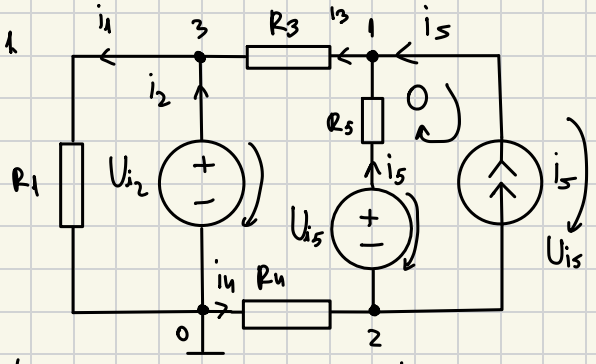
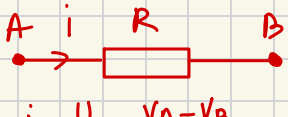
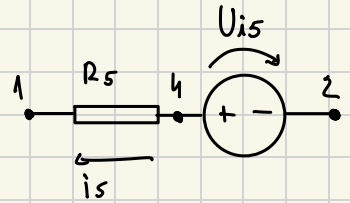
1





$i = \frac{U}{R} = \frac{V_A - V_B}{R}$



$U_{i5} = V_4 - V_2 \Rightarrow V_4 = U_{i5} + V_2$

$i_5 = \frac{V_4 - V_1}{R_5} = \frac{V_2 - V_1 + U_{i5}}{R_5}$

$U_{i2} = U_{i5} = 30V$, $i_5 = 3A$, $R_1 = R_5 = 5\Omega$, $R_3 = R_4 = 10\Omega$, $i_2 = 0A$

alle V_0 - referință $\Rightarrow V_0 = 0V$

$U_{i2} = V_3 - V_0 \Rightarrow V_3 = U_{i2} = 30V$

$i_1 = \frac{V_3 - V_0}{R_1}$ $i_3 = \frac{V_1 - V_3}{R_3}$ $i_4 = \frac{V_0 - V_2}{R_4}$ $i_5 = \frac{V_2 - V_1 + U_{i5}}{R_5}$

aplic legea I a lui Kirchoff în nodul 1 și 2

1: $i_3 = i_5 + i_5 \Rightarrow i_3 = i_4 \Rightarrow \frac{V_1 - 30}{10} = \frac{-V_2}{10} \Rightarrow V_1 = 30 - V_2$

2: $i_4 = i_5 + i_5$

$i_3 = i_5 + i_5 \Rightarrow \frac{V_1 - 30}{10} = \frac{V_2 - V_1 + 30}{5} + 3 \Leftrightarrow \frac{30 - V_2 - 30}{10} = \frac{V_2 - 30 - V_2 + 30}{5} + 3 \mid \cdot 10 \Leftrightarrow -V_2 = 4V_2 + 30 \Rightarrow V_2 = -6V$

$V_1 = 30 - (-6) = 36V$

$i_1 = \frac{30 - 0}{5} = 6A$ $i_3 = \frac{36 - 30}{10} = 0,6A$ $i_4 = -\frac{-6}{10} = 0,6A$ $i_5 = \frac{-6 - 36 + 30}{5} = -2,4A$

aplic legea I a lui Kirchoff în nodul 3

3: $i_1 = i_2 + i_3 \Rightarrow i_2 = i_4 - i_3 = 6 - 0,6 = 5,4A$

b) $P = \sum R i^2 = R_1 i_1^2 + R_3 \cdot i_3^2 + R_4 i_4^2 + i_5 \cdot R_5^2 = 5 \cdot 6^2 + 10 \cdot 0,6^2 + 10 \cdot 0,6^2 + 5 \cdot (-2,4)^2 = 216 W$ (1)

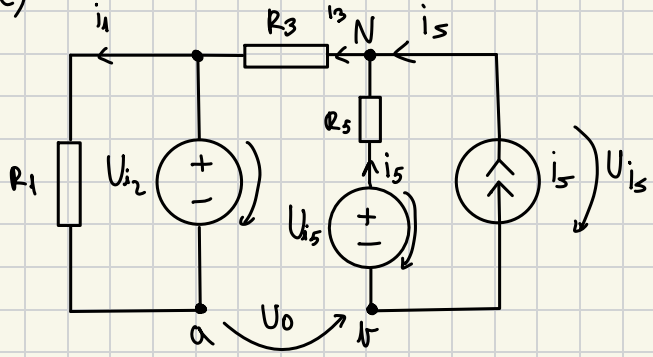
aplic legea a II-a a lui Kirchoff în ochiul 0

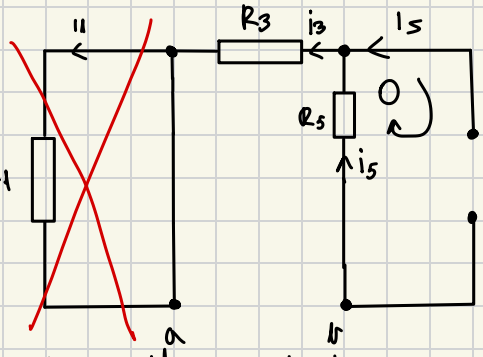
0: $U_{i5} + i_5 R_5 - U_{i5} = 0 \Rightarrow U_{i5} = U_{i5} - i_5 R_5 = 30 - (-2,4) \cdot 5 = 42V$

$P_{redat} = i_2 \cdot U_{i2} + i_5 \cdot U_{i5} + U_{i5} \cdot i_5 = 5,4 \cdot 30 + (-2,4) \cdot 30 + 42 \cdot 3 = 216 W$ (2)

Din (1) și (2) $\Rightarrow$ se verifică bilanțul puterilor

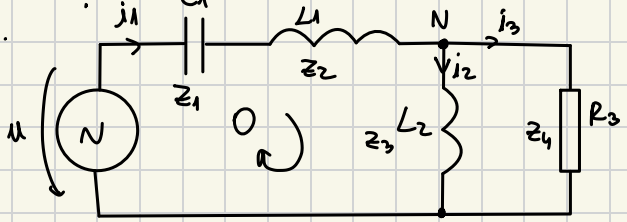
c)





R_3, R_5 - paralel $\Rightarrow R_i = \frac{R_3 \cdot R_5}{R_3 + R_5} = \frac{5 \cdot 10}{5 + 10} = \frac{50}{15} = 3,33\Omega$

2.



a) $u(t) = \frac{20}{\sqrt{2}} \sin(\omega t + \frac{\pi}{2})$

$U\sqrt{2} = \frac{20}{\sqrt{2}} \simeq \frac{10\sqrt{2}}{\underline{Z}} \Rightarrow U = 10V$

$f = 200Hz \Rightarrow \omega = 2\pi f = 400\pi$ rad/s

$\underline{Z_1} = \frac{1}{j\omega C_1} = \frac{j}{j \cdot 400\pi \cdot \frac{25}{\pi} \cdot 10^{-6}} = -100j\ \Omega$

$\underline{Z_2} = j \cdot \omega \cdot L_1 = j \cdot 400\pi \cdot \frac{1}{4\pi} = 100j\ \Omega$

$\underline{Z_3} = j \cdot \omega \cdot L_2 = j \cdot 400\pi \cdot \frac{1}{4\pi} = 100j\ \Omega$

$\underline{Z_4} = R_3 = 20\ \Omega$

$\underline{Z_{echiv}} = \underline{Z_1} + \underline{Z_2} + \frac{\underline{Z_3} \cdot \underline{Z_4}}{\underline{Z_3} + \underline{Z_4}} = -100j + 100j + \frac{20 \cdot 100j}{20 + 100j} = \frac{2000j}{20 + 100j} = \frac{2000j}{20(1+5j)} = \frac{100j(1-5j)}{1+25} = \frac{500}{26} + \frac{100}{26}j$

cum $\operatorname{Im}\{\underline{Z_{echiv}}\} > 0 \Rightarrow$ caracter inductiv

b) $\underline{U} = U(\cos\frac{\pi}{2} + j\sin\frac{\pi}{2}) = jU = 10j\ V$

$\underline{i_1} = \frac{\underline{U}}{\underline{Z_{echiv}}} = \frac{10j}{\frac{500 + 100j}{26}} = 0{,}1 + 0{,}5j$

$\varphi = \operatorname{arctg}\frac{0{,}5}{0{,}1} = \operatorname{arctg} 5$

$|\underline{i_1}| = \sqrt{0{,}1^2 + 0{,}5^2} = 0{,}5$

$i_1(t) = 0{,}5 \sin(400\pi t + \operatorname{arctg} 5)$

aplic legea a II-a a lui Kirchoff in nodul O

$O: \underline{i_1}(\underline{Z_1} + \underline{Z_2}) + \underline{i_2}\,\underline{Z_3} - \underline{U} = 0 \Rightarrow \underline{i_2} = \frac{\underline{U} - \underline{i_1}(\underline{Z_1} + \underline{Z_2})}{\underline{Z_3}} = \frac{10j - (0{,}1 + 0{,}5j) \cdot 0}{100j} = 0{,}1\ A$

$\varphi = \operatorname{arctg}\frac{0}{0{,}1} = 0$

$|\underline{i_2}| = \sqrt{0{,}1^2 + 0} = 0{,}1$

$i_2(t) = 0{,}1 \sin(400\pi t)$

aplic legea I a lui Kirchoff in nodul N

$N: \underline{i_1} = \underline{i_2} + \underline{i_3} \Rightarrow \underline{i_3} = \underline{i_1} - \underline{i_2} = 0{,}1 + 0{,}5j - 0{,}1 = 0{,}5j$

$\varphi = \operatorname{arctg}\frac{0{,}5}{0} = \operatorname{arctg}\infty = \frac{\pi}{2}$

$|\underline{i_3}| = \sqrt{0 + 0{,}5^2} = 0{,}5$

$i_3(t) = 0{,}5 \sin(400\pi t + \frac{\pi}{2})$

c) $\underline{P} = \underline{U} \cdot \underline{i}^* = 10j(0{,}1 - 0{,}5j) = 5 + j$ $\Rightarrow P = P_{activ} + P_{reactiv}$

$P_{activ} = R_3 \cdot |\underline{i_3}|^2 = 20 \cdot 0{,}5^2 = 5$

$P_{reactiv} = j \cdot 100 \cdot 0{,}5^2 + j \cdot 100 \cdot 0{,}1^2 - j \cdot 100 \cdot 0{,}5^2 = j$