



Elektrotehnika (AVT-ELITE)

Vežbe 7

Konturne struje,
transfiguracije otpornika
vežbanje



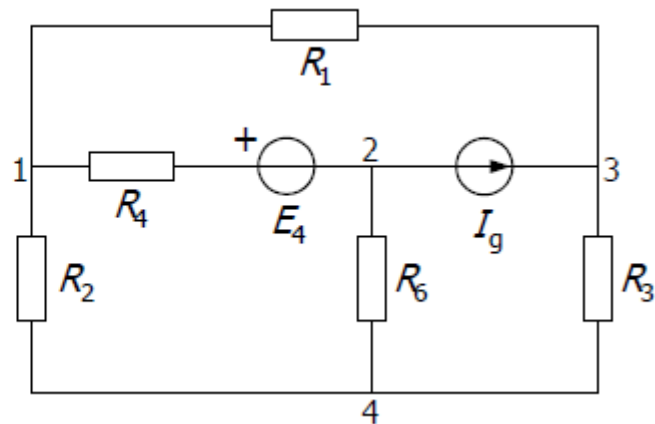
Konturne struje

II.8.2.6 Odrediti struje svih grana kola primenom metode konturnih struja, kao i snage svih elemenata u kolu. Poznato je:

$$E_4 = 138 \text{ V}, I_g = 34 \text{ mA},$$

$$R_1 = 2 \text{ k}\Omega, R_2 = 2 \text{ k}\Omega, R_3 = 3 \text{ k}\Omega,$$

$$R_4 = 500 \text{ }\Omega, R_6 = 6 \text{ k}\Omega.$$





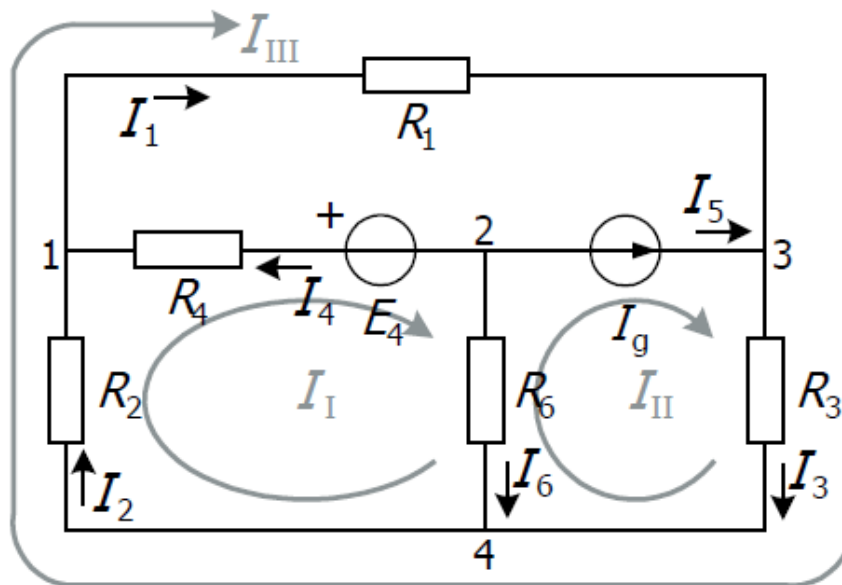
Konturne struje

Zadatak II.8.2.6

Rešenje:

$$n_g - (n_{\zeta} - 1) = 3$$

$$n_g - (n_{\zeta} - 1) - n_{I_g} = 2$$



$$(R_2 + R_4 + R_6)I_I - R_6I_{II} + R_2I_{III} = -E_4$$

$$I_{II} = I_g$$

$$R_2I_I + R_3I_{II} + (R_1 + R_2 + R_3)I_{III} = 0$$



Konturne struje

Zadatak II.8.2.6

$$8,5I_{\text{I}} + 2I_{\text{III}} = 66$$

$$2I_{\text{I}} + 7I_{\text{III}} = -102$$

$$\Delta = \begin{vmatrix} 8,5 & 2 \\ 2 & 7 \end{vmatrix} = 8,5 \cdot 7 - 2 \cdot 2 = 55,5,$$

$$\Delta_{\text{I}} = \begin{vmatrix} 66 & 2 \\ -102 & 7 \end{vmatrix} = 66 \cdot 7 - (-102) \cdot 2 = 666,$$

$$\Delta_{\text{III}} = \begin{vmatrix} 8,5 & 66 \\ 2 & -102 \end{vmatrix} = 8,5 \cdot (-102) - 2 \cdot 66 = -999.$$



Konturne struje

Zadatak II.8.2.6

$$I_{\text{I}} = \frac{\Delta_{\text{I}}}{\Delta} = \frac{666}{55,5} \text{ mA} = 12 \text{ mA}, \quad I_{\text{III}} = \frac{\Delta_{\text{III}}}{\Delta} = \frac{-999}{55,5} \text{ mA} = -18 \text{ mA}.$$

$$I_1 = I_{\text{III}} = -18 \text{ mA},$$

$$I_2 = I_{\text{I}} + I_{\text{III}} = -6 \text{ mA},$$

$$I_3 = I_{\text{II}} + I_{\text{III}} = 16 \text{ mA}$$

$$I_4 = -I_{\text{I}} = -12 \text{ mA},$$

$$I_5 = I_{\text{II}} = 34 \text{ mA},$$

$$I_6 = I_{\text{I}} - I_{\text{II}} = -22 \text{ mA}.$$



Konturne struje

Zadatak II.8.2.6

$$U_{32} = -R_6 I_6 + R_3 I_3 = 180 \text{ V}$$

$$P_{I_g} = U_{32} \cdot I_g = 180 \text{ V} \cdot 0,034 \text{ A} = 6,12 \text{ W}$$

$$P_{E_4} = E_4 I_4 = 138 \text{ V} \cdot (-0,012 \text{ A}) = -1,656 \text{ W}$$

$$P_{R_1} = R_1 I_1^2 = 2000 \Omega \cdot (-18 \cdot 10^{-3} \text{ A})^2 = 0,648 \text{ W},$$

$$P_{R_2} = R_2 I_2^2 = 2000 \Omega \cdot (-6 \cdot 10^{-3} \text{ A})^2 = 0,072 \text{ W},$$

$$P_{R_3} = R_3 I_3^2 = 3000 \Omega \cdot (-16 \cdot 10^{-3} \text{ A})^2 = 0,768 \text{ W},$$

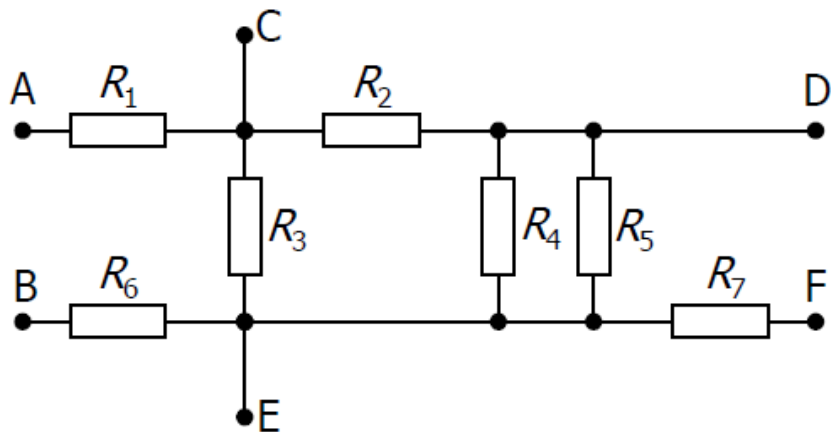
$$P_{R_4} = R_4 I_4^2 = 500 \Omega \cdot (-12 \cdot 10^{-3} \text{ A})^2 = 0,072 \text{ W}.$$

$$P_{R_6} = R_6 I_6^2 = 6000 \Omega \cdot (-22 \cdot 10^{-3} \text{ A})^2 = 2,904 \text{ W}.$$



Transfiguracije otpornika

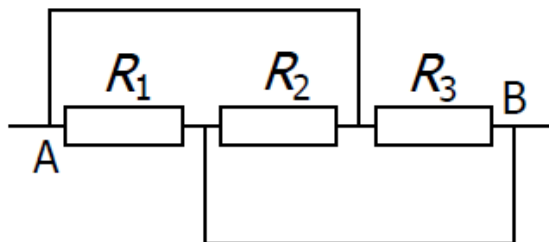
II.8.3.1.3 Za grupu otpornika na slici odrediti ekvivalentne otpornosti između svih parova tačaka označenih na slici.





Transfiguracije otpornika

II.8.3.1.4 Izračunati ekvivalentnu otpornost između tačaka A i B, ako je $R_1 = 10 \text{ k}\Omega$, $R_2 = 20 \text{ k}\Omega$, $R_3 = 60 \text{ k}\Omega$.





Transfiguracije otpornika

Zadatak II.8.3.1.4

$$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{10 \text{ k}\Omega} + \frac{1}{20 \text{ k}\Omega} + \frac{1}{60 \text{ k}\Omega} = 0,167 \frac{1}{\text{k}\Omega}$$

$$R_e = R_1 || R_2 || R_3 = \frac{1}{0,167} \text{ k}\Omega = 6 \text{ k}\Omega$$



Transfiguracije otpornika

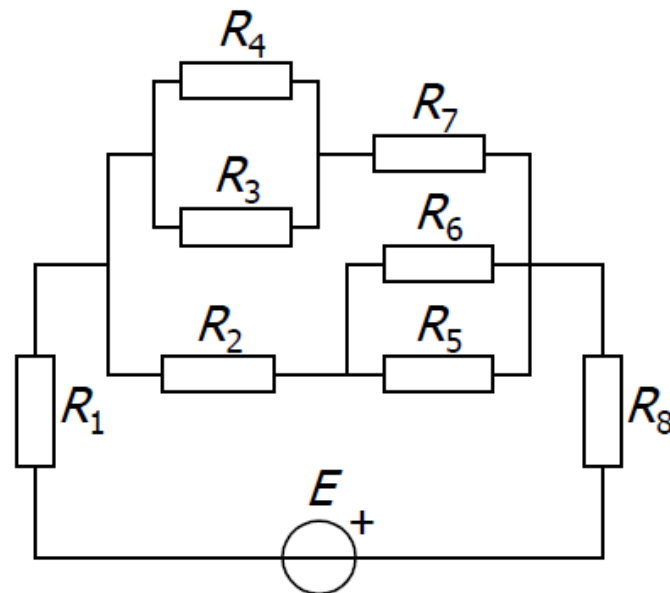
II.8.3.1.5 Izračunati struje u granama kola sa slike, kao i snagu naponskog generatora.

Dato je:

$$R_1 = 7 \text{ k}\Omega, R_2 = 8 \text{ k}\Omega, R_3 = 10 \text{ k}\Omega, R_4 = 30 \text{ k}\Omega,$$

$$R_5 = 3 \text{ k}\Omega, R_6 = 6 \text{ k}\Omega, R_7 = 2,5 \text{ k}\Omega, R_8 = 8 \text{ k}\Omega,$$

$$E = 40 \text{ V}$$





Transfiguracije otpornika

Zadatak II.8.3.1.5

$$\frac{1}{R_{34}} = \frac{1}{R_3} + \frac{1}{R_4}$$

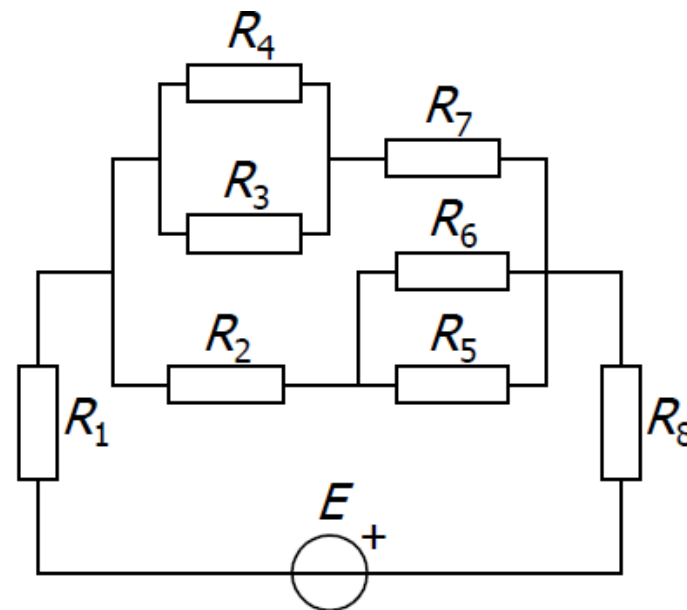
$$R_{34} = R_3 || R_4 = \frac{R_3 R_4}{R_3 + R_4} = \frac{10 \text{ k}\Omega \cdot 30 \text{ k}\Omega}{10 \text{ k}\Omega + 30 \text{ k}\Omega} = 7,5 \text{ k}\Omega$$

$$R_{347} = R_7 + R_{34} = 2,5 \text{ k}\Omega + 7,5 \text{ k}\Omega = 10 \text{ k}\Omega$$

$$\frac{1}{R_{56}} = \frac{1}{R_5} + \frac{1}{R_6}$$

$$R_{56} = R_5 || R_6 = \frac{R_5 R_6}{R_5 + R_6} = \frac{3 \text{ k}\Omega \cdot 6 \text{ k}\Omega}{3 \text{ k}\Omega + 6 \text{ k}\Omega} = 2 \text{ k}\Omega$$

$$R_{562} = R_2 + R_{56} = 8 \text{ k}\Omega + 2 \text{ k}\Omega = 10 \text{ k}\Omega$$



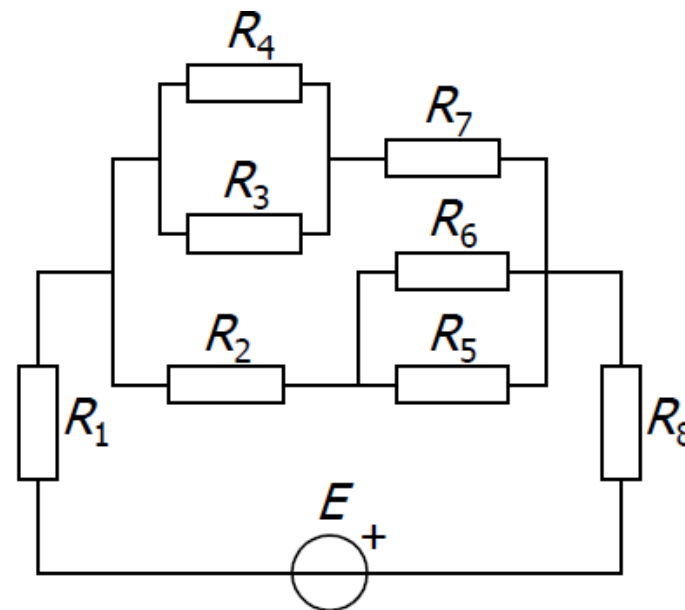


Transfiguracije otpornika

Zadatak II.8.3.1.5

$$\frac{1}{R_{234567}} = \frac{1}{R_{347}} + \frac{1}{R_{562}}$$

$$R_{234567} = R_{347} \parallel R_{562} = \frac{R_{347} R_{562}}{R_{347} + R_{562}} = \frac{10 \text{ k}\Omega \cdot 10 \text{ k}\Omega}{10 \text{ k}\Omega + 10 \text{ k}\Omega} = 5 \text{ k}\Omega$$



$$R_e = R_1 + R_8 + R_{234567} = 7 \text{ k}\Omega + 8 \text{ k}\Omega + 5 \text{ k}\Omega = 20 \text{ k}\Omega$$



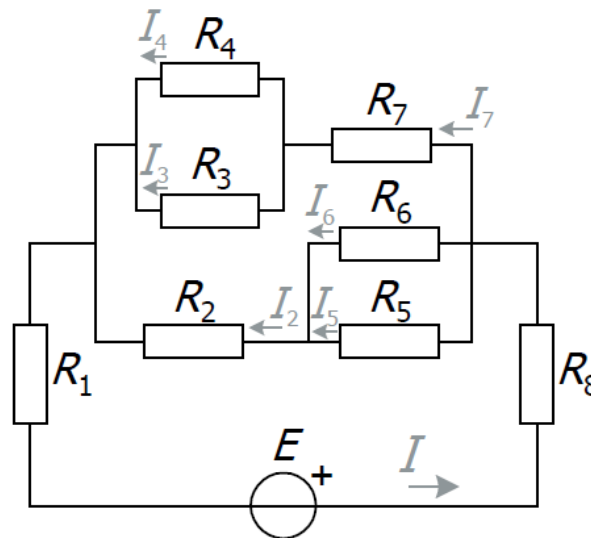
Transfiguracije otpornika

Zadatak II.8.3.1.5

$$I = \frac{E}{R_e} = \frac{40 \text{ V}}{20 \text{ k}\Omega} = 2 \text{ mA}$$

$$I_7 = \frac{R_{562}}{R_{347} + R_{562}} I = \frac{10 \text{ k}\Omega}{10 \text{ k}\Omega + 10 \text{ k}\Omega} \cdot 2 \text{ mA} = 1 \text{ mA}$$

$$I_2 = \frac{R_{347}}{R_{347} + R_{562}} I = \frac{10 \text{ k}\Omega}{10 \text{ k}\Omega + 10 \text{ k}\Omega} \cdot 2 \text{ mA} = 1 \text{ mA}$$





Transfiguracije otpornika

Zadatak II.8.3.1.5

$$I_3 = \frac{R_4}{R_3 + R_4} I_7 = \frac{30 \text{ k}\Omega}{10 \text{ k}\Omega + 30 \text{ k}\Omega} \cdot 1 \text{ mA} = 0,75 \text{ mA}$$

$$I_4 = \frac{R_3}{R_3 + R_4} I_7 = \frac{10 \text{ k}\Omega}{10 \text{ k}\Omega + 30 \text{ k}\Omega} \cdot 1 \text{ mA} = 0,25 \text{ mA}$$

$$I_5 = \frac{R_6}{R_5 + R_6} I_2 = \frac{6 \text{ k}\Omega}{3 \text{ k}\Omega + 6 \text{ k}\Omega} \cdot 1 \text{ mA} = 0,67 \text{ mA}$$

$$I_6 = \frac{R_5}{R_5 + R_6} I_2 = \frac{3 \text{ k}\Omega}{3 \text{ k}\Omega + 6 \text{ k}\Omega} \cdot 1 \text{ mA} = 0,33 \text{ mA}$$

