

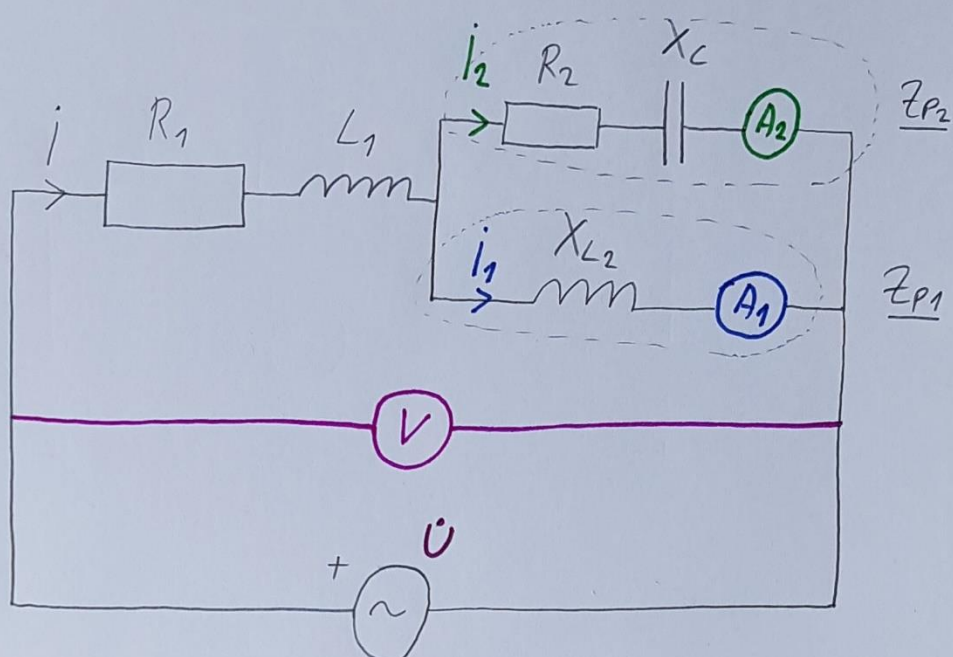
1.6

$$|R_1| = |R_2| = |X_{L1}| = |X_c| = 10 \Omega$$

$$|A_1| = |i_1| = 1 \text{ A}$$

$$|A_2| = |i_2| = \sqrt{2} \text{ A}$$

$$U_V = |U| = ?$$

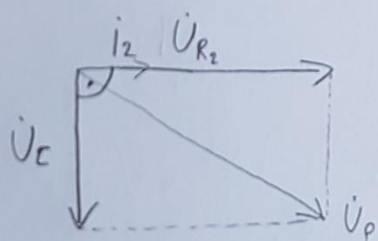


$$\underline{Z}_{P1} = X_{L2} \quad - \text{KINE ZADANO}$$

$$\underline{Z}_{P2} = R_2 + X_c = 10 - 10j \Omega$$

NAPON NA OBJEKTU PARALELE
MORA BITI JEDNAK, T.J. VRIJEDI:

$$\dot{U}_P = \underline{Z}_{P1} \cdot \dot{i}_1 = \underline{Z}_{P2} \cdot \dot{i}_2$$



$$|\dot{U}_P| = \sqrt{|\dot{U}_{R2}|^2 + |\dot{U}_C|^2}$$

$$|\dot{U}_P| = \sqrt{(|i_2| \cdot |R_2|)^2 + (|i_2| \cdot |X_c|)^2}$$

$$|\dot{U}_P| = \sqrt{2 \cdot (10\sqrt{2})^2} = 20 \text{ V}$$

$$|\dot{U}_P| = |\dot{U}_{L2}| = |i_1| \cdot |X_{L2}|$$

$$|X_{L2}| = \frac{|\dot{U}_P|}{|i_1|} = \frac{20 \text{ V}}{1 \text{ A}} = 20 \Omega$$

$$X_{L2} = 20 \angle 90^\circ \Omega = \underline{Z}_{P1}$$

$$\underline{Z}_P = \frac{\underline{Z}_{P1} \cdot \underline{Z}_{P2}}{\underline{Z}_{P1} + \underline{Z}_{P2}} = 20 \angle 0^\circ \Omega$$

PRETPOSTAVIT ČEMO NUT STRUJE i_1
OD 0° . $\Rightarrow i_1 = 1 \angle 0^\circ \text{ A}$

$$\underline{Z}_{P1} \cdot \dot{i}_1 = \underline{Z}_{P2} \cdot \dot{i}_2$$

$$\dot{i}_2 = \frac{\underline{Z}_{P1}}{\underline{Z}_{P2}} \cdot \dot{i}_1 = \frac{20 \angle 90^\circ}{10 - 10j} \cdot 1 \angle 0^\circ = \sqrt{2} \angle 135^\circ \text{ A}$$

$$\dot{i} = \dot{i}_1 + \dot{i}_2 = 1 \angle 0^\circ \text{ A} + \sqrt{2} \angle 135^\circ \text{ A}$$

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

$$\dot{U} = \dot{i} \cdot \underline{Z}$$

$$\dot{U} = \dot{i} \cdot (\underline{Z}_P + R_1 + X_{L1})$$

$$\dot{U} = 1 \angle 90^\circ \cdot (20 \angle 0^\circ + 10 \angle 0^\circ + 10 \angle 90^\circ)$$

$$\dot{U} = 10\sqrt{10} \angle 108,43^\circ \text{ V}$$

$$|\dot{U}| = 10\sqrt{10} = 31,623 \text{ V} = U_V$$

1.18

$$U_{EF} = 120V$$

$$\omega = 3000 \frac{1}{s}$$

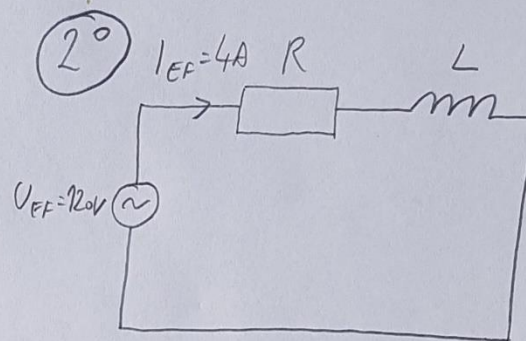
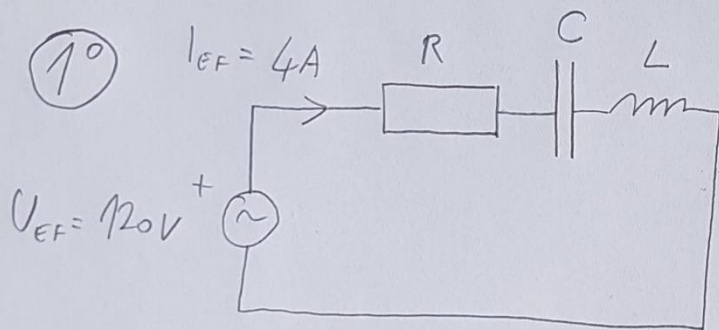
$$I_{EF} = 4A$$

$$C = 6,95 \cdot 10^{-6} F$$

$$X_C = \frac{-j}{\omega C} = \frac{-j}{3000 \frac{1}{s} \cdot 6,95 \cdot 10^{-6} F} = -47,962 j \Omega$$

$$X_C = 47,962 \angle -90^\circ \Omega$$

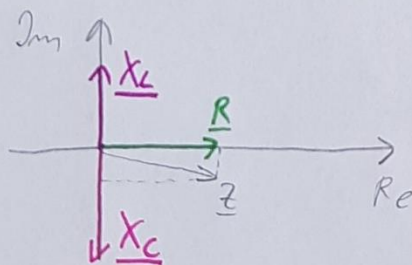
$$R = ? , L = ?$$



AMPERMETAR POKAZUJE EFektivnu VRIJEDNOST STRUJE, ŠTO NE ZNAČI DA POSRE ISTO STRUJA TEČE U OBA SLUČAJA, NEGO SAMO DA JE EFektivna VRIJEDNOST TE STRUJE ISTA U OBA SLUČAJA.

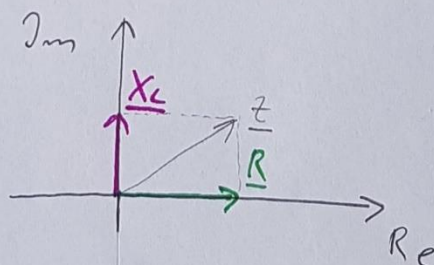
$$U_{EF} = I_{EF} \cdot |Z| \Rightarrow |Z| = \frac{U_{EF}}{I_{EF}} \Rightarrow \text{Ako je } U_{EF} \text{ i } I_{EF} \text{ jednako u oboj slučaja, mora biti i } |Z|.$$

1° $Z = R + X_C + X_L$



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

2° $Z = R + X_L$



$$|Z| = \sqrt{|X_L|^2 + R^2}$$

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

$$||X_L - X_C| = |X_L|$$

$$|X_L| = \frac{|X_C|}{2} \Rightarrow$$

$$X_L = 23,981 j \Omega$$

znano da je fazni kut između 90°

$$|X_L| = \omega L \Rightarrow L = \frac{|X_L|}{\omega} = \frac{23,981 \Omega}{3000} = 8 \text{ mH}$$

$$L = 8 \text{ mH}$$

- DRUGI OIO

1.18

$$|\underline{Z}| = \frac{U_{EF}}{I_{EF}} = \frac{120 \text{ V}}{4 \text{ A}} = \boxed{30 \Omega}$$

$$|\underline{Z}|^2 = |\underline{X}_L|^2 + |\underline{R}|^2 \Rightarrow |\underline{R}| = \sqrt{|\underline{Z}|^2 - |\underline{X}_L|^2} = \sqrt{30^2 - 23,981^2} = \boxed{18 \Omega}$$

$$\underline{R} = 18 \angle 0^\circ \Omega, \text{ T.J. } \boxed{R = 18 \Omega}$$

1.19

$$|U_{V_1}| = 36 \text{ V}$$

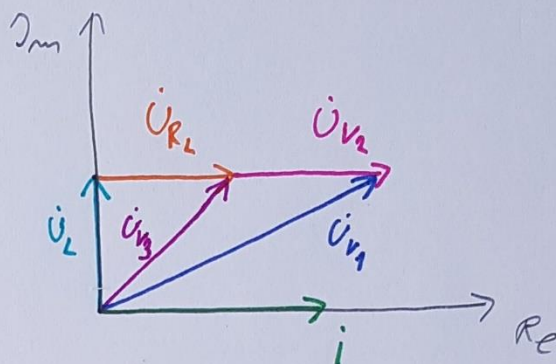
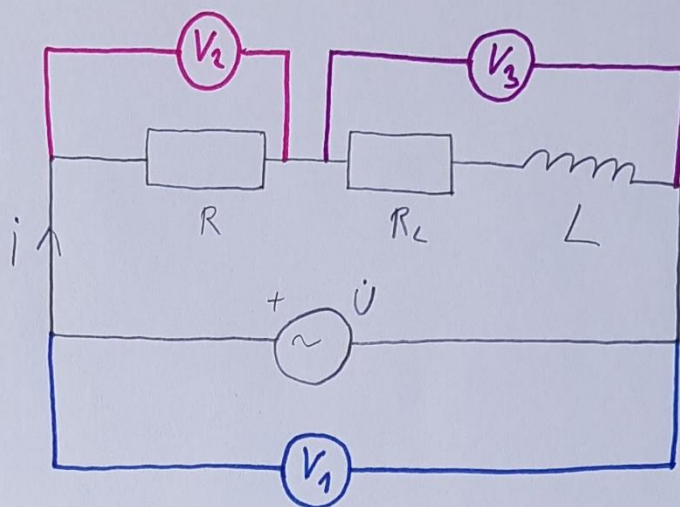
$$|U_{V_2}| = 20 \text{ V}$$

$$|U_{V_3}| = 22,4 \text{ V}$$

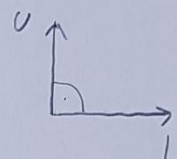
$$R = 10 \Omega$$

$$f = 50 \text{ Hz}$$

$$R_L, L = ?$$



zadovoljena



$$|\dot{U}_{V_3}|^2 = |\dot{U}_L|^2 + |\dot{U}_{R_L}|^2$$

$$|\dot{U}_{V_1}|^2 = |\dot{U}_L|^2 + (|\dot{U}_{R_L}| + |\dot{U}_{V_2}|)^2$$

$$|\dot{U}_L|^2 = |\dot{U}_{V_3}|^2 - |\dot{U}_{R_L}|^2$$

$$|\dot{U}_{V_1}|^2 = |\dot{U}_{V_3}|^2 - |\dot{U}_{R_L}|^2 + |\dot{U}_{R_L}|^2 + 2|\dot{U}_{R_L}||\dot{U}_{V_2}| + |\dot{U}_{V_2}|^2$$

$$2|\dot{U}_{R_L}||\dot{U}_{V_2}| = |\dot{U}_{V_1}|^2 - |\dot{U}_{V_2}|^2 - |\dot{U}_{V_3}|^2$$

$$|\dot{U}_{R_L}| = \frac{|\dot{U}_{V_1}|^2 - |\dot{U}_{V_2}|^2 - |\dot{U}_{V_3}|^2}{2|\dot{U}_{V_2}|} = \frac{36^2 - 20^2 - 22,4^2}{2 \cdot 20} = 9,856 \text{ V}$$

$$|\dot{U}_L| = \sqrt{|\dot{U}_{V_3}|^2 - |\dot{U}_{R_L}|^2} = \sqrt{22,4^2 - 9,856^2} = 20,115 \text{ V}$$

$$|i| = \frac{|\dot{U}_{V_2}|}{|R|} = \frac{20 \text{ V}}{10 \Omega} = 2 \text{ A}$$

$$|R_L| = \frac{|\dot{U}_{R_L}|}{|i|} = \frac{9,856 \text{ V}}{2 \text{ A}} = 4,928 \Omega$$

$$|X_L| = \frac{|\dot{U}_L|}{|i|} = \frac{20,115 \text{ V}}{2 \text{ A}} = 10,0575 \Omega$$

$$|X_L| = \omega L \Rightarrow L = \frac{|X_L|}{\omega}$$

$$L = \frac{10,0575 \Omega}{2\pi \cdot 50 \text{ Hz}} = 32,01 \text{ mH}$$

1.20

$$\varphi = -63,4^\circ$$

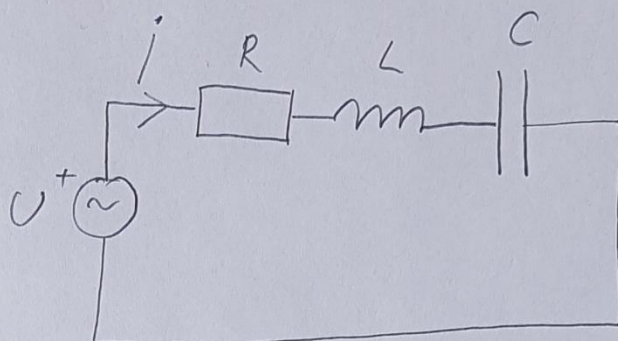
$$U = 12 \text{ V}$$

$$\omega = 400 \frac{1}{\text{s}}$$

$$L = 25 \cdot 10^{-3} \text{ H}$$

$$C = 50 \cdot 10^{-6} \text{ F}$$

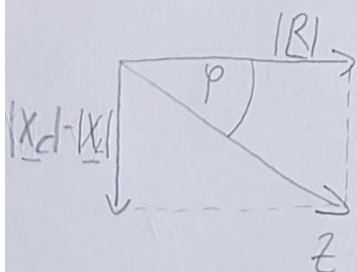
$$U_R, U_L, U_C = ?$$



$$\underline{X}_L = j \cdot \omega L = j \cdot 400 \cdot 25 \cdot 10^{-3} \frac{\text{H}}{\text{s}} = 10j \, \Omega = 10 \angle 90^\circ \, \Omega$$

$$\underline{X}_C = \frac{-j}{\omega C} = \frac{-j}{400 \frac{1}{\text{s}} \cdot 50 \cdot 10^{-6} \text{ F}} = -50j \, \Omega = 50 \angle -90^\circ \, \Omega$$

$$\underline{Z} = \underline{R} + \underline{X}_L + \underline{X}_C$$



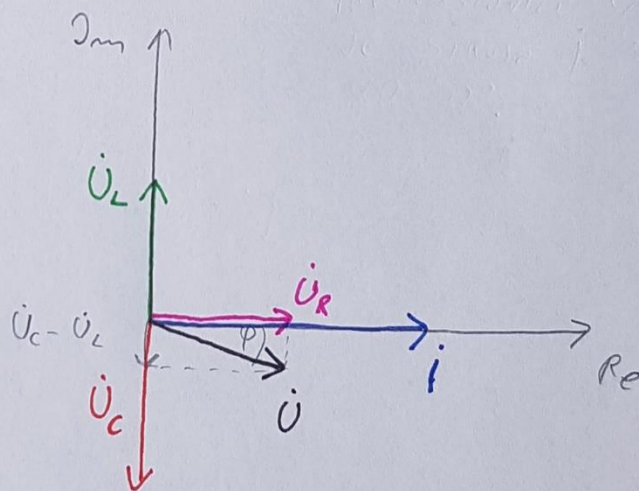
$$\tan \varphi = \frac{|\underline{X}_C| - |\underline{X}_L|}{|\underline{R}|}$$

$$|\underline{R}| = \frac{|\underline{X}_C| - |\underline{X}_L|}{\tan \varphi} = \frac{50 - 10}{\tan(63,4^\circ)}$$

$$|\underline{R}| = 20 \, \Omega$$

$$\underline{R} = 20 \angle 0^\circ \, \Omega$$

$$\underline{Z} = \underline{R} + \underline{X}_L + \underline{X}_C = 44,74 \angle -63,4^\circ$$



$$i = \frac{U}{Z} = \frac{12 \angle -63,4^\circ}{44,74 \angle -63,4^\circ} = 0,27 \angle 0^\circ \text{ A}$$

$$|U_R| = |i \cdot R| = 5,36 \text{ V}$$

$$|U_L| = |i \cdot X_L| = 2,7 \text{ V}$$

$$|U_C| = |i \cdot X_C| = 13,5 \text{ V}$$

1.24

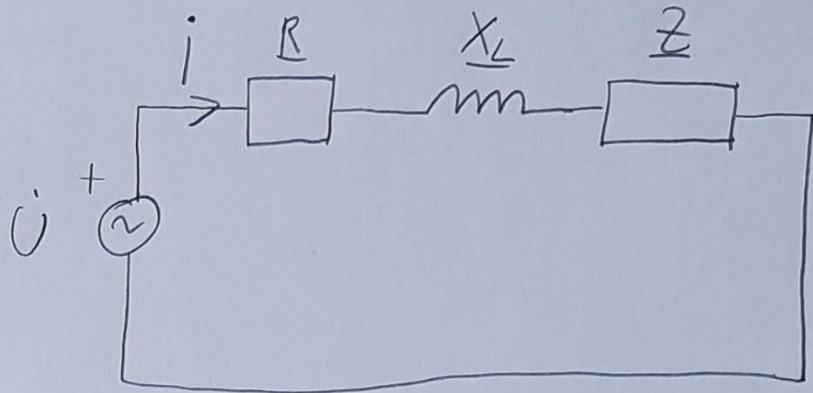
$$\dot{U} = 50 \angle 45^\circ \text{ V}$$

$$|R| = 5 \Omega \Rightarrow R = 5 \angle 0^\circ \Omega$$

$$|X_L| = 8 \Omega \Rightarrow X_L = 8 \angle 90^\circ \Omega$$

$$\dot{i} = 2,5 \angle -15^\circ \text{ A}$$

$$Z = ?$$



$$\underline{Z}_{\text{un}} = \frac{\dot{U}}{\dot{i}} = \frac{50 \angle 45^\circ \text{ V}}{2,5 \angle -15^\circ \text{ A}} = \boxed{20 \angle 60^\circ \Omega}$$

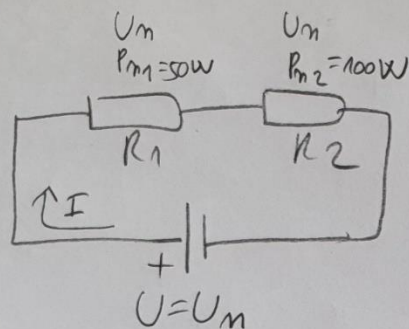
$$\underline{Z}_{\text{un}} = \underline{R} + \underline{X}_L + \underline{Z}$$

$$\underline{Z} = \underline{Z}_{\text{un}} - \underline{R} - \underline{X}_L$$

$$\underline{Z} = 20 \angle 60^\circ - 5 - j8$$

$$\boxed{\underline{Z} = 5 + j9,32 \Omega}$$

II. 2-13.



$$R_1 = \frac{U_m^2}{P_{m1}} = \frac{U_m^2}{50}$$

$$R_2 = \frac{U_m^2}{P_{m2}} = \frac{U_m^2}{100}$$

$$I = \frac{U}{R_1 + R_2} = \frac{U_m}{\frac{U_m^2}{50} + \frac{U_m^2}{100}} = \frac{U_m}{\frac{2U_m^2 + U_m^2}{100}} = \frac{100U_m}{3U_m^2}$$

$$P_1 = R_1 \cdot I^2 = \frac{U_m^2}{50} \cdot \frac{10000}{9U_m^2} = \frac{1000}{9} \text{ W}$$

$$P_2 = R_2 \cdot I^2 = \frac{U_m^2}{100} \cdot \frac{10000}{9U_m^2} = \frac{100}{9} \text{ W}$$

$$I = \frac{100}{3U_m}$$

$$P = P_1 + P_2 = \frac{1000}{9} + \frac{100}{9} = \frac{1000 + 100}{9} = \frac{1100}{9} = \frac{1500}{9} = \frac{300}{9} = 33.33 \text{ W}$$

$$P = 33.33 \text{ W}$$

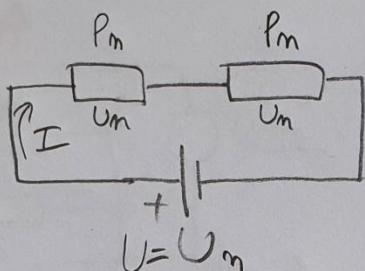
II. 2-7

P_m U_m
 \nearrow \nearrow
 NAZIUNA
 SWAGA NAZIUNI
 NAPON

ONDA TREŠTIL
 RADI OK
 NA ŽADNOM NAPONU
 I STRUJI

NPR. ŽARKOST
 SVIJETLI
 NAJBOLJE

AKO NAPON/STRUJA
 IDE PREKO
 NAZIUNIH
 VRIJEDNOSTI
 ONDA DOLAZI
 DO
 KUPOVA,
 PREGRIJAVANJA
 ...



$$P_m = \frac{U_m^2}{R}$$

$$R = \frac{U_m^2}{P_m} \quad \text{OTPOR TRAJICA}$$

$$I = \frac{U_m}{R + R} = \frac{U_m}{\frac{U_m^2}{P_m} + \frac{U_m^2}{P_m}} = \frac{U_m}{2 \frac{U_m^2}{P_m}} = \frac{P_m}{2U_m}$$

$$\Rightarrow I = \frac{P_m}{2U_m}$$

$$R_{uk} = R + R = \frac{U_m^2}{P_m} + \frac{U_m^2}{P_m} = 2 \frac{U_m^2}{P_m}$$

$$P_{uk} = I^2 \cdot R_{uk} = \frac{P_m^2}{4U_m^2} \cdot 2 \frac{U_m^2}{P_m} = \frac{P_m}{2}$$

$$P_{uk} = P_1 + P_2$$

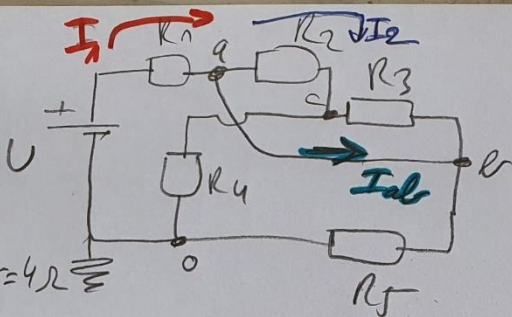
$$P_{uk} = \frac{P_m}{2}$$

III. 1-4.

$$U = 10V$$

$$R_1 = R_2 = R_3 = R_5 = 4\Omega$$

$$R_4 = 2\Omega$$



ZA TOČKU a:
K25

$$I_1 = I_2 + I_{ab}$$

$$I_{ab} = I_1 - I_2$$

$$I_{ab} = \frac{5}{3} - \frac{5}{12} = \frac{20-5}{12} = \frac{15}{12} = \frac{5}{4} = 1.25A$$

$$I_2 = \frac{U_{PAR2}}{R_2} = \frac{\frac{5}{3}}{4}$$

$$I_2 = \frac{5}{12}A$$

$$U_{PAR2} = I_4 \cdot (R_2 \parallel R_3)$$

$$U_{PAR2} = \frac{5}{6} \cdot (4 \parallel 4) = \frac{5}{6} \cdot 2 = \frac{10}{6} = \frac{5}{3}V$$

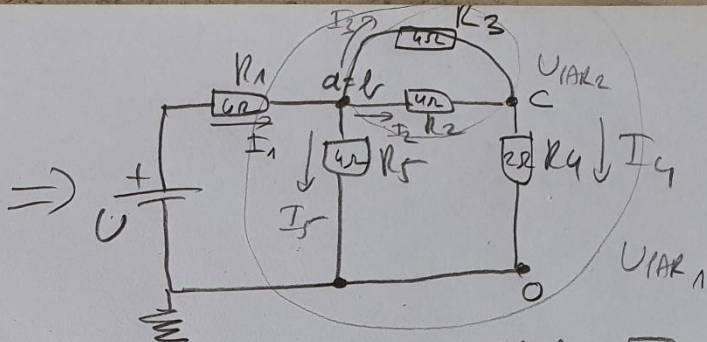
$$I_4 = \frac{U_{PAR1}}{R_4 + R_2 \parallel R_3} = \frac{\frac{10}{3}}{2 + 4 \parallel 4} = \frac{\frac{10}{3}}{2+2} = \frac{10}{4} = \frac{5}{2}A$$

NAPON PARALELNE VEVI:

$$U_{PAR1} = I_1 \cdot (R_5 \parallel (R_4 + R_2 \parallel R_3)) = \frac{5}{3} \cdot (4 \parallel (2 + 4 \parallel 4))$$

$$U_{PAR1} = \frac{5}{3} \cdot (4 \parallel (2+2)) = \frac{5}{3} \cdot (4 \parallel 2) = \frac{5}{3} \cdot \frac{4 \cdot 2}{4+2} = \frac{5}{3} \cdot \frac{8}{6} = \frac{10}{3}V$$

$$I_4 = \frac{U_{PAR1}}{R_4 + R_2 \parallel R_3} = \frac{\frac{10}{3}}{2 + 4 \parallel 4} = \frac{\frac{10}{3}}{2+2} = \frac{10}{4} = \frac{5}{2}A$$



ODREĐIMO I_1 , ODREĐIMO I_2
I O NDA SE VRAĆAMO

UKUPNI OTPOR:

$$R = R_1 + R_5 \parallel (R_4 + R_2 \parallel R_3)$$

$$R = 4 + 4 \parallel (2 + 4 \parallel 4)$$

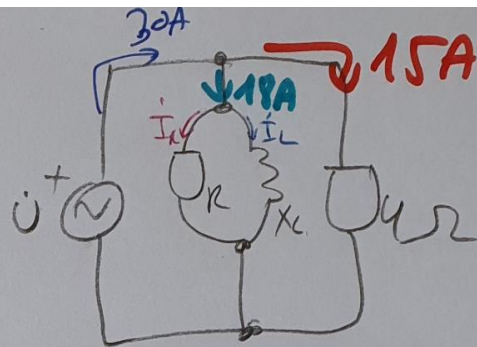
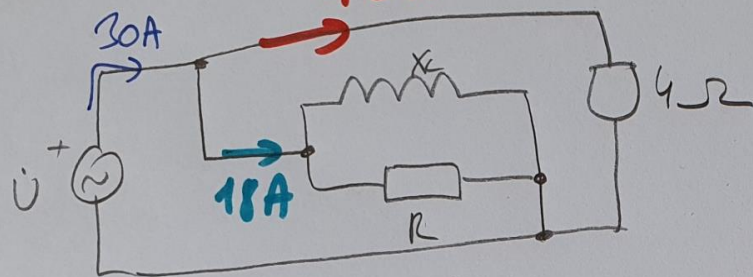
$$R = 4 + 4 \parallel (2+2)$$

$$R = 4 + 4 \parallel 4 = 4 + 2 = 6\Omega$$

ODVA

$$I_1 = \frac{U}{R} = \frac{10}{6} = \frac{5}{3} \approx 1.67A$$

VII. 1-23.



PARALELNI SPJ!
NA SVIM JE NAPON
GRANAMA ISTI $\rightarrow U$!

Koliko je $U = 15 \cdot 4 = 60 \text{ V}$
 $U?$

Stavimo ga po 0°!

$\underline{U} = U \angle 0^\circ = 60 \angle 0^\circ \text{ V}$

10 NPA
 $I_L + I_R = 18$
 $I_L^2 = 18^2 - I_R^2$
 $I_L = \sqrt{324 - 11.7^2}$
 $I_L = 13.6788 \text{ A}$

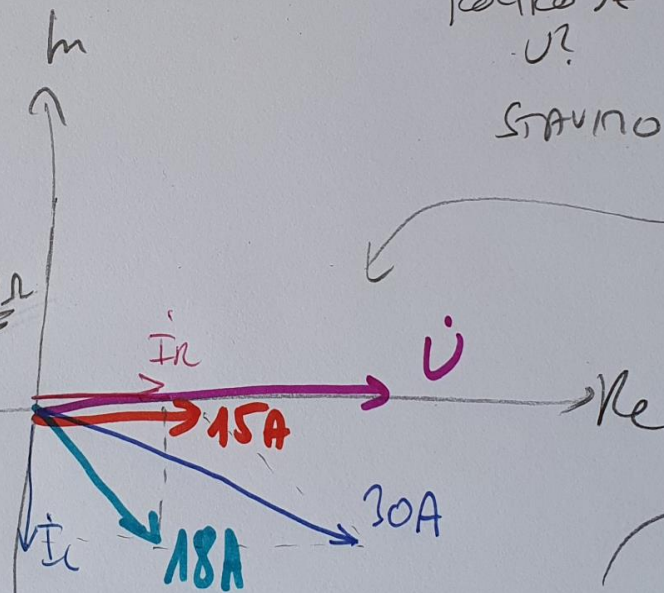
$X_L = \frac{U}{I_L} = 4.389 \Omega$

$\cos \phi = \frac{I_R + 15}{30}$

$\cos \phi \cdot 30 - 15 = I_R$

$I_R = 11.7 \text{ A}$

$R = \frac{U}{I_R} = 5.128 \Omega$



$\cos \phi = ?$

$18^2 = 30^2 + 15^2 - 2 \cdot 15 \cdot 30 \cdot \cos \phi$
 $\cos \phi = \frac{18^2 - 30^2 - 15^2}{-2 \cdot 15 \cdot 30}$

$\cos \phi = \frac{-801}{-900} = \frac{801}{900}$

