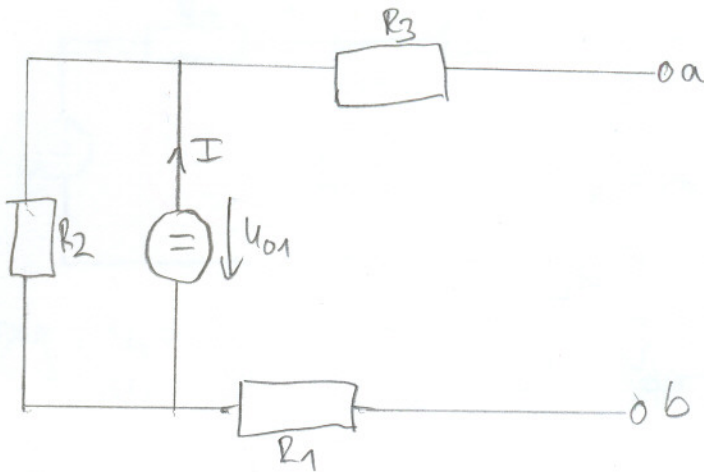


Übungsblatt 1

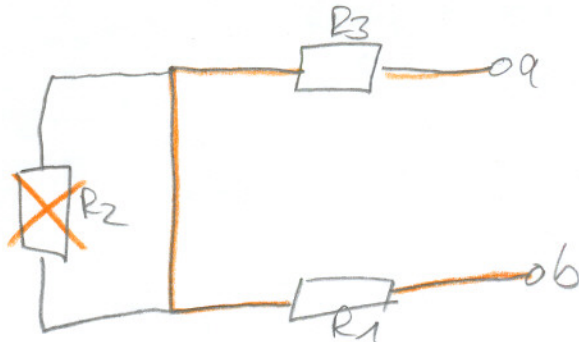
Aufgabe 2

(3)



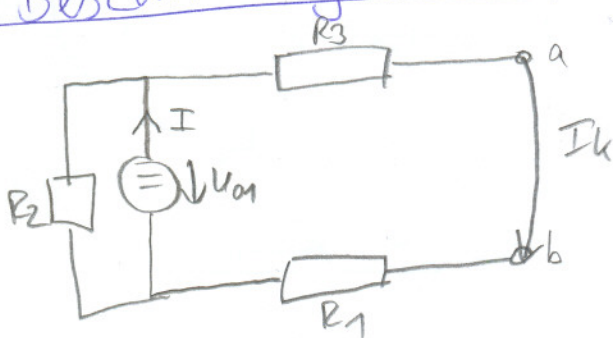
Bestimmung von R_i :

Ersatzschaltung:



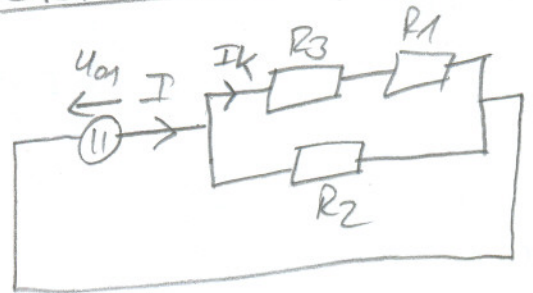
$$\underline{\underline{R_i = R_1 + R_3}}$$

Bestimmung von I_k :



$$I_k = \frac{U_{01}}{R_i} = \frac{U_{01}}{\underline{\underline{R_1 + R_3}}}$$

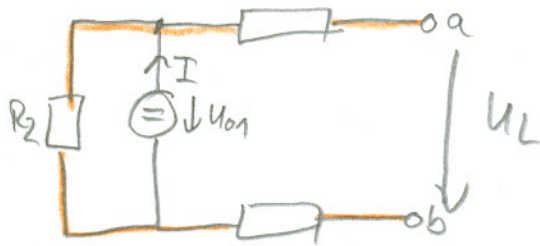
Ersatzschaltung:



Bestimmung von U_L :

$$U_L = R_i \cdot I_L = (\cancel{R_1 + R_3}) \cdot \frac{U_{01}}{(\cancel{R_1 + R_3})} = \underline{\underline{U_{01}}}$$

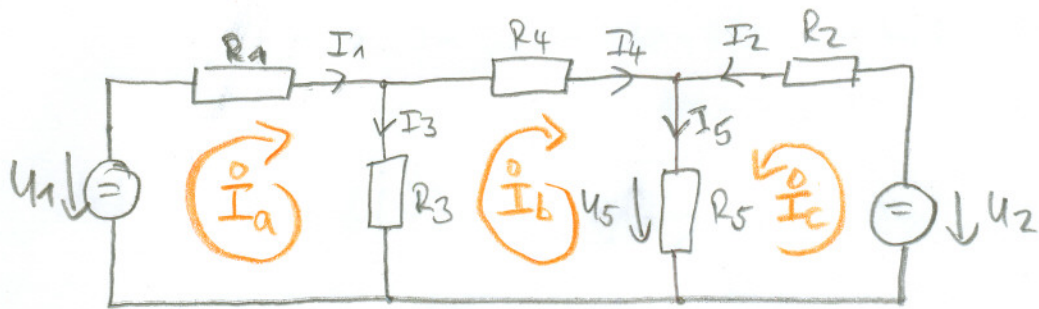
oder auch:



$$\underline{\underline{U_L = R_2 \cdot I}}$$

Übungsblatt 2

Aufgabe 1 (mit Werten aus Aufgabe 1)



geg.: $U_1 = 6V$ $R_1 = 1\Omega$ $R_3 = 1\Omega$ $R_5 = 470\Omega$
 $U_2 = 9V$ $R_2 = 1\Omega$ $R_4 = 270\Omega$

ges.: I_1, I_2, I_3, U_5

Meshstromverfahren:

$$M1: R_1 \overset{\circ}{I}_a + R_3 \overset{\circ}{I}_a - R_3 \overset{\circ}{I}_b = U_1$$

$$M2: -R_3 \overset{\circ}{I}_a + R_3 \overset{\circ}{I}_b + R_4 \overset{\circ}{I}_b + R_5 \overset{\circ}{I}_b + R_5 \overset{\circ}{I}_c = 0$$

$$M3: R_5 \overset{\circ}{I}_b + R_5 \overset{\circ}{I}_c + R_2 \overset{\circ}{I}_c = U_2$$

Matrixdarstellung:

$$\begin{pmatrix} R_1+R_3 & -R_3 & 0 \\ -R_3 & R_3+R_4+R_5 & R_5 \\ 0 & R_5 & R_2+R_5 \end{pmatrix} \begin{pmatrix} \overset{\circ}{I}_a \\ \overset{\circ}{I}_b \\ \overset{\circ}{I}_c \end{pmatrix} = \begin{pmatrix} U_1 \\ 0 \\ U_2 \end{pmatrix}$$

$A \quad \quad \quad x \quad \quad \quad b$

Konkrete Werte:

$$\begin{pmatrix} 2\Omega & -1\Omega & 0\Omega \\ -1\Omega & 741\Omega & 470\Omega \\ 0 & 470\Omega & 471\Omega \end{pmatrix} \begin{pmatrix} \overset{\circ}{I}_a \\ \overset{\circ}{I}_b \\ \overset{\circ}{I}_c \end{pmatrix} = \begin{pmatrix} 6V \\ 0V \\ 9V \end{pmatrix}$$

$$\det(A) = \overset{-4-}{698022} \cdot 2 \times 741 \times 471 + (-1) \times (470) \times 0 + 0 \times (-1) \times (470) \\ - \underbrace{0 \times (741) \times 0}_0 - \underbrace{470 \times 470 \times 2}_{441800} - \underbrace{471 \cdot (-1) \cdot (-1)}_{471} \neq$$

$$\det \Rightarrow \det(A) = 698022 - 441800 - 471 = \underline{\underline{255751}}$$

$$\det(A_1) = \det \begin{pmatrix} 6 & -1 & 0 \\ 0 & 741 & 470 \\ 9 & 470 & 471 \end{pmatrix} = 2094066 - 4230 - 132540 \\ = \underline{\underline{764436}}$$

$$\det(A_2) = \det \begin{pmatrix} 2 & 6 & 0 \\ -1 & 0 & 470 \\ 0 & 9 & 471 \end{pmatrix} = -8460 + 2826 = \underline{\underline{-5634}}$$

$$\det(A_3) = \det \begin{pmatrix} 2 & -1 & 6 \\ -1 & 741 & 0 \\ 0 & 470 & 9 \end{pmatrix} = 13338 - 2820 - 9 = \underline{\underline{10509}}$$

$$\overset{\circ}{I}_a = \frac{\det(A_1)}{\det(A)} = \frac{764436}{255751} = \underline{\underline{2,999A}}$$

$$\overset{\circ}{I}_b = \frac{\det(A_2)}{\det(A)} = -\frac{5634}{255751} = \underline{\underline{-0,022A}}$$

$$\overset{\circ}{I}_c = \frac{\det(A_3)}{\det(A)} = \frac{10509}{255751} = \underline{\underline{0,041A}}$$

~~$$I_1 = R_1 \cdot \overset{\circ}{I}_a = 1\Omega \cdot 2,999A = 2,999A \approx 3A$$~~

~~$$I_2 = R_2 \cdot \overset{\circ}{I}_c = 1\Omega \cdot 0,041A = 0,041A$$~~

~~$$I_3 = R_3 \cdot \overset{\circ}{I}_a - R_3 \cdot \overset{\circ}{I}_b = 1\Omega \cdot 2,999A - 1\Omega \cdot (-0,022A) = 3,021A$$~~

~~$$U_5 = R_5 \cdot (\overset{\circ}{I}_b + \overset{\circ}{I}_c) = 470\Omega \cdot (-0,022 + 0,041)A = 29,61A$$~~

$$I_1 = \dot{I}_a = 2,999 \text{ A} \approx \underline{\underline{3 \text{ A}}}$$

$$\cancel{I_2 = R_2 \cdot \dot{I}_c =}$$

$$I_2 = \dot{I}_c = \underline{\underline{0,041 \text{ A}}}$$

$$I_3 = \dot{I}_a - \dot{I}_b = 2,999 - (-0,022) = \underline{\underline{3,021 \text{ A}}}$$

$$U_5 = R_5 \cdot I_5 = R_5 \cdot (\dot{I}_b + \dot{I}_c) = 470 \Omega \cdot (-0,022 + 0,041) \text{ A} = \underline{\underline{29,61 \text{ V}}}$$