Vysoké učení technické v Brně
Fakulta informačních technologií

Elektronika pro informační technologie

2018/2019

Semestrální projekt

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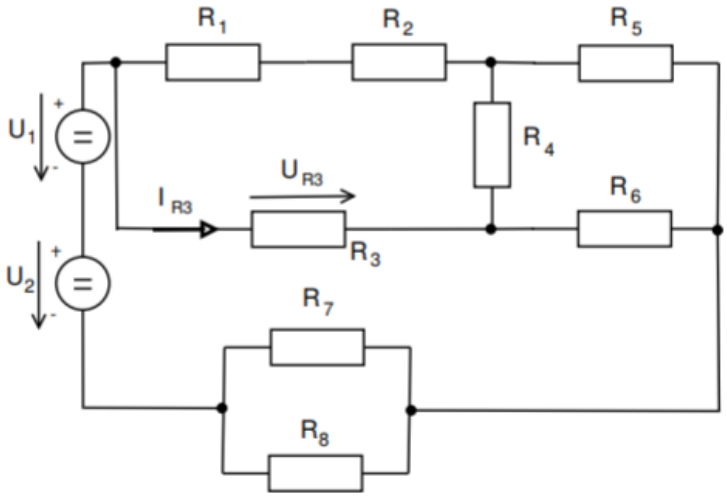
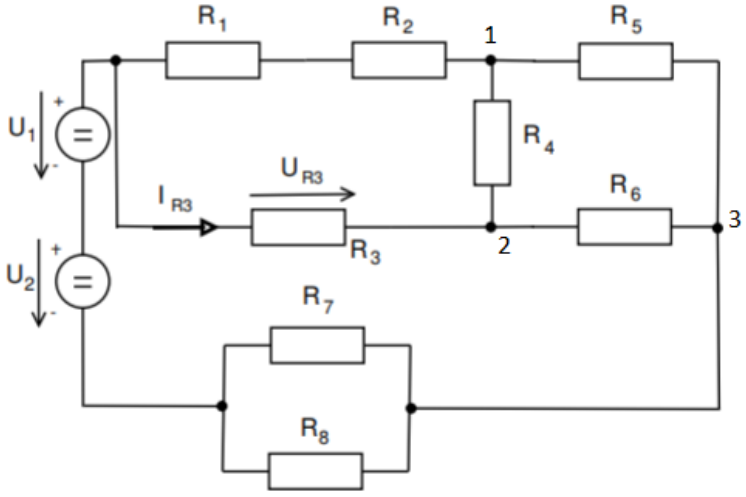
1.C

Zadání:
$U_1 = 100V$ $U_2 = 80V$
$R_1 = 450\Omega$ $R_2 = 810\Omega$ $R_3 = 190\Omega$ $R_4 = 220\Omega$ $R_5 = 220\Omega$ $R_6 = 720\Omega$
$R_7 = 260\Omega$ $R_8 = 180\Omega$
$U_{r3} =?$ $I_{r3} =?$



Řešení metodou postupného zjednodušování

Označení uzlů pro transfiguraci (trojuhelník ⇒ hvězda):



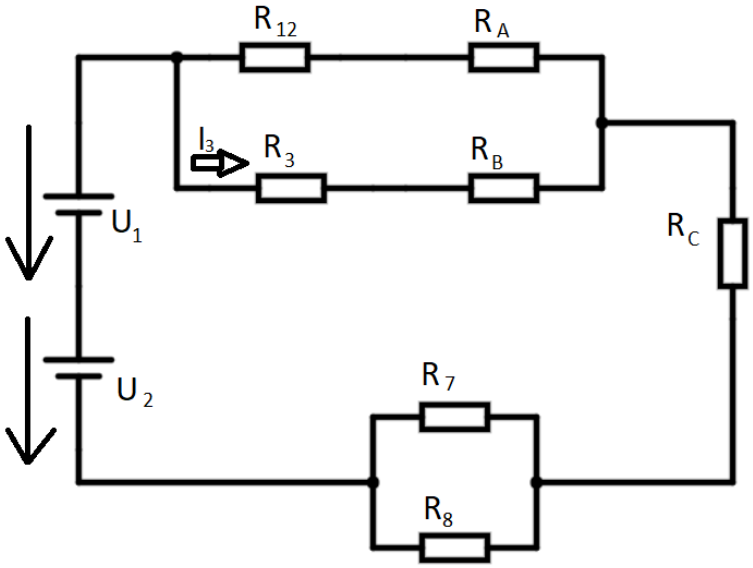
Provedení transfigurace a spojení R_1 a R_2:

$$R_{12} = R_1 + R_2 = 450 + 810 = 1260$$

$$R_A = \frac{R_4 * R_5}{R_4 + R_6 + R_5} = \frac{220 * 220}{220 + 220 + 720} = 41.7241\Omega$$

$$R_B = \frac{R_4 * R_6}{R_4 + R_6 + R_5} = \frac{220 * 720}{220 + 220 + 720} = 136.5517\Omega$$

$$R_C = \frac{R_6 * R_5}{R_4 + R_6 + R_5} = \frac{220 * 720}{220 + 220 + 720} = 136.5517\Omega$$

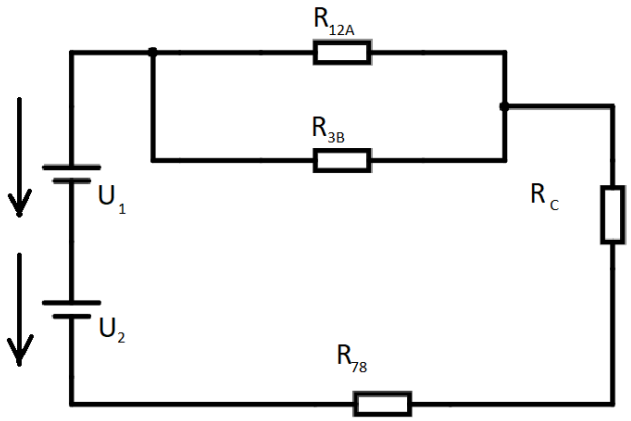


Sériové spojení R_{12} s R_A a R_3 s R_B a Paralelní spojení R_7 s R_8

$$R_{12A} = R_{12} + R_A = 1260 + 41.7241 = 1300.7241\Omega$$

$$R_{3B} = R_3 + R_A = 190 + 136.5517 = 326.5517\Omega$$

$$R_{78} = \frac{R_7 * R_8}{R_7 + R_8} = \frac{260 * 180}{260 + 180} = 106.3636\Omega$$

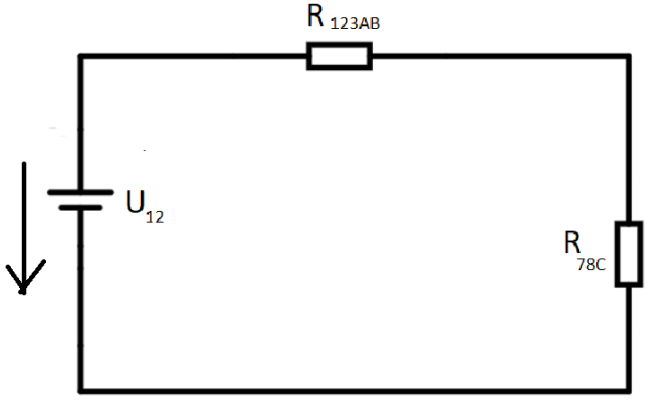


Sériové spojení R_{78} s R_C, Paralelní spojení R_12A s R_3B a spojení zdrojů napětí

$$R_{78C} = R_{78} + R_C = 106.3636 + 136.5517 = 242.9153$$

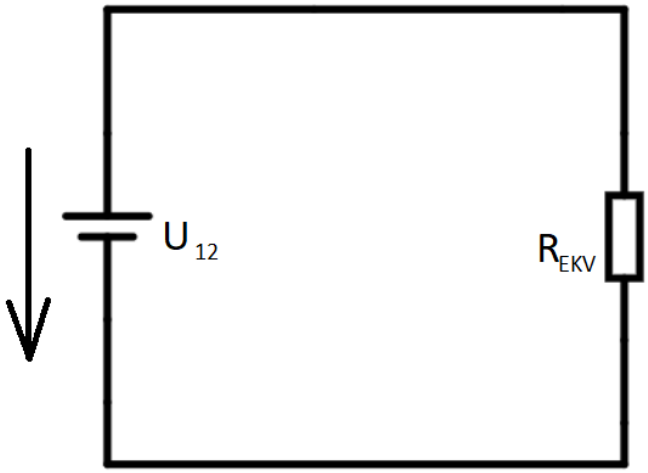
$$R_{123AB} = \frac{R_{12A} * R_{3B}}{R_{12A} + R_{3B}} = \frac{1300.7241 * 326.5517}{1300.7241 + 326.5517} = 261.0184\Omega$$

$$U_{12} = U_1 + U_2 = 100 + 800 = 180V$$



Sériové spojení R_{123AB} s R_{78C}

$$R_{EKV} = R_{123AB} + R_{78C} = 261.0184 + 242.9153 = 503.9337$$



Celkový proud I:

$$I = \frac{U}{R_{EKV}} = \frac{180}{503.9337} = 0.3571A$$

Nyní můžeme zpětně dopočítat napětí a proud na rezistoru R_3

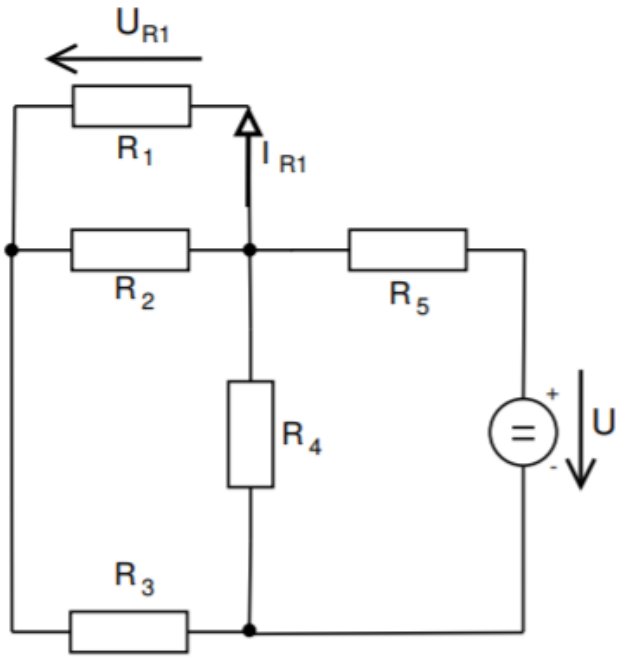
$$U_{123AB} = I * R_{123AB} = 0.3571 * 261.0184 = 93.2096$$

$$I_3 \equiv I_{3B} = \frac{U_{123AB}}{R_{3B}} = \frac{93.2096}{326.5551} = 0.2854$$

$$U_3 = I * R_3 = 0.2854 * 190 = 54.226$$

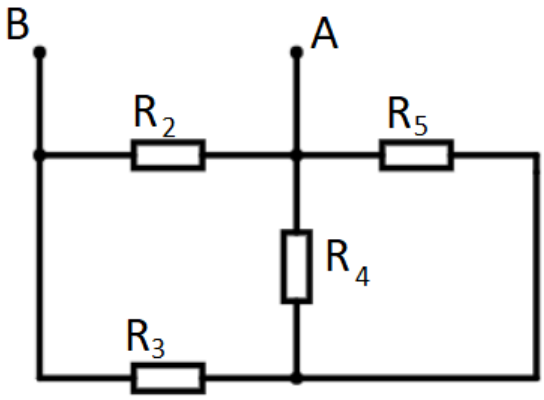
2.B

Zadání:
$U = 100V$
$R_1 = 50\Omega$ $R_2 = 310\Omega$ $R_3 = 610\Omega$ $R_4 = 220\Omega$ $R_5 = 570\Omega$



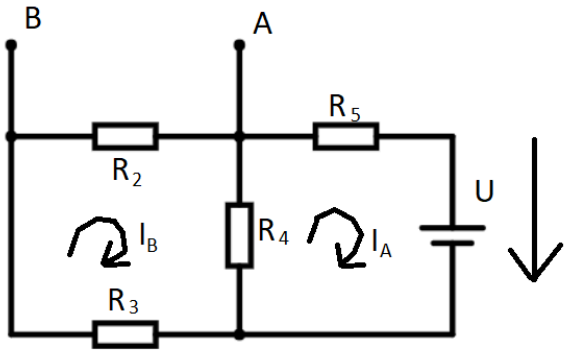
Řešení pomocí Théveninovy věty

Výpočet R_i:



$$R_i = \frac{(\frac{R_5 * R_4}{R_5 + R_4} + R_3) * R_2}{(\frac{R_5 * R_4}{R_5 + R_4} + R_3) + R_2} = \frac{(\frac{570*220}{570+220} + 610) * 310}{(\frac{570*220}{570+220} + 610) + 310} = 220.9141$$

Výpočet U_i:



Vypočítáme I_B metodou smyčkových proudů:

$$\begin{cases} U + R_4 * I_A - R_4 * I_B + R_5 * I_A = 0 \\ R_2 * I_B + R_3 * I_B + R_4 * I_B - R_4 * I_B = 0 \end{cases}$$

$$\begin{cases} 100 + 220I_A - 220I_B + 570I_A = 0 \\ 310I_B + 610I_B + 220I_B - 220I_B = 0 \end{cases}$$

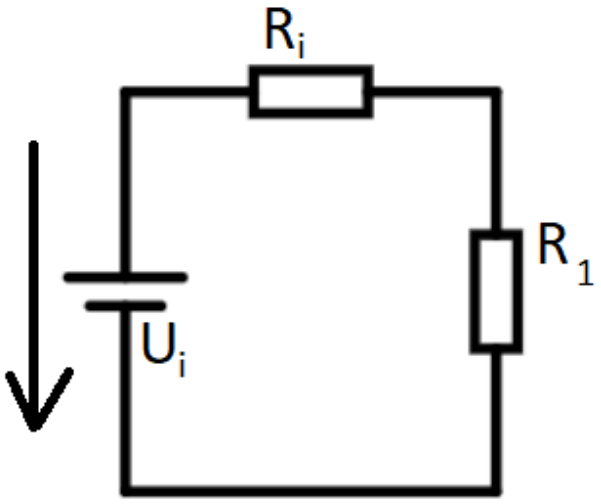
$$\begin{cases} 790I_A - 220I_B = -100 \\ -220I_A + 1140I_B = 0 / * 3.590909091 \end{cases}$$

$$\begin{cases} 790I_A - 220I_B = -100 \\ -790I_A + 4093.6363I_B = 0 \end{cases}$$

$$3873.6363I_B = -100$$

$$I_B = 0.02581A$$

$$U_i = U_2 = R_2 * I_B = 310 * 0.02581 = 8.00281V$$



$$I_i = \frac{U_i}{R_i + R_1} = \frac{8.00281}{220.9141 + 50} = 0.02964A$$

$$U_1 = R_1 * I_i = 1.48200V$$

$$I_1 = \frac{U_1}{R_1} = \frac{1.48200}{50} = 0.02964A$$