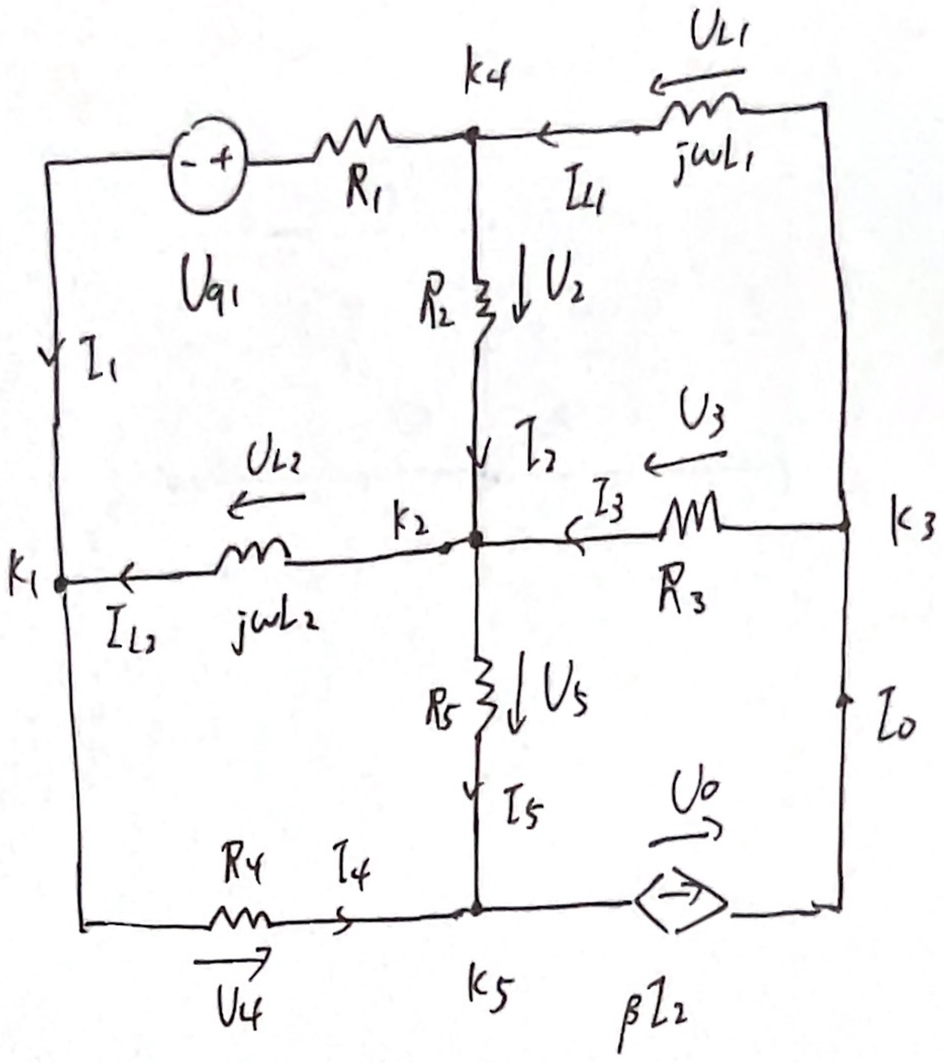
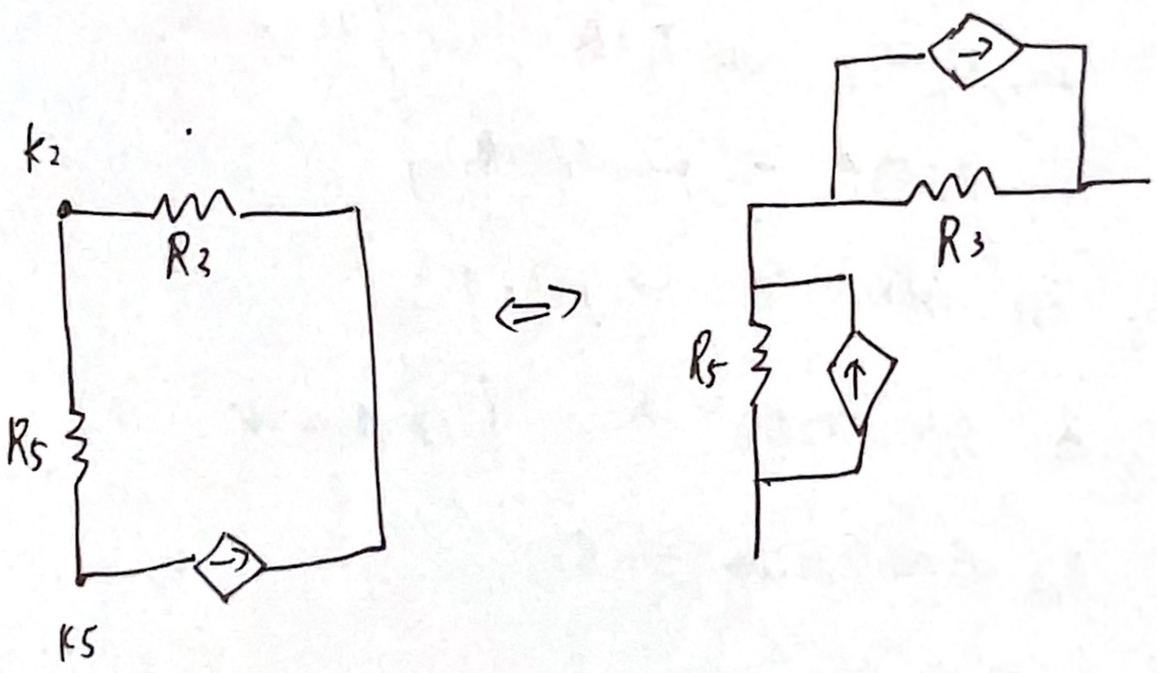
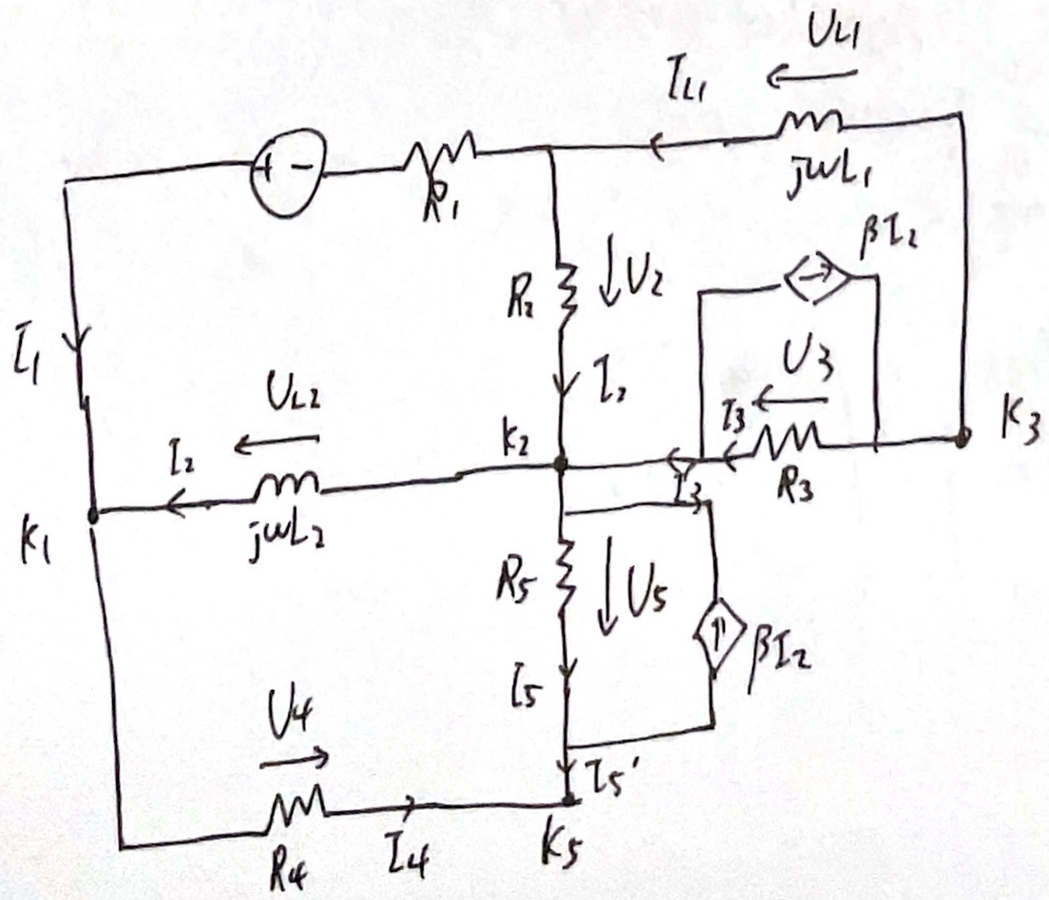
Aufgabe 15



a. Quellenverschieben, I_4, I_{L1} 不变





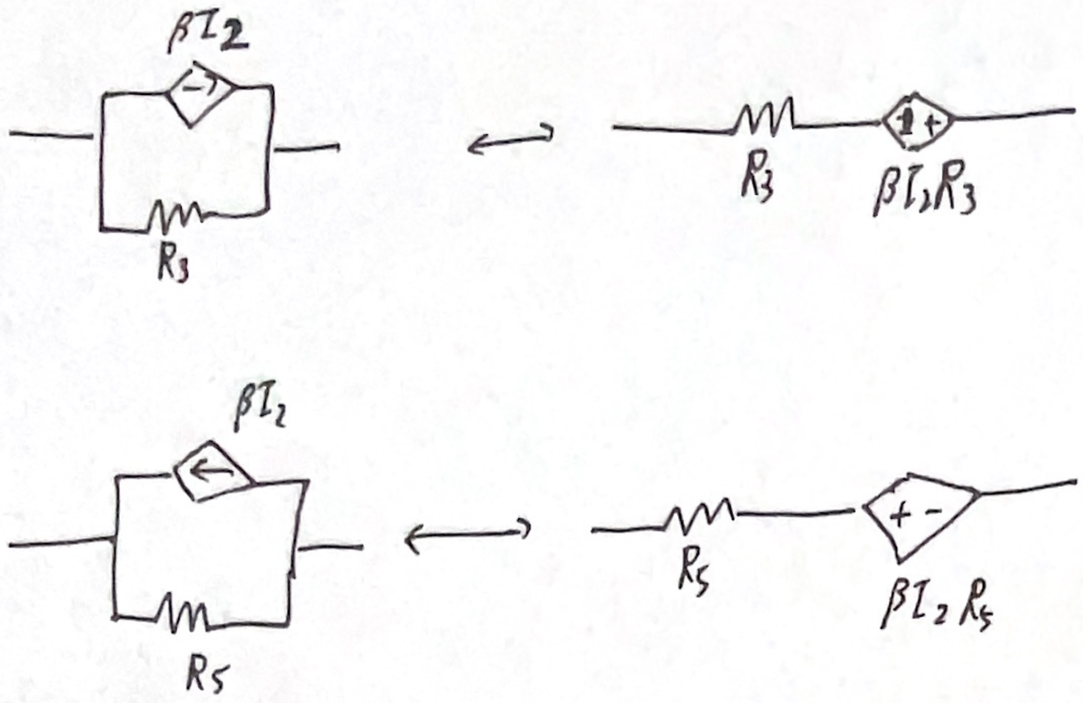
$U_0 = -U_5 - U_3$

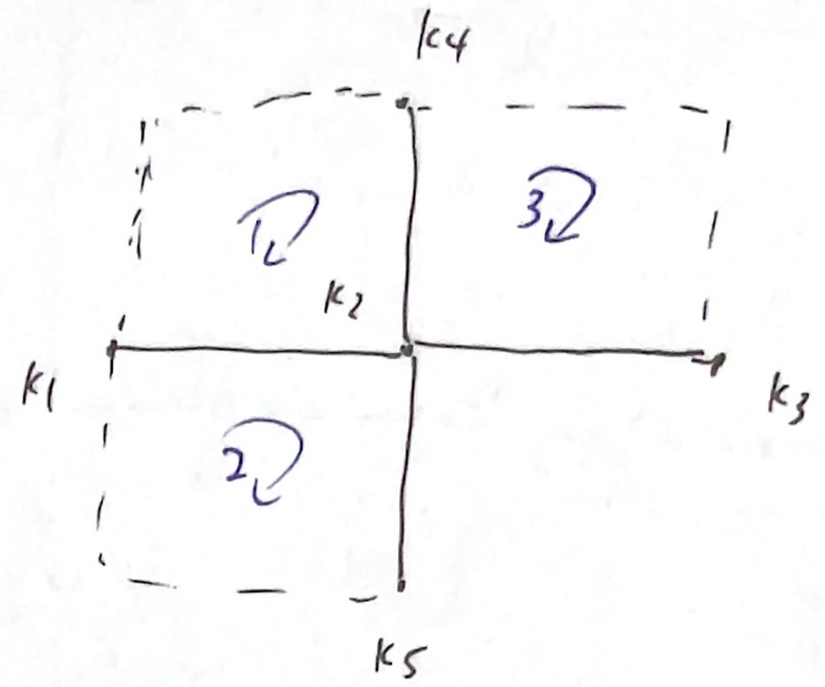
$I_3' = I_3 \pm \beta I_2$ $\quad \Leftrightarrow \quad I_3 = I_3' + \beta I_2$

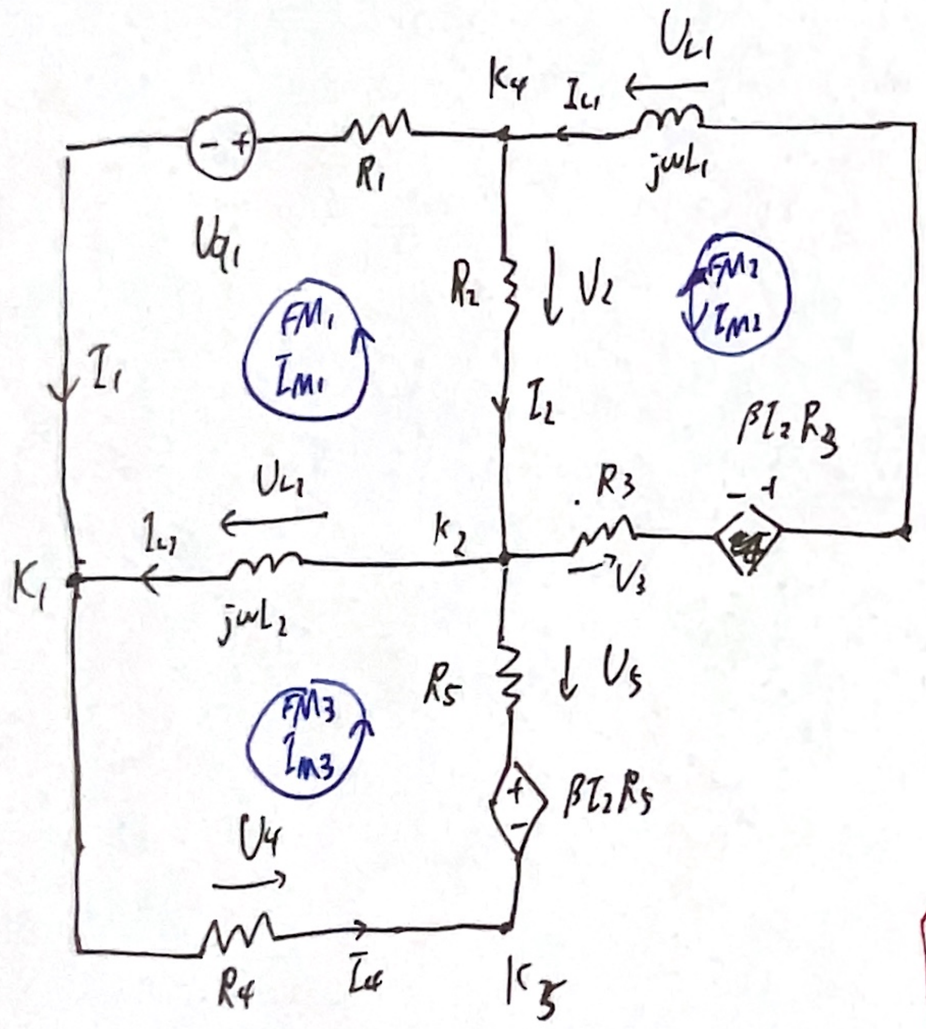
$I_5' = I_5 \pm \beta I_2$ $\quad\quad I_5 = I_5' + \beta I_2$

b. 书上 Gleichyssystem des Maschen impedanzverfahrens in Matrixform

电流源 → 电压源







Z_{11}，在FM1中 → $R_1 + R_2 + jωL_2$

Z_{22}，在FM2中 → $R_2 + R_3 + jωL_1$

Z_{33}，在FM3中 → $jωL_2 + R_5 + R_4$

11 Z2 33 ⋮ positiv

Z_{13}，与FM1,FM3相交 → $jωL_2$

Z_{23}，与FM2,FM3相交 → 0

Z_{12}，与FM1,FM2相交 → R_2

12 13 23 negativ ⋮

$$m = z - k + 1 = 7 - 5 + 1 = 3$$

$$\begin{cases} I_{M1} = I_1 \\ I_{M2} = I_{L1} \\ I_{M3} = I_4 \end{cases}$$

网孔方向最好与外支路电流方向一致

不过负无所谓

$$\begin{pmatrix} R_1+R_2+jωL_2 & -R_2 & -jωL_2 \\ -R_2 & R_2+R_3+jωL_1 & 0 \\ -jωL_2 & 0 & jωL_2+R_5+R_4 \end{pmatrix} \begin{pmatrix} I_{M1} \\ I_{M2} \\ I_{M3} \end{pmatrix} = \begin{pmatrix} -U_{q1} \\ βI_2R_3 \\ βI_2R_5 \end{pmatrix}$$

$U_1 \rightarrow U_{q1}$

$U_2 \rightarrow βI_2R_2$

$U_3 \rightarrow βI_2R_3$

顺方 positiv

逆方 negativ

Ui不能自己受控源 $I_2 = -I_{m1} + I_{m2}$

$$\begin{pmatrix} R_1+R_2+j\omega L_2 & -R_2 & -j\omega L_2 \\ -R_2+\beta R_3 & (R_2+R_3+j\omega L_1)-\beta R_3 & 0 \\ -j\omega L_2+\beta R_5 & -\beta R_5 & j\omega L_2+R_4+R_5 \end{pmatrix} \begin{pmatrix} I_{m1} \\ I_{m2} \\ I_{m3} \end{pmatrix} = \begin{pmatrix} -U_{g1} \\ 0 \\ 0 \end{pmatrix}$$

$$-R_2 I_{m1} + (R_2+R_3+j\omega L_1) I_{m2} = \beta I_2 R_3 = -\beta R_3 I_{m1} + \beta R_3 I_{m2}$$

$$-j\omega L_2 I_{m1} + 0 + \cdots = \beta I_2 R_5 = -\beta R_5 I_{m1} + \beta R_5 I_{m2}$$

C.f. $H(j\omega) = \dfrac{I_4}{U_{g1}}$

$$I_4 = I_{m3} = \frac{\begin{vmatrix} R_1+R_2+j\omega L_2 & -R_2 & -U_{g1} \\ -R_2+\beta R_3 & (R_2+R_3+j\omega L_1-\beta R_3 & 0 \\ -j\omega L_2+\beta R_5 & -\beta R_5 & 0 \end{vmatrix}}{\det \underline{\underline{Z}}}$$

$H(j\omega) = \cdots$