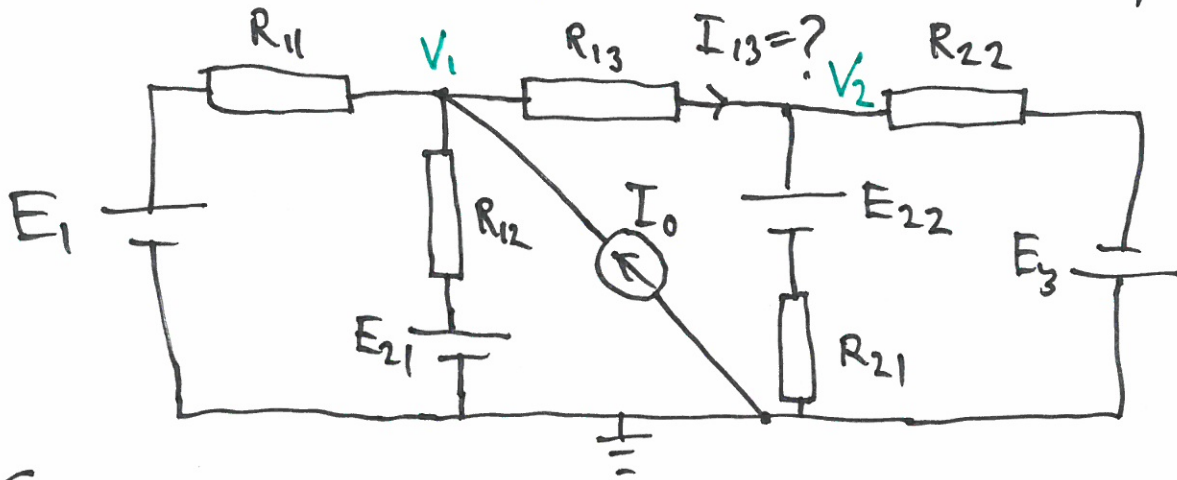


A 1.17 Lösung mit nod analysis



$$\begin{aligned}
 E_1 &= 3.0\text{V} \\
 E_{21} &= E_{22} \\
 &= 2.0\text{V} \\
 E_3 &= 6.0\text{V} \\
 I_0 &= 1.0\text{V} \\
 R_{11} &= R_{12} \\
 &= R_{13} = 1.0\Omega \\
 R_{21} &= R_{22} \\
 &= 2.0\Omega
 \end{aligned}$$

$$\begin{cases}
 \frac{E_1 - V_1}{R_{11}} + \frac{V_2 - V_1}{R_{13}} + I_0 + \frac{E_{21} - V_1}{R_{12}} = 0 \\
 \frac{V_1 - V_2}{R_{13}} + \frac{E_{22} - V_2}{R_{21}} + \frac{-E_3 - V_2}{R_{22}} = 0
 \end{cases}$$

$$\Leftrightarrow \begin{cases}
 \left(-\frac{1}{R_{11}} - \frac{1}{R_{13}} - \frac{1}{R_{12}}\right) \cdot V_1 + \frac{1}{R_{13}} \cdot V_2 = -\frac{E_1}{R_{11}} - \frac{E_{21}}{R_{12}} - I_0 \\
 \frac{1}{R_{13}} \cdot V_1 + \left(-\frac{1}{R_{13}} - \frac{1}{R_{21}} - \frac{1}{R_{22}}\right) \cdot V_2 = \frac{E_3}{R_{22}} - \frac{E_{22}}{R_{21}}
 \end{cases}$$

$$\Leftrightarrow \begin{cases}
 -3 \cdot V_1 + V_2 = -\frac{3}{1} - \frac{2}{1} - 1 = -6 \\
 V_1 - 2 \cdot V_2 = \frac{-2}{2} + \frac{6}{2} = 2
 \end{cases}$$

$$\Rightarrow V_1 = 2 + 2V_2 \Rightarrow -3(2 + 2V_2) + V_2 = -6$$

$$\Leftrightarrow -6 - 6V_2 + V_2 = -6 \Leftrightarrow V_2 = 0\text{V} \Rightarrow V_1 = 2\text{V}$$

$$I_{13} = \frac{V_1 - V_2}{R_{13}} = \frac{2 - 0}{1} = 2.0\text{A}$$

$$\boxed{I_{13} = 2.0\text{A}}$$