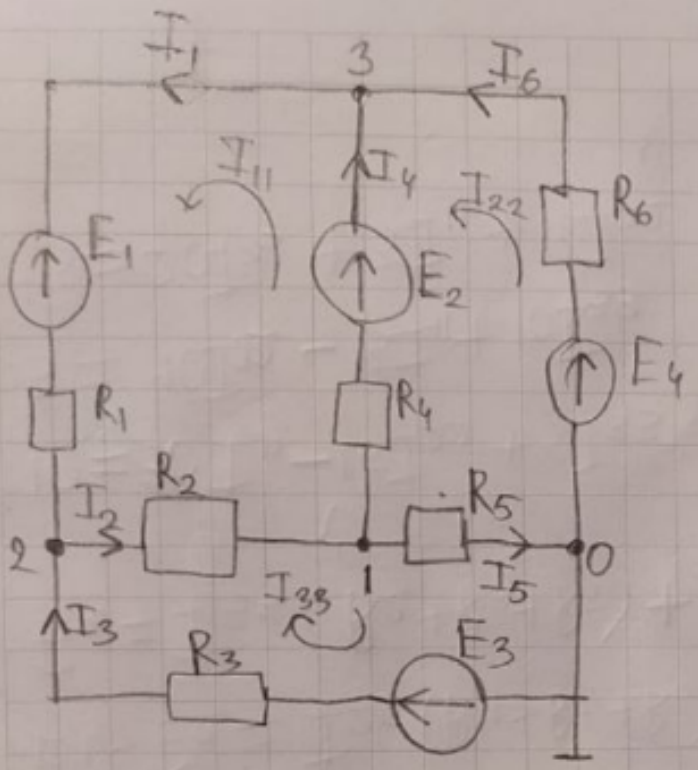

Метод узловых потенциалов:

$\varphi_0 = 0$

$$\begin{cases} 1)\ \varphi_1\left(\frac{1}{R_2}+\frac{1}{R_4}+\frac{1}{R_5}\right) - \frac{\varphi_2}{R_2} - \frac{\varphi_3}{R_4} = -\frac{E_2}{R_4} \\ 2)\ \varphi_2\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right) - \frac{\varphi_1}{R_2} - \frac{\varphi_3}{R_1} = \frac{E_3}{R_3} - \frac{E_1}{R_1} \\ 3)\ \varphi_3\left(\frac{1}{R_1}+\frac{1}{R_4}+\frac{1}{R_6}\right) - \frac{\varphi_1}{R_4} - \frac{\varphi_2}{R_1} = \frac{E_4}{R_6} + \frac{E_2}{R_4} + \frac{E_1}{R_1} \end{cases}$$

$$\begin{cases} 1)\ 11\varphi_1 - 6\varphi_2 - 2\varphi_3 = -40 \\ 2)\ -2\varphi_1 + 5\varphi_2 - \varphi_3 = 20 \\ 3)\ -2\varphi_1 - 3\varphi_2 + 7\varphi_3 = 120 \end{cases} \Rightarrow \begin{aligned} \varphi_1 &= \frac{50}{7} \\ \varphi_2 &= \frac{655}{56} \\ \varphi_3 &= \frac{1355}{56} \end{aligned}$$

$$I_1 = \frac{\varphi_3 - \varphi_2 - E_1}{R_1} = \frac{140}{56 \cdot 10} = \frac{1}{4}$$

$$I_2 = \frac{\varphi_2 - \varphi_1}{R_2} = \frac{51}{56} \qquad I_3 = \frac{-\varphi_2 + E_3}{R_3} = \frac{37}{56}$$

$$I_4 = \frac{\varphi_1 - \varphi_3 + E_2}{R_4} = \frac{11}{56} \qquad I_5 = \frac{\varphi_1}{R_5} = \frac{5}{7}$$

$$I_6 = \frac{-\varphi_3 + E_4}{R_6} = \frac{3}{56}$$

Метод контурных токов

$$\begin{cases} E_2 - E_1 = I_{11}(R_1 + R_2 + R_4) - I_{22}R_4 + I_{33}R_2 \\ E_4 - E_2 = I_{22}(R_4 + R_5 + R_6) - I_{11}R_4 + I_{33}R_5 \\ E_3 = I_{33}(R_2 + R_3 + R_5) + I_{11}R_2 + I_{22}R_5 \end{cases}$$

$$\Downarrow$$

$$\begin{cases} 10 = 30I_{11} - 15I_{22} + 5I_{33} \\ 5 = 40I_{22} - 15I_{11} + 10I_{33} \\ 15 = 20I_{33} + 5I_{11} + 10I_{22} \end{cases} \Big| :5 \Rightarrow \begin{cases} 2 = 6I_{11} - 3I_{22} + I_{33} \\ 1 = 8 - 3I_{11} + 8I_{22} + 2I_{33} \\ 3 = I_{11} + 2I_{22} + 4I_{33} \end{cases}$$

$$\Downarrow$$

$$I_{11} = \frac{1}{4} \qquad I_{22} = \frac{3}{56}$$

$$I_{33} = \frac{37}{56}$$

$I_1 = I_{11} = \frac{1}{4}$ $\quad I_2 = I_{11} + I_{33} = \frac{51}{56}$

$I_3 = I_{33} = \frac{37}{56}$ $\quad I_4 = I_{11} - I_{22} = \frac{11}{56}$

$I_5 = I_{22} + I_{33} = \frac{5}{7}$ $\quad I_6 = I_{22} = \frac{3}{56}$

$$I_1 = \frac{\varphi_3 - \varphi_2 - E_1}{R_1} = \frac{1}{4} \Rightarrow \varphi_3 - \varphi_2 = \frac{10}{4} + 10 = \frac{25}{2}$$

$$I_2 = \frac{\varphi_2 - \varphi_1}{R_2} = \frac{51}{56} \Rightarrow \varphi_2 - \varphi_1 = \frac{255}{56}$$

$$I_3 = \frac{E_3 - \varphi_2}{R_3} = \frac{37}{56} \Rightarrow -\varphi_2 = \frac{185}{56} - \frac{840}{56} \Rightarrow \varphi_2 = \frac{655}{56}$$

$$I_4 = \frac{\varphi_1 - \varphi_3 + E_2}{R_4} = \frac{11}{56} \Rightarrow \varphi_1 - \varphi_3 = \frac{165}{56} - \frac{1120}{56} = -\frac{955}{56}$$

$$I_5 = \frac{\varphi_1}{R_5} \Rightarrow \frac{5}{7} \Rightarrow \varphi_1 = \frac{50}{7}$$

$$I_6 = \frac{-\varphi_3 + E_4}{R_6} = \frac{3}{56} \Rightarrow \varphi_3 = \frac{45}{56} - \frac{1400}{56} \Rightarrow \varphi_3 = \frac{1355}{56}$$

Ответ: $I_1 = \frac{1}{4}$; $I_2 = \frac{51}{56}$; $I_3 = \frac{37}{56}$; $I_4 = \frac{11}{56}$

$I_5 = \frac{5}{7}$; $I_6 = \frac{3}{56}$

$\varphi_1 = \frac{50}{7}$; $\varphi_2 = \frac{655}{56}$; $\varphi_3 = \frac{1355}{56}$