi}{2}$$

$$\Psi = \Theta_c - \left(-\frac{\pi}{2}\right)$$

$$\Psi = \Theta_c + \frac{\pi}{2}$$

$$\underline{i(t)} = \underline{\omega C U_c \sqrt{2}}\ \underline{\cos(\omega t + \Theta_c + \tfrac{\pi}{2})}$$

I

$$u(t) = U\sqrt{2}\cos(\omega t + \Theta)$$

$$U = I \cdot Z \qquad Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$$U = \omega C U_c \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$\varphi = ?$

$\phi = \varphi - \psi$

$\phi = \operatorname{arctg} \frac{\omega C - \frac{1}{\omega C}}{R}$

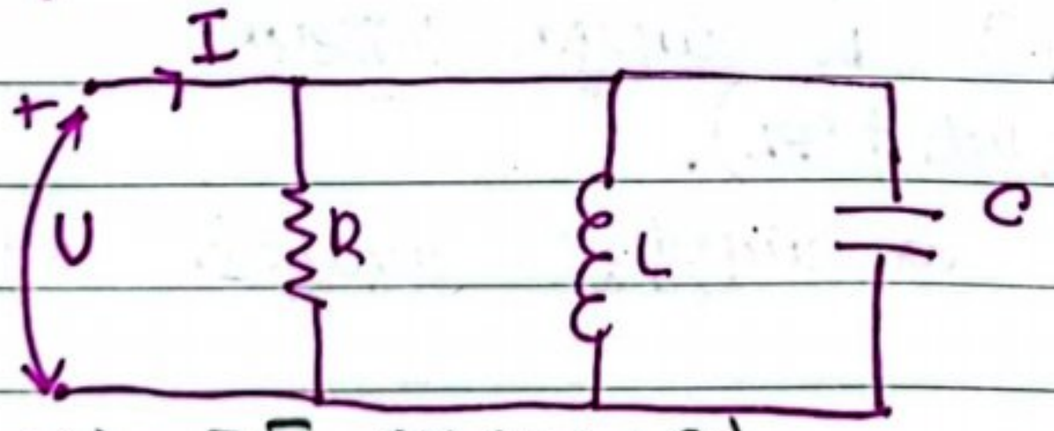
$\varphi = \phi + \psi$

$\varphi = \underbrace{\operatorname{arctg} \frac{\omega C - \frac{1}{\omega C}}{R} + \varphi_c \pm \frac{\pi}{2}}$

$u(t) = \omega C U_c \underbrace{\sqrt{R^2 + \left(\omega C - \frac{1}{\omega C}\right)^2}}_{U} \cdot \sqrt{2} \cos\left(\omega t + \underbrace{\varphi_c \pm \frac{\pi}{2} + \operatorname{arctg} \frac{\omega C - \frac{1}{\omega C}}{R}}_{\varphi}\right)$

(40) За уређај пропагирајне струје са слике, познато је R, L, C и $u(t) = U\sqrt{2}\cos(\omega t + \varphi)$

Одредити израз за тренутну јачину струје напона гране:



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

$I = \frac{U}{y} \qquad \frac{1}{y} = Y \qquad \boxed{I = YU}$

$y = \sqrt{R^2 + \left(\omega C - \frac{1}{\omega L}\right)^2}$

$$I = U\sqrt{R^2 + \left(\omega C - \frac{1}{\omega L}\right)^2}$$

$\varphi = ?$

$\phi = \Theta - \varphi$

$\varphi = \Theta - \phi$

$$\phi = -\operatorname{arct} \frac{\left(\omega C - \frac{1}{\omega L}\right)}{\frac{1}{R}}$$

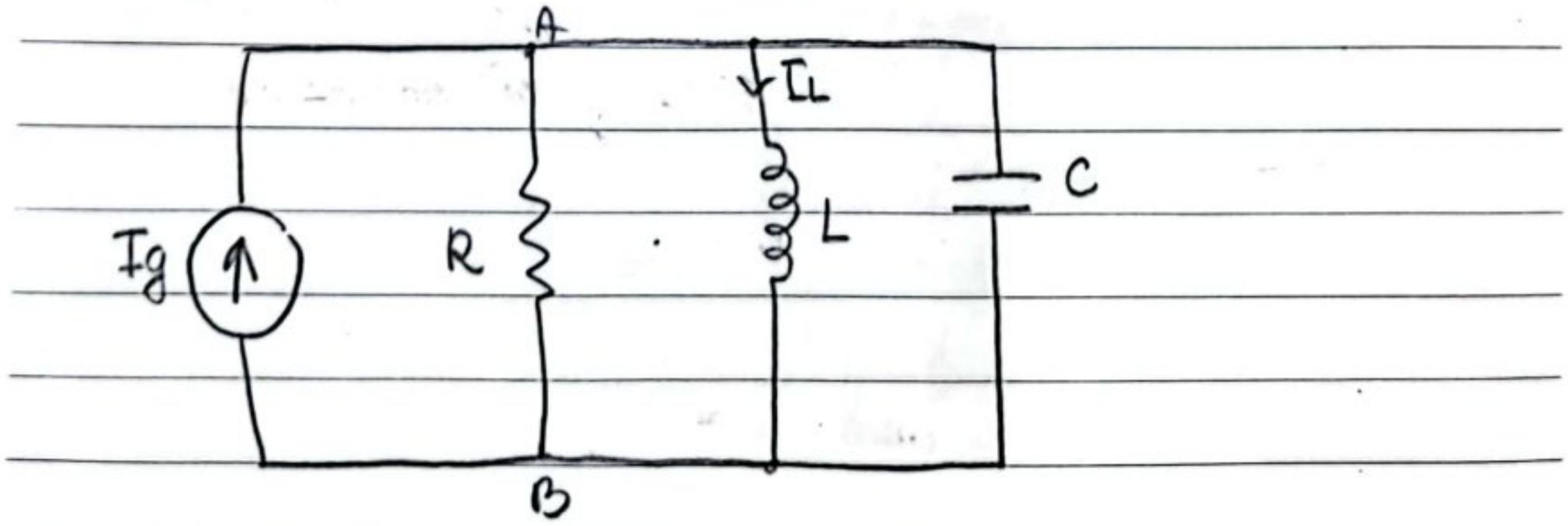
$$\phi = -\operatorname{arct}\ R \cdot \left(\omega C - \frac{1}{\omega L}\right)$$

$$\varphi = \Theta + \operatorname{arctg}\left(R\left(\omega C - \frac{1}{\omega L}\right)\right)$$

$$u(t) = \sqrt{2}\, U \sqrt{R^2 + \left(\omega C - \frac{1}{\omega L}\right)^2} \cos\left(\omega t + \Theta + \operatorname{arctg}\left(R\left(\omega C - \frac{1}{\omega L}\right)\right)\right)$$

(41) У колу простопериодичне струје са слике познато је R, L, C и струја калема $i_L(t) = I_L\sqrt{2}\cos(\omega t + \psi_L)$.

Одредити израз за струју струјног генератора $i_g(t)$



$u(t) = U\sqrt{2}\cos(\omega t + \theta)$

$U = I_L \cdot Z_L$

$U = I_L \cdot \omega L$

$\theta = ?$ знамо настна фазну продљоси струја

$\phi = \theta - \psi_L = \frac{\pi}{2}$

$\theta = \frac{\pi}{2} + \psi_L$

$u(t) = I_L \omega L \sqrt{2} \cos(\omega t + \psi_L + \frac{\pi}{2})$

$i_g(t) = I_g \sqrt{2} \cos(\omega t + \psi)$

$I_g = \frac{U}{\frac{1}{Y}} \qquad \frac{1}{Z} = Y$

$I_g = UY \qquad Y = \sqrt{R^2 + (\omega C - \frac{1}{\omega L})^2}$

$I_g = U\sqrt{R^2 + (\omega C - \frac{1}{\omega L})^2}$

$\phi = \theta - \psi \qquad \phi = \arctg \frac{-(\omega C - \frac{1}{\omega C})}{\frac{1}{R}} = -\arctg \frac{\omega C - \frac{1}{\omega C}}{\frac{1}{R}}$

$\psi = \theta - \phi$

$\psi = \theta - \left(-\arctg \frac{\omega C - \frac{1}{\omega C}}{R}\right) = \theta + \arctg \frac{\omega C - \frac{1}{\omega C}}{\frac{1}{R}}$

$i(t) = U\sqrt{2} \cdot \sqrt{R^2 + (\omega C - \frac{1}{\omega L})^2} \cos\left(\omega t + \frac{\pi}{2} + \psi_L + \arctg \left(\frac{\omega C - \frac{1}{\omega C}}{\frac{1}{R}}\right)\right)$

(42) $R = 10\Omega$

$L = 6{,}14\ mH$

$i_g(t) = 4{,}23 \cos\left(3140t_{[s]} + \frac{\pi}{4}\right)\ A.$

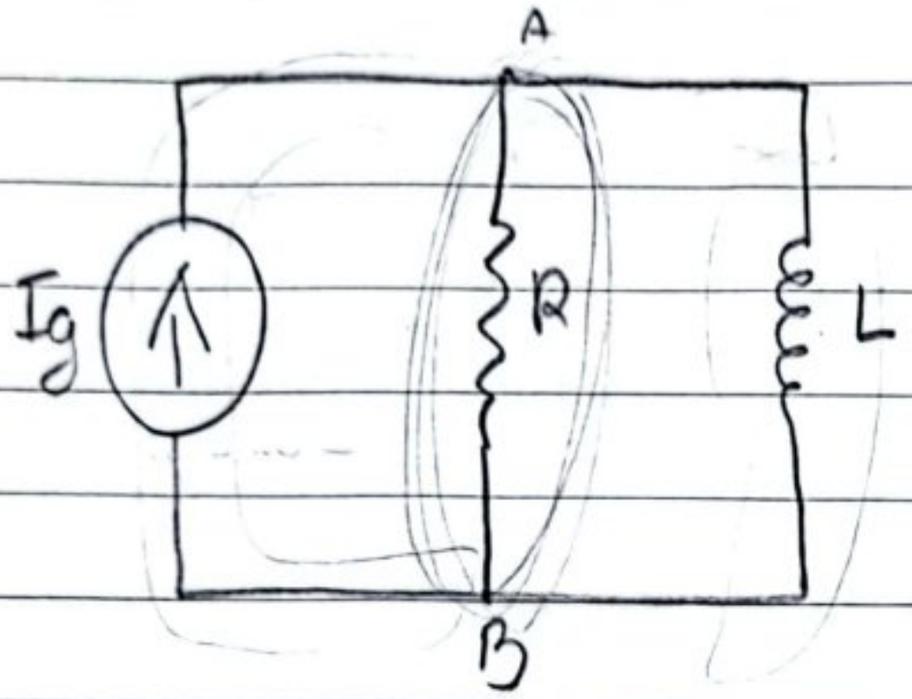
$u(t) = ?$

$I_m = I\sqrt{2}$

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

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

$I_g = 2{,}99$



$u(t) = \sqrt{2}\, U \cos(\omega t + \varphi)$

$I_R = \frac{U}{Z} \Rightarrow \frac{I}{Y} = Y$

$I_R = Y \cdot U$

$U = \frac{I_R}{Y}$

$\underline{U = 26{,}83\ V}$

$U \cdot \sqrt{2} = 34{,}9$

$Y = \sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{\omega L}\right)^2}$

$Y = \sqrt{\left(\frac{1}{10}\right)^2 + \left(\frac{1}{3140 \cdot 6{,}14 \cdot 10^{-3}}\right)^2}$

$Y = \sqrt{0{,}01 + (0{,}05)^2}$

$Y = \sqrt{0{,}0125} = 0{,}1118.$

$\theta = ?$

$\phi = \theta - \gamma \qquad \gamma = \frac{\Pi}{4}$

$\theta = \phi + \gamma$

$\phi = \operatorname{arctg} \frac{\frac{1}{\omega L}}{\frac{1}{R}} = \operatorname{arctg} \frac{R}{\omega L} = \operatorname{arctg} \frac{10}{3140 \cdot 6,4 \cdot 10^{-3}}$

$= \operatorname{arctg}\left(\frac{10}{20,096} \cdot 10^{3}\right)$

$u(t) = 34,9 \cos(\omega t + \underbrace{\operatorname{arctg} \frac{R}{\omega L} + \frac{\Pi}{4}}_{=})$?

(43) $R = 30\,\Omega$

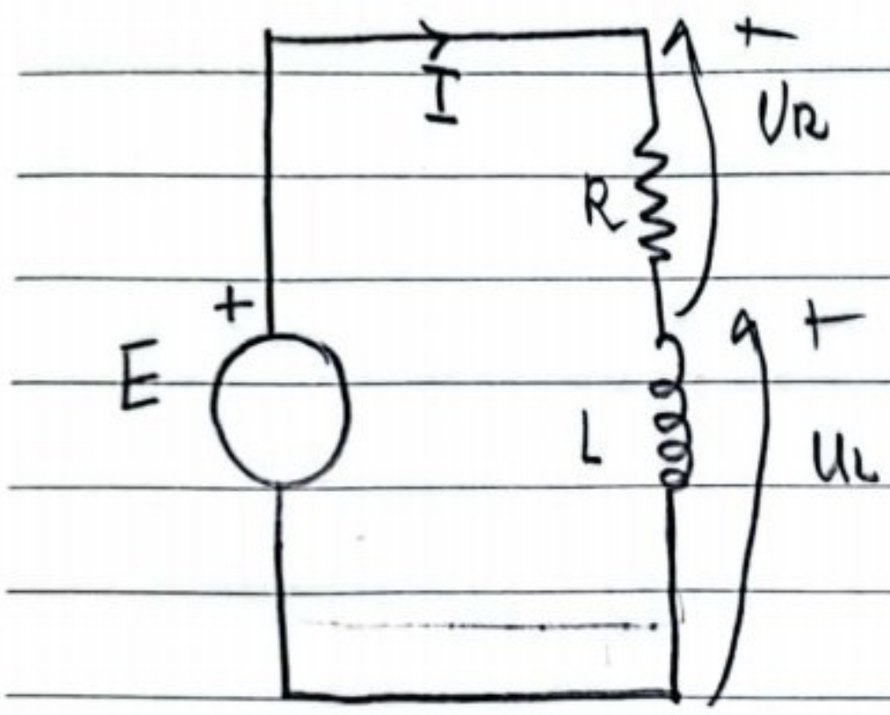
$L = 50\,mH$

$e(t) = 141 \cos\left(800t_{[s]} + \frac{\pi}{3}\right)$

a) Израчунати струју у колу:

c) наћи амплитуду, почетну фазу и период струје

$t = \frac{\pi}{200}\,s$



$e(t) = E\sqrt{2}\cos(\omega t + \Theta_e)$

$i(t) = I\sqrt{2}\cos(\omega t + \Psi)$

$I = \frac{E}{Z}$ $\quad Z = \sqrt{R^2 + (\omega L)^2}$

$Z = \sqrt{30^2 + (800 \cdot 50 \cdot 10^{-3})^2}$

$Z = \sqrt{30^2 + 40^2}$

$Z = \sqrt{2500}$

$Z = 50\,\Omega$

$E_m = 141$

$E_m = E\sqrt{2}$

$E = \frac{E_m}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$E = \frac{E_m\sqrt{2}}{2} = \frac{141\sqrt{2}}{2} = \underline{99{,}14\ V}$

$I = \frac{99{,}14}{50} = 1{,}99 \approx \underline{2A}$

$\varphi = ?$

$\phi = \varphi - \alpha$

$\varphi = \varphi - \phi$

$\phi = \operatorname{arctg}\frac{\omega L}{R} = \operatorname{arctg}\frac{800 \cdot 50 \cdot 10^{-3}}{30} \approx \underline{53^\circ}$

$\varphi = 60 - 53 = 4^\circ$

$i(t) = 2\sqrt{2}\cos(800t_{(s)} + 4^\circ)$

d) $u_R = U_R\sqrt{2}(\omega t + \varphi)$ $\quad t_1 = \frac{\pi}{200}$

$u_R = R \cdot i(t_1) = 30 \cdot 2\sqrt{2}\cos(800 \cdot \frac{\pi}{200} + 4^\circ)$ $\quad 0{,}038\pi$

$= 60\sqrt{2}\cos(4\pi + 0{,}038\pi)$

$= 84 \cdot \cos(12{,}64) \approx \underline{82\ V}$

$u_L = \omega L \cdot i(t) = \omega L \cdot 2\sqrt{2}\cos(800\frac{\pi}{200} + 0{,}038\pi + \frac{\pi}{2}) =$

$= 113{,}13\cos(14{,}24)$

(44) $R = 5\,k\Omega$

$C = 1\,\mu F$

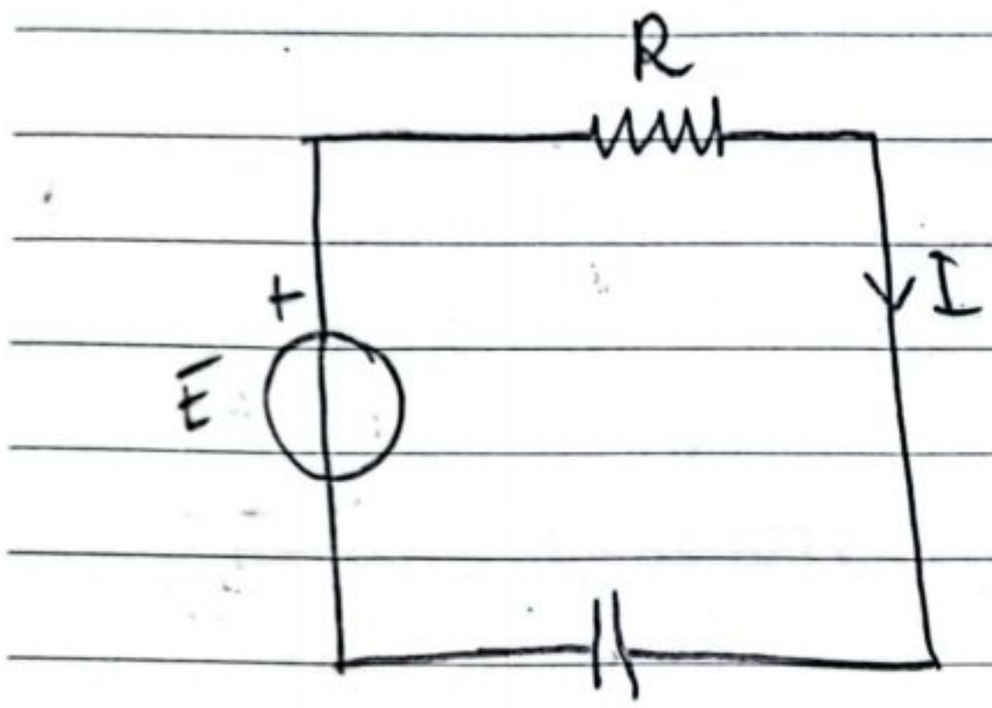
$e(t) = 100 \sin(400 t_{[s]})\ V$

za $t_1 = \frac{\pi}{200}$ sekunde

1) isključiti struje u kolu

2) mesto otpornika, kondenzatora

3) prekratiti sve ost. elem. kola



$$\bar{i}(t) = I\sqrt{2}\cos(\omega t + \psi)$$

a)

$$I = \frac{E}{Z} \qquad Z = \sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2} = \sqrt{(5\cdot 10^3)^2 + \left(\frac{1}{400\cdot 10^{-6}}\right)^2}$$

$$= \sqrt{25\,000\,000 + 2500}$$

$$E = \frac{100}{\sqrt{2}} = 70{,}71 \qquad = 5000{,}24\ \Omega \simeq \underline{5\ k\Omega}$$

$$I = \frac{70{,}71}{5\cdot 10^3} = 14{,}14\ mA$$

$$\varphi = \Theta - \psi \qquad \phi = \operatorname{arctg}\left(\frac{-\omega t C}{R}\right)$$

$$\psi = \Theta - \phi$$

$$i(t) = 14{,}14 \cdot 10^{-3} \sqrt{2} \cos\left(\omega t + \Theta^{=0} - \mathrm{arctg}\left(\frac{-\frac{1}{\omega C}}{R}\right)\right)$$

$$u_R = R \cdot i(t) = 5 \cdot 10^{3} \cdot 14{,}14 \cdot 10^{-3} \cos\left(\omega t, - \mathrm{arctg}\left(\frac{-\frac{1}{\omega C}}{R}\right)\right)$$

$$u_C = \frac{1}{\omega C} \cdot i(t) = \frac{1}{\omega C} \sqrt{2} \cos\left(\omega t, - \mathrm{arctg}\left(\frac{-\frac{1}{\omega C}}{R}\right) - \frac{\pi}{2}\right)$$

снас

тренутни снаг: отпор $p_r = u_R(t) \cdot i(t)$

конд $p_c = u_c(t) \cdot i(t)$

ген $p_e = e(t) \cdot i(t)$ =0 јер је

$p_r + p_c = p_e$

теорема одржања снаге