

### 3. MASOVNE : OE

#### ① SNAGA

→ TRENUĆNA SNAGA  $p(t) = u(t) \cdot i(t)$

→  $u(t) = U_m \cdot \sin(\omega t + 0)$

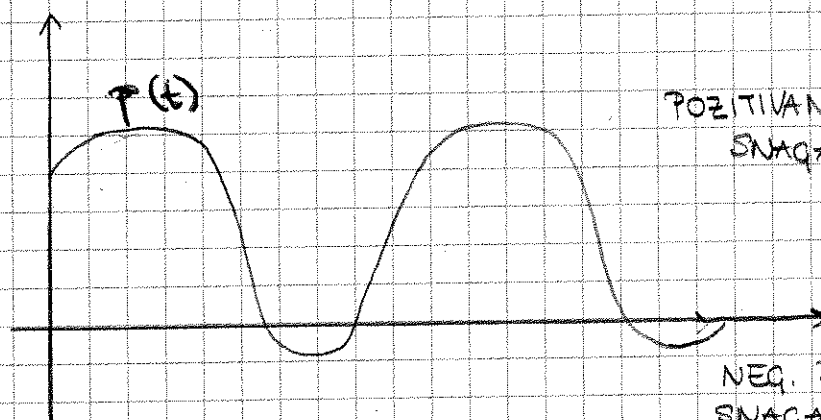
$i(t) = I_m \cdot \sin(\omega t + \varphi)$

→  $p(t) = U_m \cdot I_m \cdot \sin(\omega t) \cdot \sin(\omega t + \varphi)$   
 $= U_{ef} \cdot I_{ef} \cdot \cos \varphi - U_{ef} \cdot I_{ef} \cdot \cos(2\omega t - \varphi)$

NE OVISI O VREMENU,  
KONSTANTA

KOSINUSOIDA,

FREKVENCJA =  $2\omega$ !



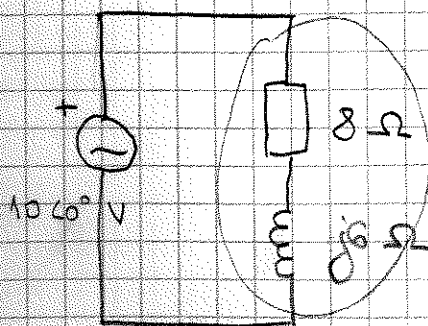
POZITIVAN DIO Y-OSI:

SNAGA IDE IZ IZVORA U  
TROŠILA

NEG. DIO Y-OSI:

SNAGA IDE IZ TROŠILA U  
IZVOR

Primjer:



$R = 8 \Omega$

$X_L = +j6 \Omega$

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

$Z_{uk} = 8 + j6 \Omega = 10 \angle 36,9^\circ \Omega$

$I = \frac{U}{Z_{uk}} = \frac{10 \angle 0^\circ \text{ V}}{10 \angle 36,9^\circ \Omega} = 1 \angle -36,9^\circ \text{ A}$

$P = |I|^2 \cdot \text{Re}(Z) = |I|^2 \cdot R = 8 \text{ W}$

$Q = |I|^2 \cdot \text{Im}(Z_{uk}) = +6 \text{ VAR} \rightarrow$  INDUKT. KARAKTER

- AKO ŽELIMO ZA IZRAČUN SNAGE KORISTITI

FORMULU:  $P = \frac{|U|^2}{R}$  tj.  $P = \frac{|U|^2}{X_L}$ , U NIJE  $U_{izv.}$

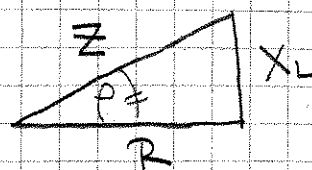
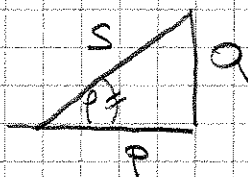
$$|S| = |U| \cdot |I|$$

$$\vec{S} = U \cdot I^* \Rightarrow \text{FORMULA ZA IZRAČUN PRIVIDNE SNAGE KAO VEKTORA}$$

$$= P + jQ$$

$$\Rightarrow = 10 \angle 0^\circ \text{ V} \cdot 1 \angle 36,9^\circ \text{ A} = 8 + j6 \text{ VA}$$

TROKUT SNAGE :



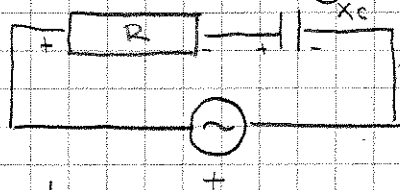
ZAD.

② ZR. 13-14 god.

$$R = 5 \Omega$$

$$X_C = -15 \Omega$$

$$U_R = 31,623 \text{ V}$$



$$|I| = \frac{|U_R|}{R} = 6,3246 \text{ A}$$

$$P = |I|^2 \cdot R = 200 \text{ W}$$

$$Q = |I|^2 \cdot X_C = -600 \text{ VAR}$$

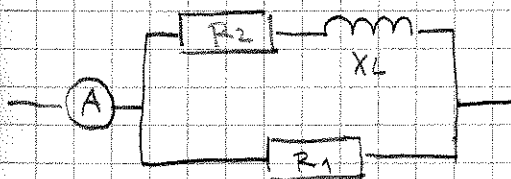
⑥ ZI. 14-15. god.

$$P_{uk} = 1100 \text{ W}$$

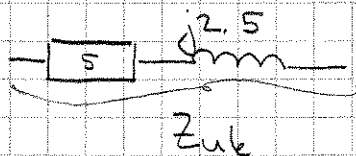
$$R_1 = 10 \Omega$$

$$R_2 = 6 \Omega$$

$$X_L = 8 \Omega$$

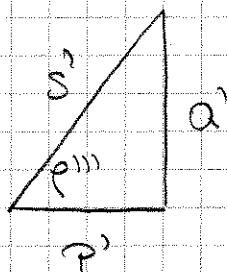
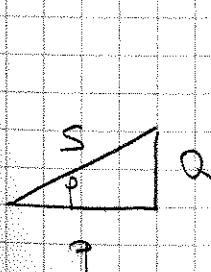


$$Z_{uk} = 10 \parallel (6 + j8) \\ = 5 + j2,5 \Omega$$



$$P_{uk} = |I|^2 \cdot R_c(Z)$$

$$I = 14,83 \text{ A}$$



$$P_{uk} = P + P'$$

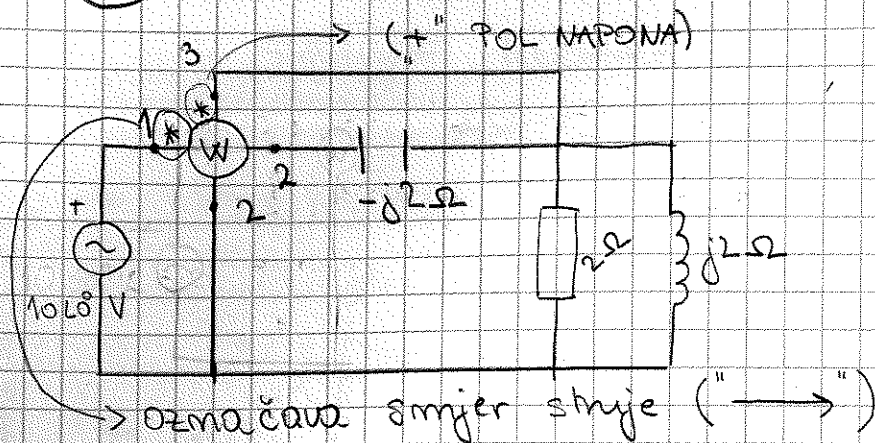
$$Q_{uk} = Q + Q'$$

$$S_{uk} \neq S + S' \Rightarrow \text{RAZLIČITI P}$$

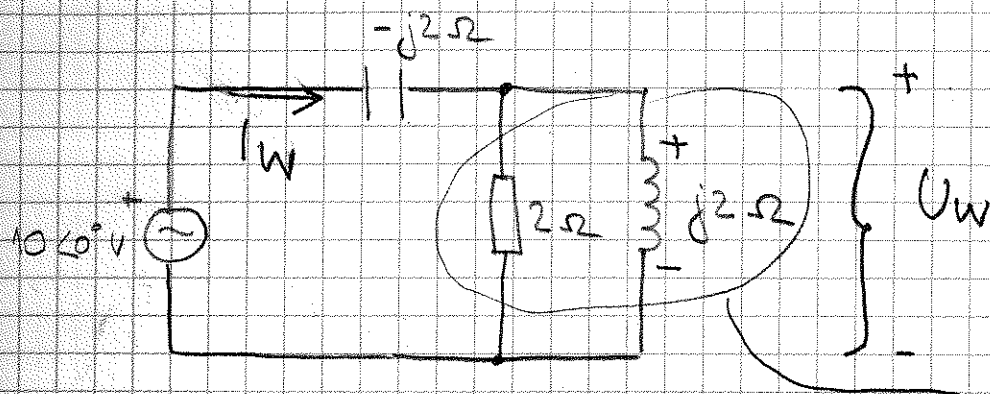
$$S_{uk} = \sqrt{P_{uk}^2 + Q_{uk}^2}$$

10. ZR. 14-15.

1,2 = STRUJNE } STE  
3,4 = NAPONSKE }



$$P_W = U_m \cdot I_m \cdot \cos(\varphi_u - \varphi_i)$$



$$Z_{uk} = -j2\Omega + 2 \parallel j2 = 1 - j1 \Omega$$

$$I_{uk} = \frac{10\angle 0^\circ}{1 - j1\Omega} = 5\sqrt{2} \angle 45^\circ \text{ A}$$

$$Z' = 2 \parallel j2 \Omega$$

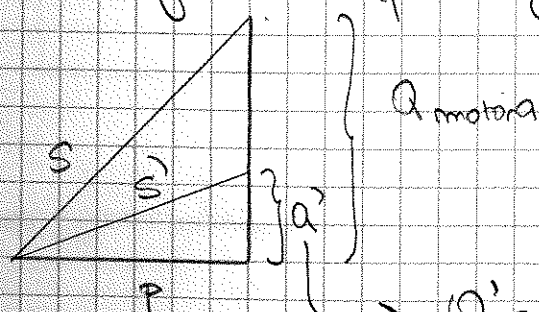
$$U_W = I_W \cdot Z' = 10 \angle 90^\circ \text{ V}$$

$$P_W = 10 \cdot 5\sqrt{2} \cdot \cos(90^\circ - 45^\circ)$$

$$= 50 \text{ W}$$

### KOMPEN. JALOVE SNAGE:

- u spoj paralelno spajamo kondenzator, da bi smanjili ukupnu jalovu snagu.



$$Q' = Q_{motora} + Q_c$$

jalova snaga kondenzatoru  
koji smo dodali

8. ZI 14-15.

$$U = 220V$$

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

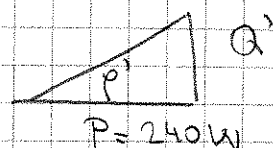
$$P = 240W$$

$$C = 150 \mu F$$

$$\cos \varphi' = 0,8 \text{ (INDUK.)}$$

$$\cos \varphi = ?$$

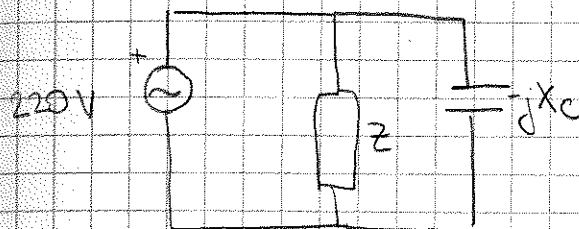
$$X_C = \frac{1}{-j\omega C} = -j 21,22 \Omega$$



$$\varphi' = \arccos 0,8$$

$$\varphi' = 36,87^\circ$$

$$Q' = \tan \varphi' \cdot P = 180 \text{ VAR}$$



$$Q_C = \frac{|U|^2}{X_C} = \frac{220^2}{21,22} = -22,81 \text{ VAR}$$

$$Q' = Q_T + Q_C$$

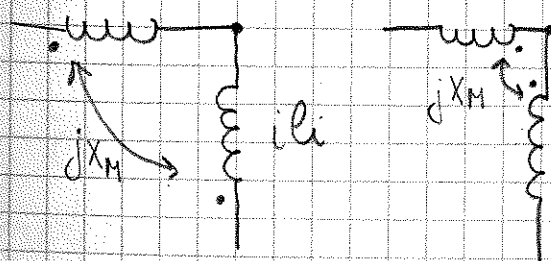
$$Q_T = Q' - Q_C = 2461 \text{ VAR}$$

$$\varphi = \arctan \frac{Q_T}{P_T} = 84,53^\circ$$

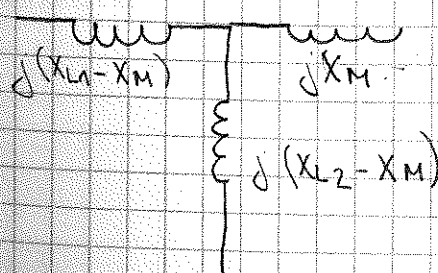
$$\cos \varphi = 0,1$$

## Transformacija međukinduktivneta

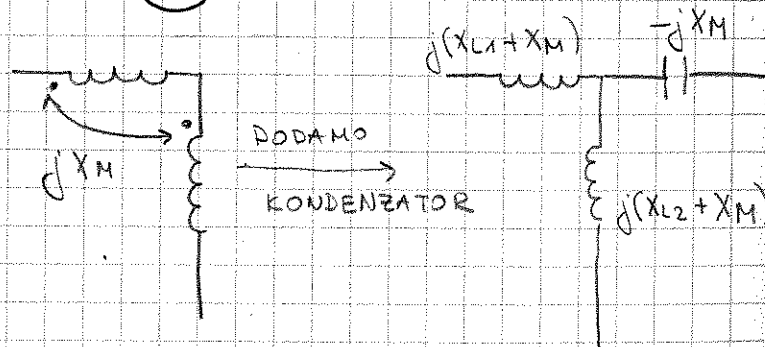
① SLUČAJ



DODAMO JOŠ JEDNU ZAVOJNICU



② SLUČAJ

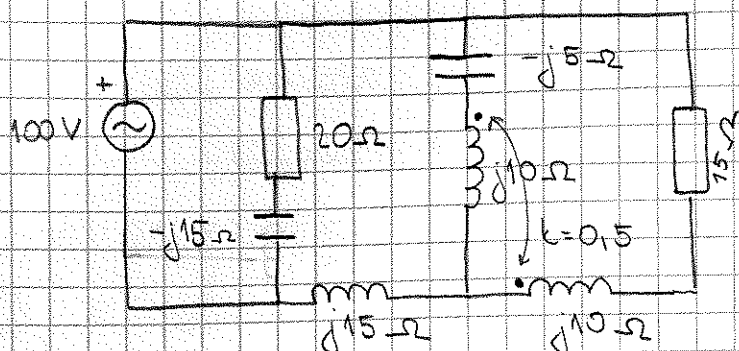


$$X_M = k \sqrt{X_{L1} \cdot X_{L2}}$$

$$M = k \sqrt{L_1 L_2}$$

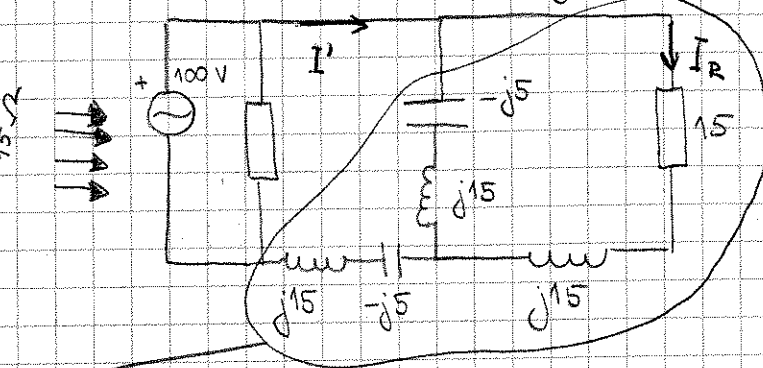


13. LJR 14-15



$$k=0,5$$

$$X_M = k \sqrt{X_{L1} X_{L2}} = j5 \Omega$$



$$Z' = j10 \parallel (15 + j5) + j15 - j5$$

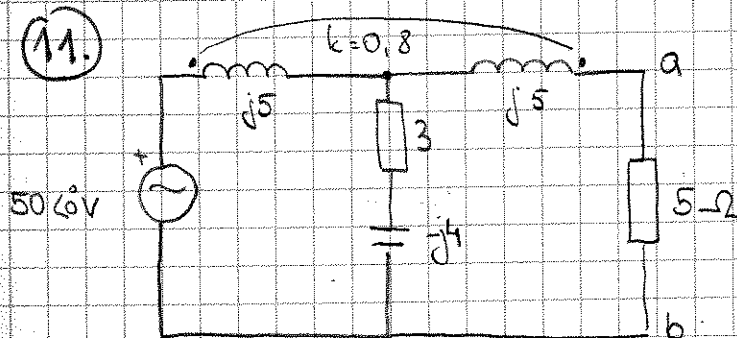
$$= 17,15 \angle 84^\circ \Omega$$

$$I' = \frac{100 \angle 0^\circ}{Z'} = 5,831 \angle -84,094^\circ$$

$$I_R = I' \cdot \frac{j10}{15 + j5} = 2 \angle -53,13^\circ \text{ A}$$

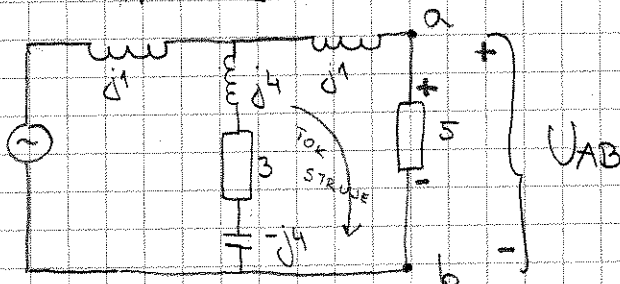
$$P_R = |I_R|^2 \cdot R = 60 \text{ W}$$

11.



$$k=0,8$$

$$X_M = 4 \Omega$$



$$Z_{uk} = j1 + 3 \parallel (5 + j1)$$

$$= 2,2084 \angle 31,03^\circ \Omega$$

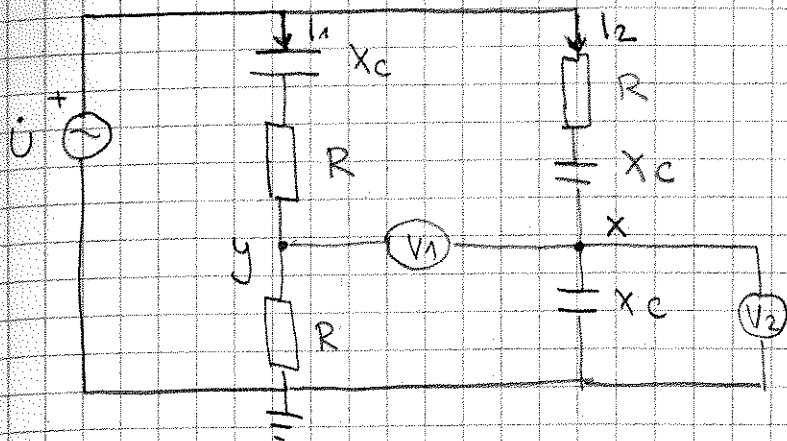
$$I_{uk} = \frac{50 \angle 0^\circ \text{ V}}{Z_{uk}} = 22,641 \angle -31,03^\circ \text{ A}$$

$$I_{AB} = I_{uk} \cdot \frac{3}{3 + 5 + j1} = 8,4248 \angle -38,16^\circ \text{ A}$$

$$U_{AB} = I_{AB} \cdot R$$

$$= 42,1 \angle -38^\circ \text{ V}$$

17. LJR 13-14



$$U_{V1} = ?$$

$$U_{V2} = 10V$$

$$R = X_c = 1 \Omega$$

$$U_{V2} = (P_x - P_o) = 10V$$

$$|P_x| = 10V$$

$$P_x = 10 \angle 0^\circ V$$

$$I_1 = \frac{U}{2\Omega - j\Omega}$$

$$I_2 = \frac{U}{-j\Omega + 1\Omega}$$

IZJEDNAČIMO

$$I_1 = \frac{20 + j10}{2\Omega - j\Omega}$$

$$I_2 = \frac{P_x - P_o}{-j\Omega} = \frac{10 \angle 0^\circ}{-j\Omega}$$

$$U_{REV} = 20 + j10V$$

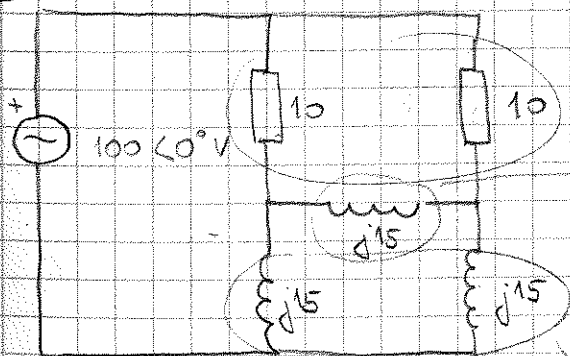
$$P_y = 0 + I_1 \cdot A$$

$$= \frac{20 + j10V}{2\Omega - j\Omega} \cdot A$$

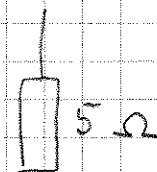
$$= 6 + j8V$$

$$U_{V1} = |P_x - P_y| = 8.94V$$

5. ZI 12-13



MOSTNI SPOJ U RAVNO TEŽI!!  
ZBOG TOGA MIČEMO



$$I = \frac{100 \angle 0^\circ V}{5 + j7.5 \Omega}$$

$$I = 11.09 \angle 56.31^\circ A$$

9. Z1 13-14.

$$I_A = 0 \quad U = 220 \text{ V}$$

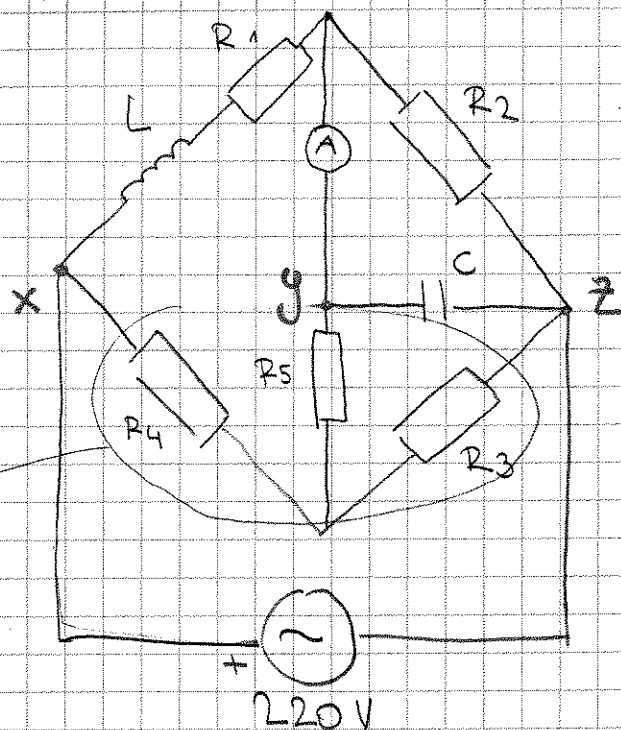
$$R_2 = 1 \text{ k}\Omega \quad f = 50 \text{ Hz}$$

$$R_3 = R_4 = 2 \text{ k}\Omega$$

$$R_5 = 200 \Omega$$

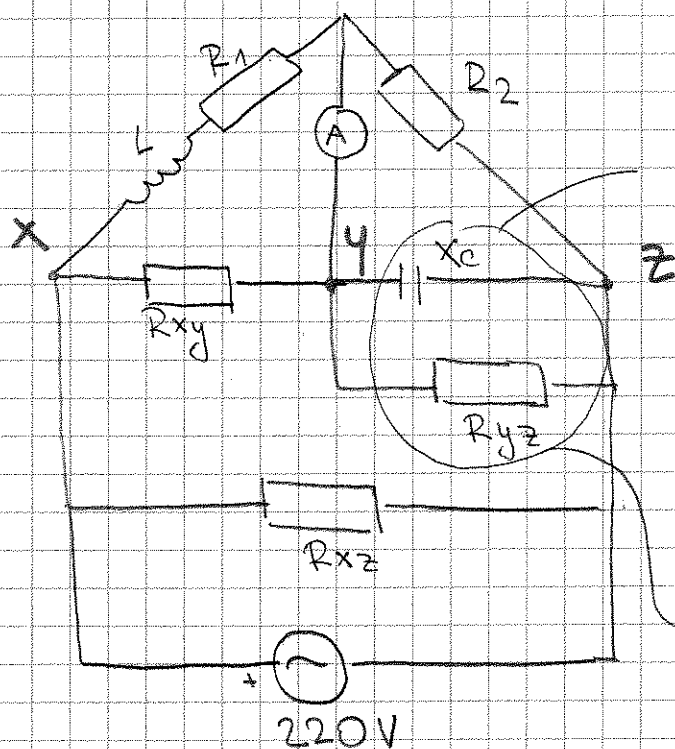
$$C = 1 \mu\text{F}$$

$$R_1 = ?$$



PRETVORBA ZVJEZDE

U TROKUT



$$X_c = \frac{1}{j\omega C} = -j3183 \Omega$$

$$\text{I. } R_{xy} = R_x + R_y + \frac{R_x R_y}{R_z} = 2000 + 200 + \frac{2000 \cdot 200}{2000} = 2400 \Omega$$

$$R_{yz} = R_y + R_z + \frac{R_y R_z}{R_x} = 2400 \Omega$$

$$Z = 2400 \parallel (-j3183) = 1530 - j1154 \Omega$$

→ DOBILI SMO MOSTNI SPOJ U RAVNOTEŽI !!

$$(R_1 + jX_L) \cdot Z = R_2 \cdot R_{xy}$$

$$R_1 + jX_L = 1000 + j754$$

$$R_1 = 1000 \Omega$$

17. JR 11.-12

$$R_1 = 8 \Omega$$

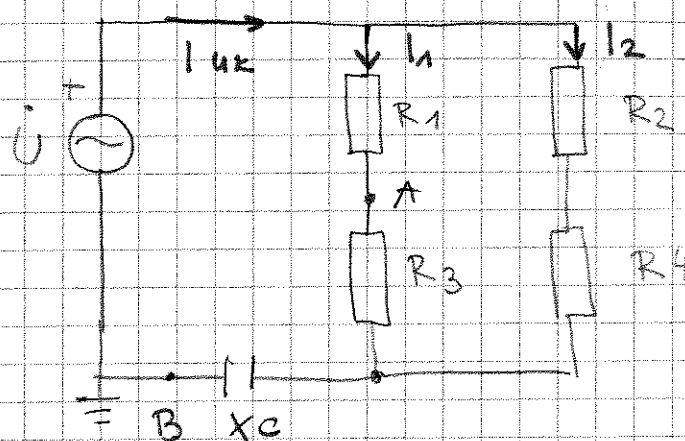
$$R_2 = 8 \Omega$$

$$R_3 = 4 \Omega$$

$$R_4 = 18 \Omega$$

$$X_C = 8 \Omega$$

$$U = 24V$$



$$U_{AB} = ?$$

$$P_B = 0$$

$$Z_{uk} = 8 - j8 \Omega$$

$$I_{uk} = \frac{U}{Z_{uk}} = 1,5 + j1,5 A$$

$$I_1 = I_{uk} \cdot \frac{24}{24 + 12} = 1 + jA$$

$$P_A = ?$$

$$= 0 + 24 \angle 0^\circ \cdot (1 - jA) \cdot 8$$

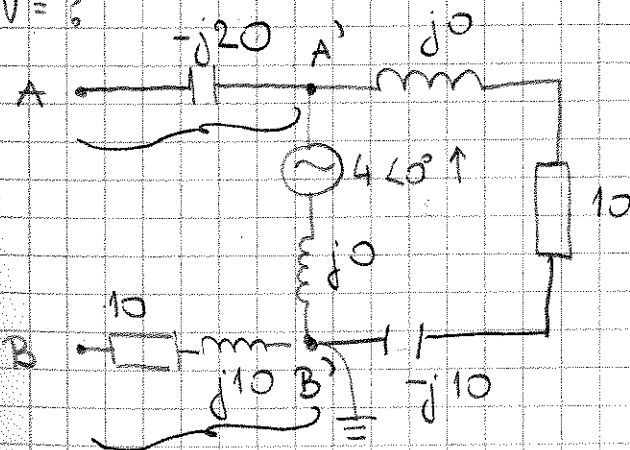
$$= 16 - j8 V$$

$$U_{AB} = |P_A - P_B| = 17,89 = 17,9V$$

15. LJR 12-13

- PRVO NAPRAVIMO TRANSFORMACIJU MEDUIN. I MAKNEMO VOLTMETAR

$$U_V = ?$$



$$P_A' = 0 + 4 \angle 0^\circ \cdot (-j10) + 4 \angle 0^\circ \cdot 10$$

$$= 40 \sqrt{2} \angle -45^\circ$$

$$U_{AB} = P_A - P_B = 40 \sqrt{2} V$$

$P_A = P_A'$  = na istom potencijalu  
 $P_B = P_B'$  jer struja ne teče  
 kroz :



