

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
Fakulta informačních technologií

Elektronika pro informační technologie
2018/2019

Semestrální projekt

Ondřej Dohnal (xdohna45)

Brno, 20. prosince 2018

1 Příklad (B)

Zadání:

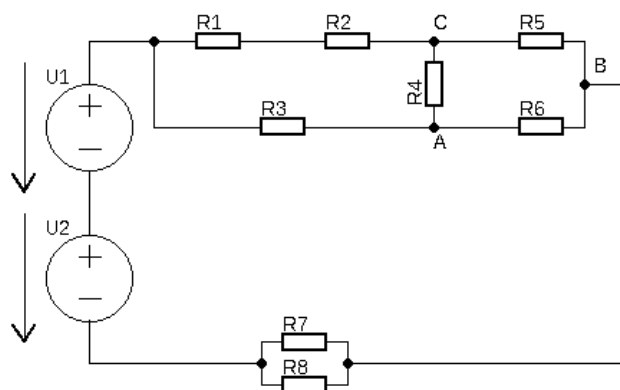
$$U_1 = 95\text{V} \quad U_2 = 115\text{V}$$

$$R_1 = 650\Omega \quad R_2 = 730\Omega \quad R_3 = 340\Omega \quad R_4 = 330\Omega \quad R_5 = 410\Omega \quad R_6 = 830\Omega$$

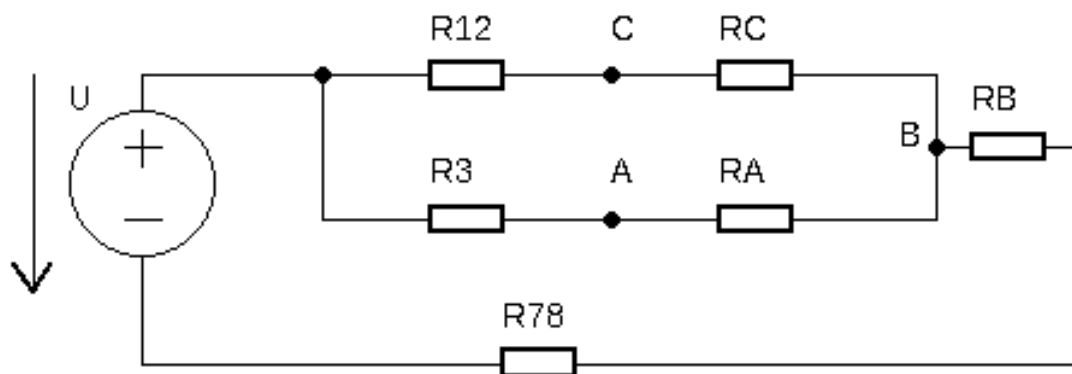
$$R_7 = 340\Omega \quad R_8 = 220\Omega$$

$$U_{R_3} = ?$$

$$I_{R_3} = ?$$



Řešení (metoda postupného zjednodušování):



Transfigurace - trojúhelník \rightarrow hvězda

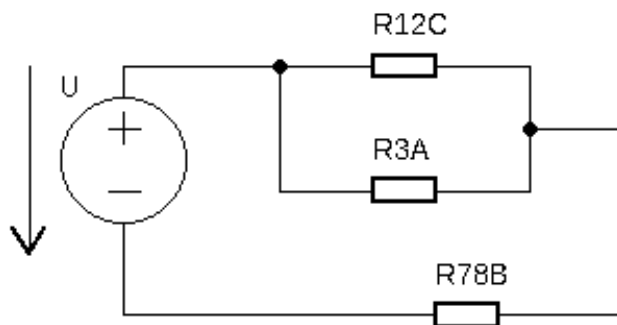
$$U = U_1 + U_2 = 95 + 115 = 210\text{V}$$

$$R_A = \frac{R_4 R_6}{R_4 + R_5 + R_6} = \frac{330 \cdot 830}{330 + 410 + 830} = \frac{27390}{157} \doteq 174.4586\Omega$$

$$R_B = \frac{R_5 R_6}{R_4 + R_5 + R_6} = \frac{410 \cdot 830}{330 + 410 + 830} = \frac{34030}{157} \doteq 216.7516\Omega$$

$$R_C = \frac{R_4 R_5}{R_4 + R_5 + R_6} = \frac{330 \cdot 410}{330 + 410 + 830} = \frac{13530}{157} \doteq 86.1783\Omega$$

$$R_{78} = \frac{R_7 R_8}{R_7 + R_8} = \frac{340 \cdot 220}{340 + 220} = \frac{935}{7} \doteq 133.7514\Omega$$

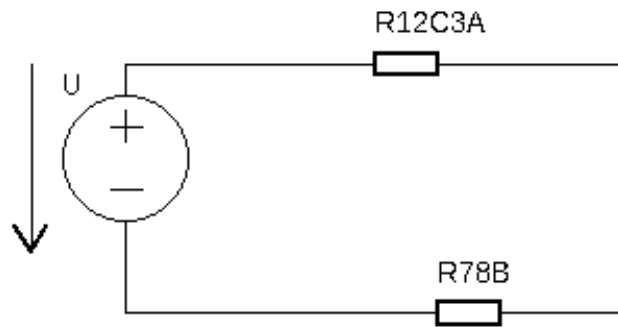


R_{12} a R_C jsou zapojeny sériově stejně jako R_3 a R_A a stejně R_{78} a R_B

$$R_{12C} = R_{12} + R_C = 1380 + \frac{13530}{157} = \frac{230190}{157} \doteq 1460.1783\Omega$$

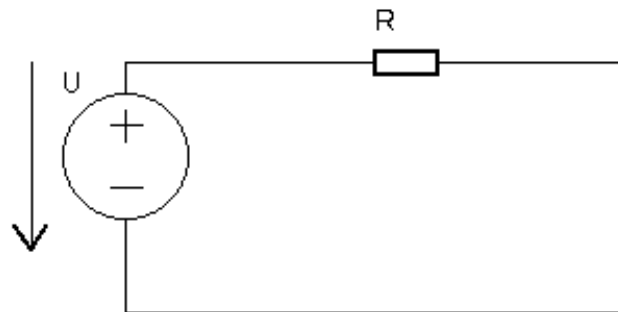
$$R_{3A} = R_3 + R_A = 340 + \frac{27390}{157} = \frac{80770}{157} \doteq 514.4586\Omega$$

$$R_{78B} = R_{78} + R_B = \frac{935}{7} + \frac{34030}{157} = \frac{385005}{1099} \doteq 350.3230\Omega$$



R_{12C} a R_{3A} jsou zapojeny paralelně

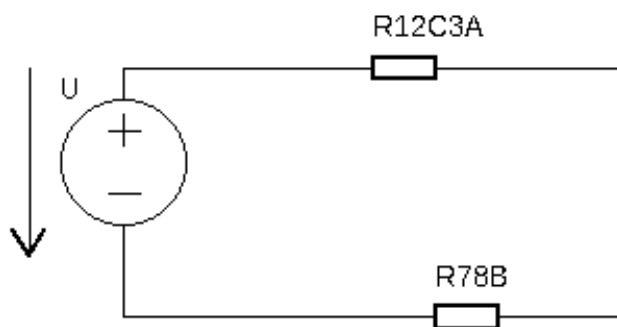
$$R_{123C3A} = \frac{R_{12C}R_{3A}}{R_{12C} + R_{3A}} = \frac{\frac{230190}{157} \cdot \frac{80770}{157}}{\frac{230190}{157} + \frac{80770}{157}} = \frac{929622315}{2441036} \doteq 380.8311\Omega$$



R_{12C3A} a R_{78B} jsou zapojeny sériově

$$R = R_{12C3A} + R_{78B} = \frac{929622315}{2441036} + \frac{385005}{1099} = \frac{79575885}{108836} \doteq 731.1541\Omega$$

$$I = \frac{U}{R} = \frac{210}{\frac{70247085}{2441030}} = \frac{1523704}{5305059} \doteq 0.2872172\text{A}$$

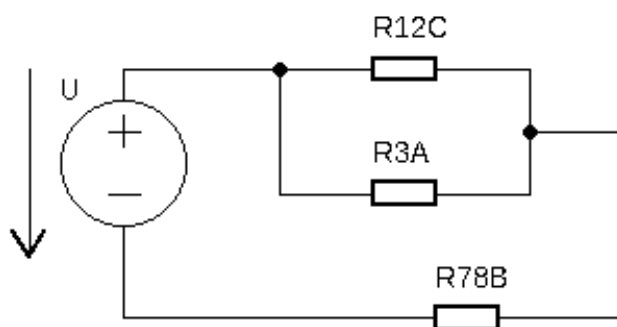


R_{12C3A} a R_{78B} jsou zapojeny sériově

Z I. Kirchhoffova zákona:

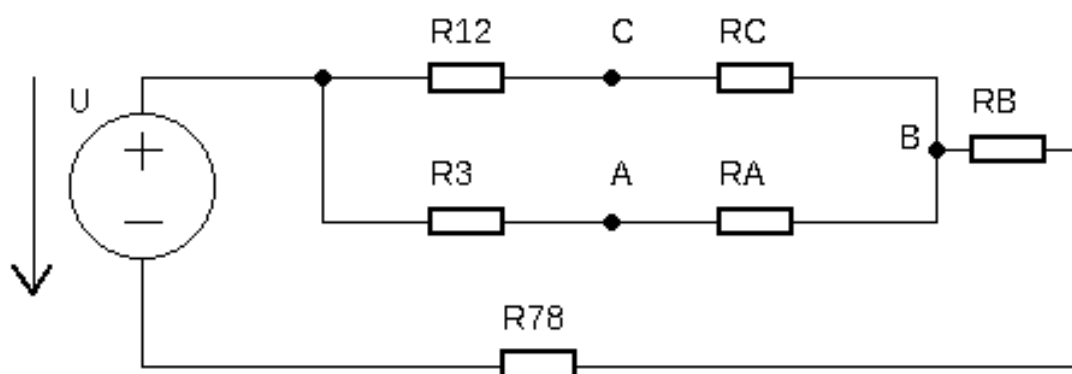
$$I_{R_{78B}} = I_{R_{12C3A}} = I$$

$$U_{R_{12C3A}} = R_{12C3A} \cdot I = \frac{1523704}{5305059} \cdot \frac{929622315}{2441036} = \frac{30367662290}{277631421} \doteq 109.3812V$$



R_{12C} a R_{3A} jsou zapojeny paralelně

$$I_{R_{3A}} = \frac{U_{R_{12C3A}}}{R_{3A}} = \frac{\frac{30367662290}{277631421}}{\frac{80770}{157}} = \frac{375977}{1768353} \doteq 0.2126142A$$



R_3 a R_A jsou zapojeny sériově

$$I_3 = I_{R_3} = \frac{375977}{1768353} \doteq 0.2126142A$$

$$U_{R_3} = R_3 \cdot I_{R_3} = 340 \cdot \frac{375977}{1768353} = \frac{127832180}{1768353} \doteq 72.288836V$$

2 Příklad (E)

Zadání:

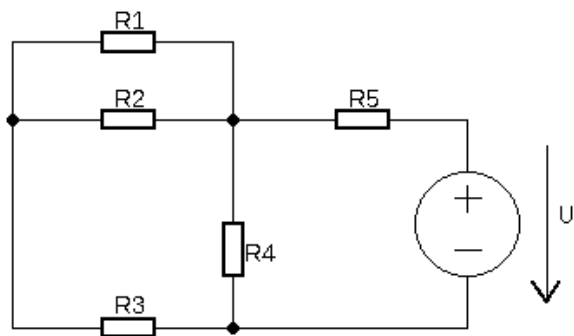
$$U = 250\text{V}$$

$$R_1 = 150\Omega \quad R_2 = 335\Omega \quad R_3 = 625\Omega \quad R_4 = 245\Omega$$

$$R_5 = 600\Omega$$

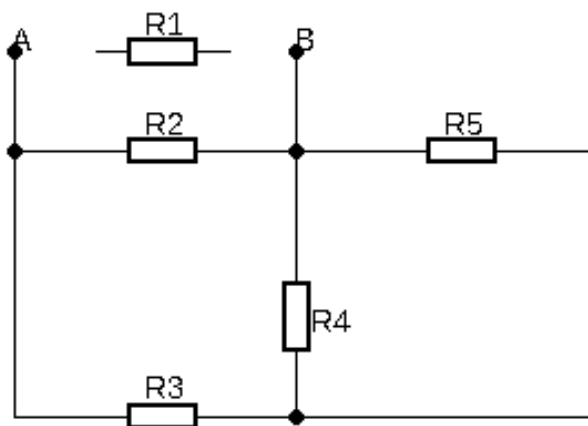
$$U_{R_1} = ?$$

$$I_{R_1} = ?$$



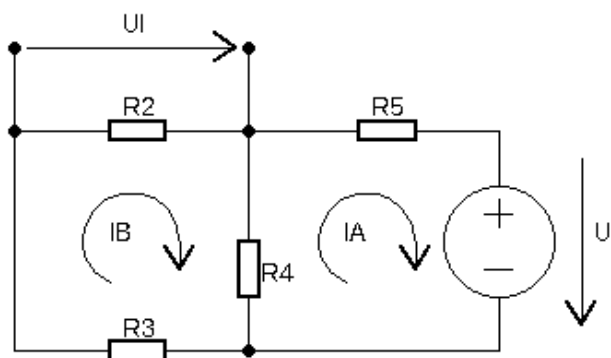
Řešení (Metoda Théveninovy věty):

Vypočítáme R_i :



Odpojíme R_1 a zkratujeme napěťový zdroj

$$R_i = \frac{R_2 \left(R_3 + \frac{R_4 R_5}{R_4 + R_5} \right)}{R_2 + \left(R_3 + \frac{R_4 R_5}{R_4 + R_5} \right)} = \frac{335 \cdot \left(625 + \frac{245 \cdot 600}{245 + 600} \right)}{335 + \left(625 + \frac{245 \cdot 600}{245 + 600} \right)} \doteq 236.03306 \Omega$$



Vypočítáme I_B metodou smyčkových proudů

$$I_A R_4 + I_A R_5 - I_B R_4 + U = 0$$

$$I_B R_3 + I_B R_2 + I_B R_4 - I_A R_4 = 0$$

$$245 I_A + 600 I_A - 245 I_B = 0$$

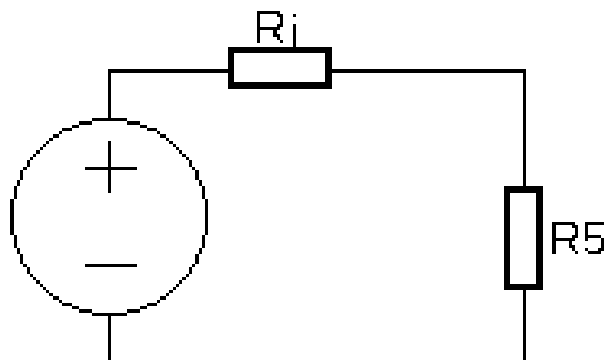
$$625 I_B + 335 I_B + 245 I_B - 245 I_A = 0$$

$$1205 I_B - 245 I_A = 0$$

$$I_A = -\frac{50 + 49 I_B}{169}$$

$$1205 I_B - 245 \left(-\frac{50 + 49 I_B}{169} \right) = 0$$

$$I_B = -\frac{1225}{19164}$$



Vypočítáme U_i a I_i

$$|I_B| = \frac{1225}{19164} \doteq 0.0639219\text{A}$$

$$U_i = R_2 I_B = 335 \cdot \frac{1225}{19164} = \frac{410375}{19164} \doteq 21.4139\text{V}$$

$$I_i = \frac{U_i}{R_i + R_1} = \frac{21.4138}{236.0331 + 150} \doteq 0.0554714\text{A}$$

$$I_{R_1} = I_i \doteq 0.0554714\text{A}$$

$$U_{R_1} = I_{R_1} R_1 = 0.0554714 \cdot 150 \doteq 8.32071\text{V}$$