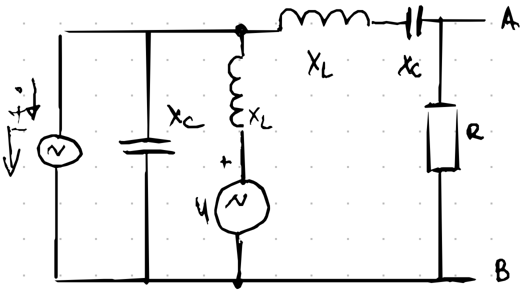
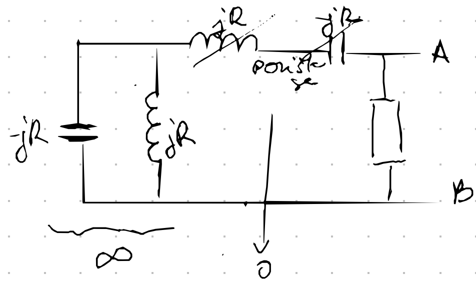
12. ZADACI THEVENIN I NORTON

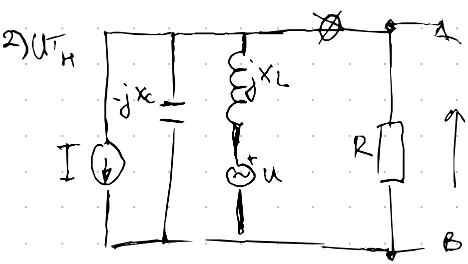
① ZI 18./19. 4.) Parametre Nortonovog nadomjesnog spoja

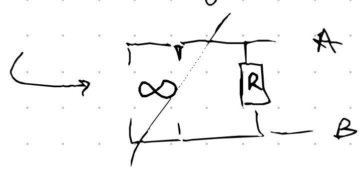


1) Z_{TH} $\quad R = X_L = X_C$



2) U_{TH}





$\boxed{Z_N = R}$

$$I_N = \frac{U_{TH}}{Z_{TH}}$$

↳ LIJEVI DIO = MILLMAN

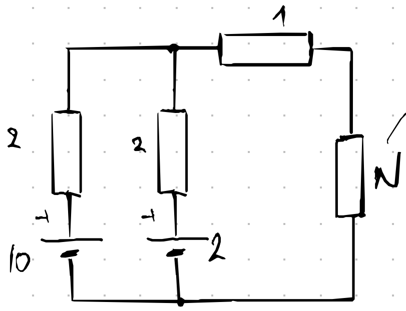
$$U_{AB} = \frac{-I + \frac{u}{jX_L}}{\frac{1}{-jX_C} + \frac{1}{jX_L} + \frac{1}{R}} = \frac{-I + \frac{u}{jR}}{\frac{1}{R} + \cancel{\frac{1}{jR}} + \cancel{\frac{1}{-jR}}} = \frac{\frac{-IjR + u}{jR}}{\frac{1}{R}}$$

$$U_{AB} = \frac{-IjR + u}{j} = \underbrace{-I \cdot R + \frac{u}{j}}$$

$$I_N = \frac{-I \cdot R + u \cdot \frac{1}{j}}{R} = -I + \frac{u}{R} \cdot \frac{1}{j} =$$

$$\boxed{I_N = -I - j\frac{u}{R}}$$

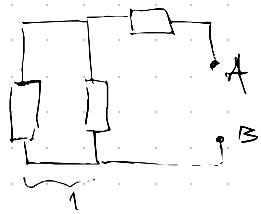
② ZI 18./19. 5.) U-I karakteristika zadana kao $I=0{,}5\,U^2$ ↪ N



$U_N = ?$

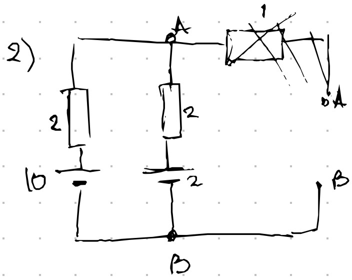
nelinearni otp

1)



$Z_N = 2\,\Omega$

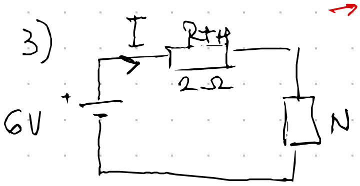
2)



$$U_{AB} = \frac{\frac{10}{2}+\frac{2}{2}}{\frac{1}{2}+\frac{1}{2}} = \frac{6}{1} \to U_{TH} = 6V$$

→ dinamički otpor ničemu ne služi ovdje

3)

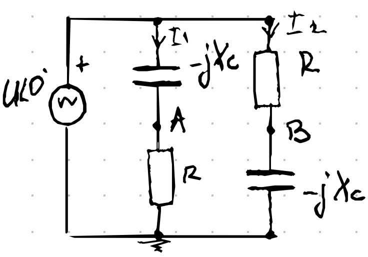


$$6V = I \cdot 2\,\Omega + U_N$$

$$6V = U_N^2 + U_N \to \boxed{U_N = 2V}$$

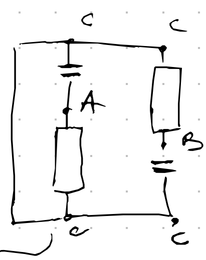
~~$U_N = -3V$~~

③ JES 18./19. 8.) $E_T = U_{AB} = ?$ $\quad R = X_C = 10\,\Omega$



$Z_T = ?$

1) ZTH

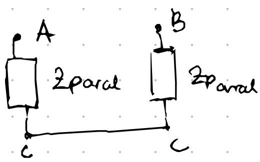


$$Z_{paral} = \left(\frac{-j+1}{-jR}\right)^{-1}$$

$$Z_{paral} = \frac{jR}{j-1} = 5-5j$$

$$\frac{1}{R}+\frac{1}{jR} \qquad \frac{1}{R}+\frac{1}{-jR}$$

⇓



$Z_{AB} = 2\cdot Z_p$ → $\boxed{Z_{AB} = 10-10j}$

2) $I_1 = I_2$ jer su te ovdje paralelne grane iste:

→ uzemljimo

$$U_{AB} = \varphi_A - \varphi_B$$

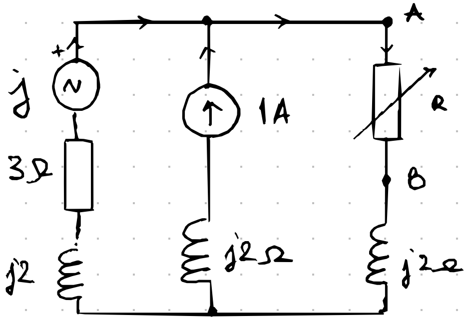
$$\varphi_A = I_1 \cdot R \qquad \varphi_B = I_2 \cdot (-jX_C)$$

$$I_1 = \frac{U}{R-jR} \Longleftrightarrow I_2 = \frac{U}{R-jR}$$

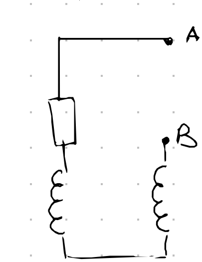
$$\varphi_A = \frac{U}{1-j} \qquad \varphi_B = \frac{-jU}{1-j} \Rightarrow \varphi_A - \varphi_B = \frac{U}{1-j}(1+j)$$

$$\boxed{E_T = U_{AB} = jU}$$

4. zi 19./20. 14.) $P_{max}=?$

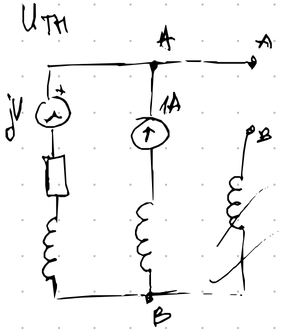


Z_{TH}



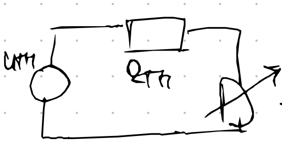
$\rightarrow Z_{TH} = 3+j4\,\Omega$

U_{TH}



$$U_{AB} = \frac{1+\frac{j}{3+j2}}{\frac{1}{3+2j}+\cancel{\ }} \Rightarrow 3\sqrt{2}\angle 45^\circ$$

ignoriramo zbog strujnog izvora



$$\rightarrow R = |Z_r| = |Z_{TH}| = \sqrt{4^2+3^2} =$$

$$I = \frac{U_{TH}}{3+j4+5} = \frac{3\sqrt{2}}{8+j4} = \frac{3\sqrt{10}}{20}$$

$$I^2 \cdot R = P \rightarrow \boxed{1{,}125\,W}$$