

$$i_0 + i_R + i_L = 0$$

$$i_0 = i_L - i_R$$

$$i_0 = -2t - 2 - i_R$$

$$i_2 = \frac{U_R}{R_S}$$

$$i_0(2) = -2 \cdot 2 - 2 - 1$$

$$U_L = L \cdot \frac{di}{dt}$$

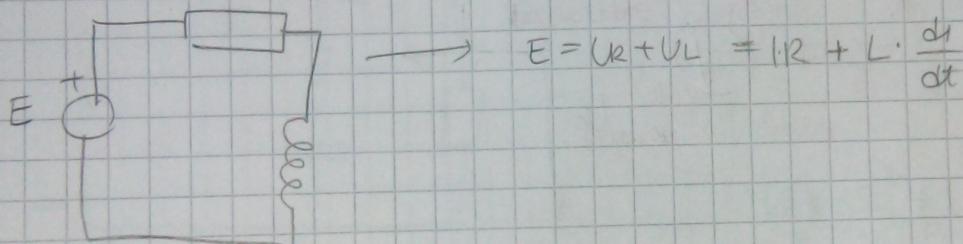
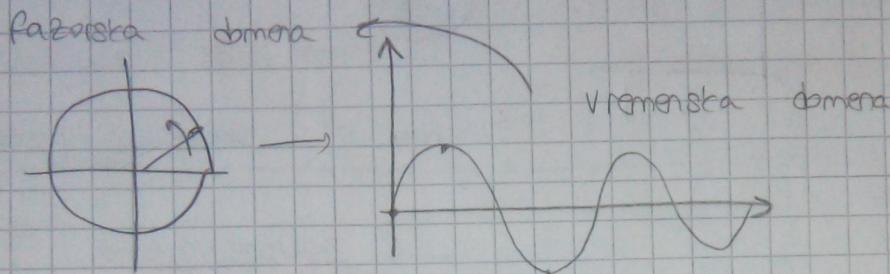
$$i_2 = \frac{1}{5}$$

$$U_L = 2,5 \cdot (-2)$$

$$i_R = 1 \text{ A}$$

$$U_L = -5 \text{ V}$$

$$= -5 - 3 = -8 \text{ A}$$

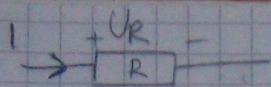


VREMENSKA DOMENA  $\rightarrow U(t) = 10 \sin(100t + 20^\circ)$

FАЗОРДОБИВАЊЕ  $\rightarrow I = \frac{\text{AMPLITУДА}}{\sqrt{2}} \cdot 20^\circ = \frac{10}{\sqrt{2}} \cdot 20^\circ$

$$I = 100 \angle 10^\circ$$

$$U(t) = 100\sqrt{2} \cdot \sin(100t - 10^\circ)$$

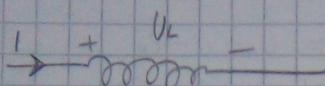


→ OTROBNIK

$$I = 10 \angle 0^\circ$$

$$R = 2 \angle 0^\circ = 2 \angle 0^\circ$$

$$U_R = I \cdot R = 10 \angle 0^\circ \cdot 2 \angle 0^\circ = 20 \angle 0^\circ$$

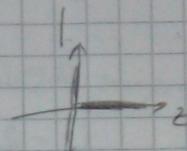


→ ZAVIJICA

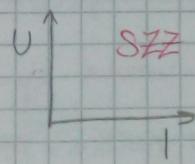
$$X_L = jL \text{ (induktivitet)}$$

$$I = 10 \angle 0^\circ$$

ao je važno! ne smjerno zaboravljati stavljati  $j$   
 $X_L = j2$  (jer će se raditi onda o otporniku)



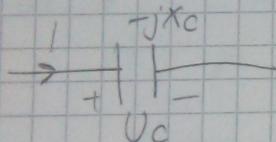
$$U_L = 10 \angle 0^\circ \cdot j2 = 10 \angle 0^\circ \cdot 2 \angle 90^\circ = 20 \angle 90^\circ$$



SZZ

→ Napon na zavojnicu preko

→ KONDenzator



$$I = 10 \angle 0^\circ$$

$$X = -j2$$

ne smjerno zaboravljati  
 stavljati  $(-j)$  jer  
 de & onda  
 raditi o zavojnici

$$U_C = I \cdot (-jX_C) = 20 \angle 90^\circ$$

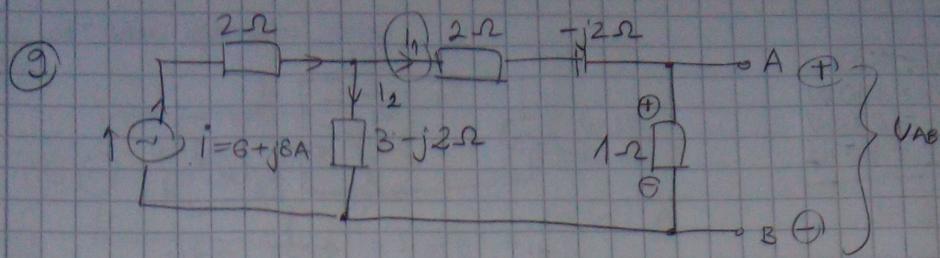
⑥

$$I = 2 + j2$$

$$I = 2\sqrt{2} \angle 45^\circ$$

$$i(t) = \frac{1}{4} \sqrt{2} \sin(\omega t + 45^\circ)$$

$$i(t=0) = 4 \sin 45^\circ \rightarrow 2,82A$$



$$I = 6 + j8A$$

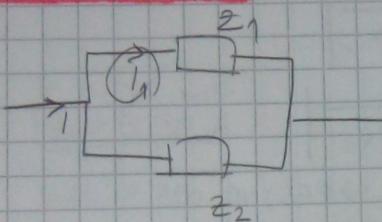
$U_{AB} = I \cdot \text{impedanija}$  od 1

$$I_1 = 1 \cdot \frac{3 - j2}{3 - j2 + 2 - j2 + 1} = 3 + j4$$

Impedanija ore boz kajne greske ne ide  
ore gdje prolazi

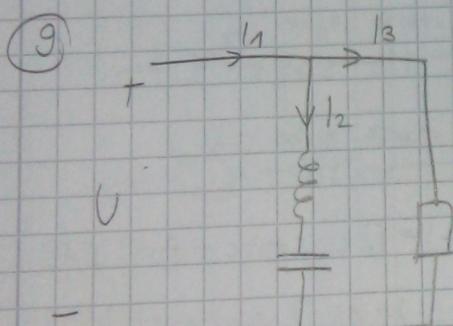
$$U_{AB} = 1 \cdot 1 = 3 + j4$$

### STRUJNO DJELOVANJE



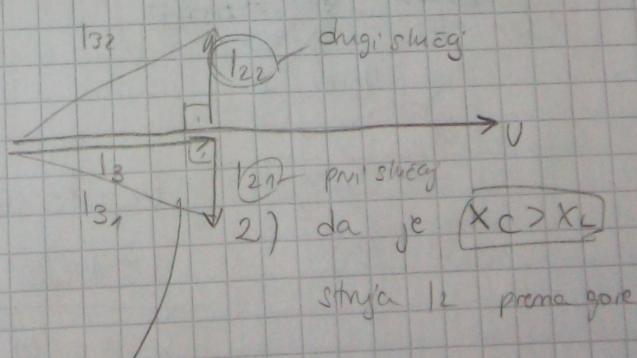
$$I_1 = 1 \cdot \frac{Z_2}{Z_1 + Z_2} = \frac{|Z_2|}{|Z_1 + Z_2|}$$

!!



$$|I_2| = 5 A$$

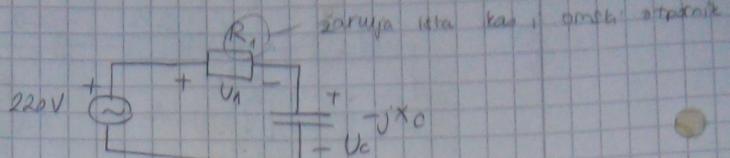
$$\frac{|I_3| = 12 A}{|I_1| = ?}$$



$$I_1 = \sqrt{I_2^2 + I_3^2} = 13 A$$

(9)

$$\begin{aligned} U_n &= 110 \text{ V} \\ P_n &= 100 \text{ W} \\ U &= 220 \text{ V} \\ f &= 50 \text{ Hz} \\ C &=? \end{aligned}$$



$$\omega = 2\pi f = 100\pi \text{ rad/s}$$

$$|U_R| = 110$$

$$\begin{aligned} U_n &= 110 \text{ V} \\ P_n &= 100 \text{ W} \\ I_R &= \frac{P_n}{U_n} = 0,91 \text{ A} \end{aligned}$$

$$R_Z = \frac{U_n}{I_Z} = 121 \Omega$$

$$U_R = |U| \left| \frac{\frac{R_Z}{Z}}{R_Z - jX_C} \right|$$

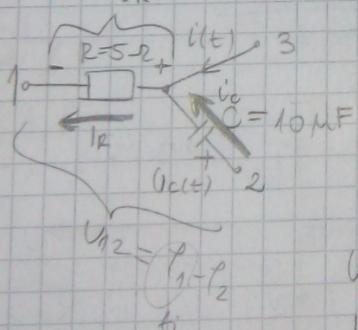
$$110 = 220 \cdot \left| \frac{121}{121 - jX_C} \right|$$

$$|121 - jX_C| = 242$$

$$\sqrt{121^2 + X_C^2} = 242$$

$$X_C = 209,6 \Omega$$

$$X_C = \frac{1}{C\omega}$$

UR

$$i(t) = \sqrt{2} \sin(10^4 t + 90^\circ) \text{ A}$$

$$U_C(t) = 10\sqrt{2} \sin(10^4 t) \text{ V}$$

$$U_{12}(t) = ?$$

$$U_C = 10 \angle 0^\circ \text{ V}$$

$$I = 1 \angle 90^\circ \text{ A}$$

$$X_C = -j10$$

$$i_C = \frac{U_C}{-j10} = 1 \angle 90^\circ \text{ A}$$

$$I_R = I + i_C = 2 \angle 90^\circ \text{ A}$$

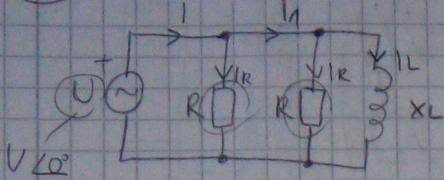
$$U_R = I_R \cdot R = 10 \angle 90^\circ \text{ V}$$

$$U_{12} = -U_C - U_R =$$

$$10\sqrt{2} \angle -135^\circ$$

$$U_{12}(t) = 20 \sin(10^4 t - 135^\circ)$$

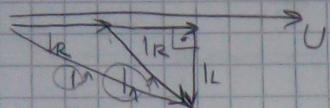
10.  $\rightarrow$  PRAĆAN ZADATAK NA MI



$$R = 20 \Omega$$

$$I = 4\sqrt{2} A$$

$$I_1 = \sqrt{20} A$$



$$1. \text{ molut (mali)} \rightarrow |I_R|^2 + |I_L|^2 = |I|^2$$

$$2. \text{ molut (veliki)} \rightarrow (2|I_R|)^2 + |I_L|^2 = |I|^2$$

$$\underline{|I_R|^2 - (2|I_R|)^2 = |I_1|^2 - |I|^2}$$

$$|I_R| = 2 A$$

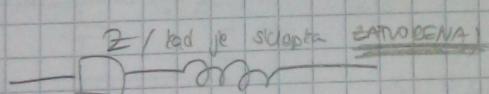
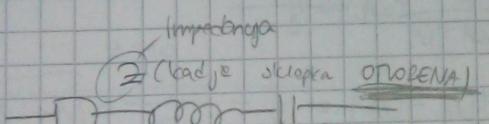
$$U = 40 V$$

9.

$$C = 0,11 \text{ mF}$$

$$|I_A| = 5,96 \text{ A}$$

$$u(t) = 110 \sin(377t) \text{ V}$$



$$U = \frac{110}{\sqrt{2}} 10^\circ$$

$$X_C = -j \frac{1}{C \omega} = -j 24,11 \Omega$$

$$|Z_1| = |Z_2|$$

$$\left| \frac{U}{Z_1} \right| = \left| \frac{U}{Z_2} \right|$$

$$|Z_1| = |Z_2|$$

$$|Z_1 + jX_C| = |Z_1 + jX_L|$$

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

$$(X_L - X_C)^2 = X_L^2$$

$$X_L - X_C = \pm X_L$$

$$\cancel{X_L \neq 0} \quad \boxed{X_L = 12,06}$$

$$X_L = j 12,06 \Omega$$

$$|Z| = \frac{|U|}{|I|} = \frac{110}{5,96} = \boxed{18,05 \Omega}$$

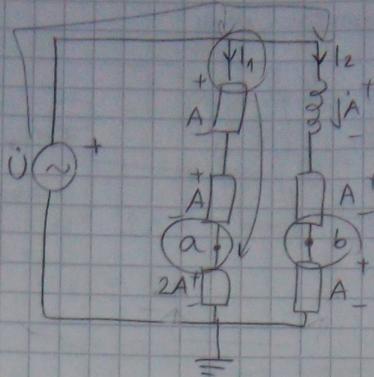
$$\sqrt{R^2 + X_L^2}$$

$$\sqrt{18,05^2 + 12,06^2} = 22,99 \Omega$$

(7)

$$R = X_L = A$$

$$\begin{aligned} U &= 10 \angle 0^\circ V \\ U_{ab} &=? \end{aligned}$$



$$I_1 = \frac{U}{A + A + 2A} = \frac{U}{4A}$$

$$I_2 = -\frac{U}{2A + jA}$$

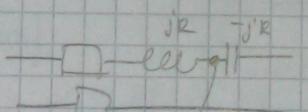
$$\begin{aligned} \varphi_A &= 0^\circ \quad I_1 \cdot 2A = \frac{U}{4A} \cdot 2A = \frac{U}{2} \\ \text{potencijal} & \quad \text{S minusna} \\ \text{tacke } A & \quad \text{na plus} \\ & \quad (\text{rasloj raste i pa} \\ & \quad \text{j je 2010 (+)}) \end{aligned}$$

$$\varphi_B = 0 + I_2 A = \frac{U}{2A + jA} \cdot A = \frac{U}{2 - j}$$

$$U_{AB} = \varphi_A - \varphi_B \quad (U_A - U_B) = \frac{U}{2} - \frac{U}{2 - j} = \boxed{U + jU}$$

## REZONANCIJE

- SERIJA → sa

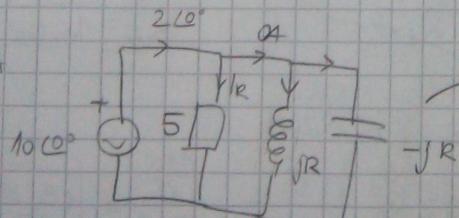


(SERIJSKA REZONANCIJA)

↳ prouzor je zavojnik  
sa krovom s objem  
(ali ne oka u  
zadatku Pita bilo  
sta od R, L ili C)

$$X_L = X_C$$

- PARALELA



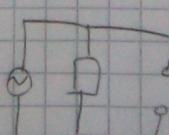
↳ 2 zavojnika je prazni krov  
(ako se ne traži rezistor na  
pojedinačnom elementu)

$$|R = 2 \angle 0^\circ$$

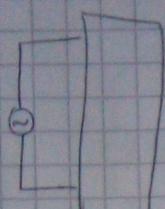
$$|L = \frac{10 \angle 0^\circ}{2 \angle 0^\circ} = 5 \angle 0^\circ$$

$$|C = \frac{10 \angle 0^\circ}{2 \angle 0^\circ} = 5 \angle 0^\circ$$

$$X_L = X_C$$



- II. OPCENITO



$$X_L = X_C \quad !$$

$$\varphi_A = 0^\circ \quad \text{but same phase}$$

$$\varphi_B = 0^\circ$$

$$\operatorname{Im}(Z) = 0$$

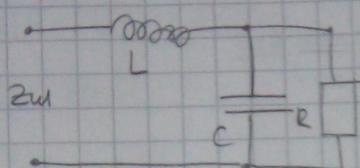
$$\varphi_C = 0^\circ$$

$$\operatorname{Im}(Y) = 0$$

impedance

admittance

(1)

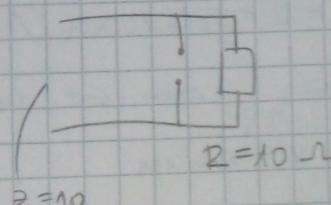


$$\omega = 0$$

DC

—ooo— kratki spoj  
—||— prazni hod

$$\omega = 0$$



$$Z = 10$$

$$\omega = \omega_{\max}$$

→ ledo je zadržujen  
spoj sema, onda  
je prazný odpis  
at impedanční

$$Z = jX_L + \frac{jX_C \cdot R}{R - jX_C} \cdot \frac{R + jX_C}{R + jX_C}$$

$$Z = 5 + j0$$

$$= jX_L + \frac{jX_C \cdot 100 + 10X_C^2}{100 + X_C^2}$$

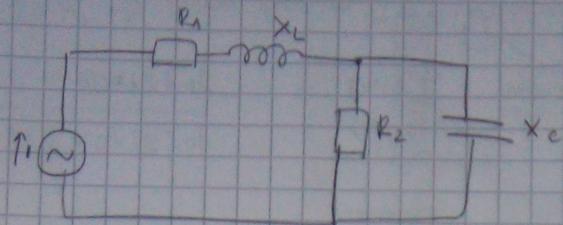
$$Z = \underbrace{\frac{10X_C^2}{100 + X_C^2}}_S + j \left( \underbrace{XL}_{0} - \underbrace{\frac{100X_C}{100 + X_C}}_0 \right)$$

$$S = \frac{10X_C^2}{100 + X_C^2}$$

:

$$X_C = 10$$

(11.)



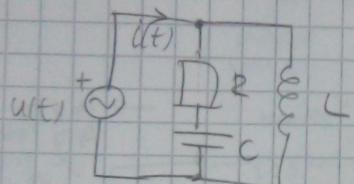
$$Z = R_1 + j50 + \frac{-j100 \cdot R_2}{R_2 - j100}$$

$$= R_1 + j50 + \frac{-j100 R_2^2 + 10000 R_2}{R_2^2 + 100^2}$$

$$\text{Im}(Z) = 0 \Rightarrow \frac{50 - 100 R_2^2}{R_2^2 + 100^2} = 0 \Rightarrow R_2 = 100$$

(ske už je)

(13.)



$$U(t) = 100 \sin(1000t) V$$

$$I(t) = 2.5 \sin(1000t) A$$

→ struja i napon pod kutom  $0^\circ$

⇒ rezonanca

$$U = \frac{100}{\sqrt{2}} \angle 0^\circ$$

$$I = \frac{2.5}{\sqrt{2}} \angle 0^\circ$$

$$Y = \frac{\frac{2.5}{\sqrt{2}} \angle 0^\circ}{\frac{100}{\sqrt{2}} \angle 0^\circ} = 0,025 + j0 \sin$$

$$y_1 = \frac{1}{Z_1} = \frac{1}{R - jX_C}$$

$$y_2 = \frac{1}{Z_2} = \frac{1}{jX_L}$$

$$y = y_1 + y_2 = \frac{1}{R - jX_C} + \left( \frac{1}{jX_L} \right) \cdot \left( \frac{j}{j} \right)$$

$$y = \frac{20 + jX_C}{400 + X_C^2} = -\frac{j}{X_L}$$

$$\text{Re}(y) = \frac{20}{400 + X_C^2} = 0,025$$

$$\text{Im}(y): \frac{X_C}{400 + X_C^2} - \frac{1}{X_L} = 0$$

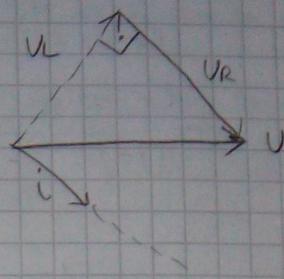
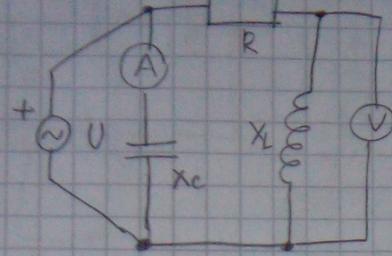
$$0,025 = \frac{20}{400 + X_C^2}$$

$$(X_C = 20 \Omega)$$

$$X_L = \frac{400 + 20^2}{20} = 40 \Omega$$

$$L = \frac{X_L}{\omega} = 0,04$$

2.

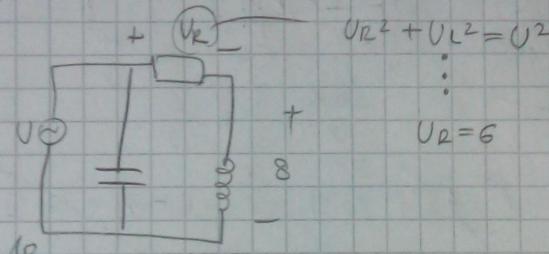


$$X_C = -j10$$

$$|U| = |11| \cdot 1 - j X_C$$

$$|U| = 10$$

$$U = 10 \angle 0^\circ$$



$$\begin{aligned} Y &= \frac{1}{-j10} + \frac{1}{R+jX_C} \quad (\text{nece korbake smz prestaroli}) \\ &= j\frac{1}{10} + \frac{R-jX_L}{R^2+X_L^2} \end{aligned}$$

$$\operatorname{Im}(Y) = 0$$

$$\frac{1}{10} - \frac{X_L}{R^2+X_L^2} = 0$$

$$\hookrightarrow 10X_L = R^2 + X_L^2$$

$$|I_{eff}| = \frac{|U_R|}{|R|} = \frac{|U|}{|X_L|}$$

$$\hookrightarrow X_L = R \cdot \frac{U_L}{U_R}$$

$$X_L = \frac{4}{3}R$$

$$10 \cdot \frac{4}{3}R = R^2 + \frac{16}{9}R^2$$

$$\hookrightarrow R = 4,8 \Omega$$