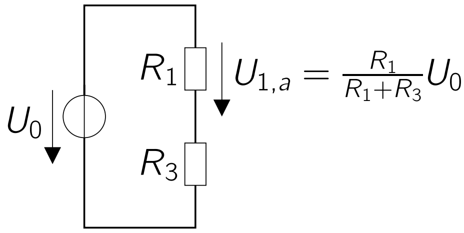
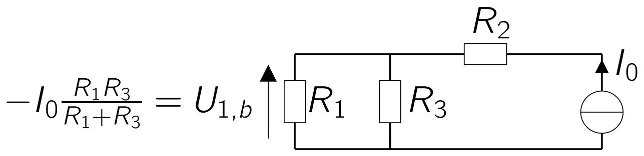
Aufgabe 1





$\Rightarrow$

$$U_1 = \frac{R_1}{R_1 + R_3}(U_0 - I_0 R_1)$$

Aufgabe 2

a)

- [x] Schaltung 2 ist identisch mit Schaltung 1.
- [ ] Schaltung 3 ist identisch mit Schaltung 1.
- [ ] Schaltung 2 ist identisch mit Schaltung 4.
- [x] Schaltung 3 ist identisch mit Schaltung 4.
- [ ] Nichts trifft zu.

b)

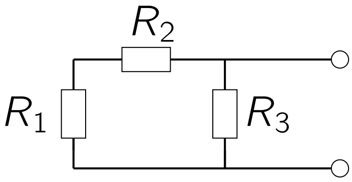
- [x] Graph 1.
- [ ] Graph 2.
- [x] Graph 3.
- [x] Graph 4.
- [ ] Nichts trifft zu.

c)

- [x] $U_1 = U_0$
- [ ] $U_1 = -U_0$
- [ ] $I_1 = I_0$
- [ ] $I_1 = -I_0$
- [ ] Nichts trifft zu.

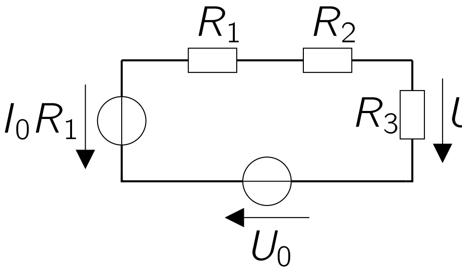
Aufgabe 3

a)



$$\Leftarrow R_q = \frac{R_3(R_1+R_2)}{R_1+R_2+R_3}$$

b)



$$U_q = \frac{R_3}{R_1+R_2+R_3}(I_0R_1 - U_0)$$

c)

$$\begin{aligned} U_L &= \frac{R_L}{R_q + R_L} U_q \\ &= \frac{R_L}{\frac{R_3(R_1+R_2)}{R_1+R_2+R_3} + R_L} \frac{R_3}{R_1 + R_2 + R_3}(I_0R_1 - U_0) \\ &= \frac{R_L R_3 (I_0 R_1 - U_0)}{R_3(R_1 + R_2) + R_L(R_1 + R_2 + R_3)} \end{aligned}$$

Aufgabe 4

a)

- [ ] $U_1 = RI_0$
- [x] $U_1 = \frac{1}{2}RI_0$
- [ ] $U_1 = \frac{1}{2}RI_0 + 2U_0$
- [ ] $U_1 = RI_0 - 2U_0$
- [ ] Nichts trifft zu.

b)

- [x] $R_x = \frac{R_1 R_3}{R_1+R_2+R_3}$
- [ ] $R_x = \frac{\frac{1}{R_1}\frac{1}{R_3}}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}}$
- [ ] $R_x = \frac{\frac{1}{R_1+R_2+R_3}}{\frac{1}{R_1}+\frac{1}{R_3}}$
- [ ] $R_x = \frac{\frac{1}{R_1}\frac{1}{R_2}\frac{1}{R_3}}{\frac{1}{R_1}+\frac{1}{R_3}}$
- [ ] Nichts trifft zu.

c)

☒ $U_1 = \frac{\frac{R_3}{R_2+R_3}}{\frac{1}{R_1}+\frac{1}{R_2+R_3}} I_0$

☒ $U_1 = \frac{R_1 R_3}{R_1+R_2+R_3} I_0$

☐ $U_1 = \frac{R_3(R_2+R_3)}{R_1+(R_2+R_3)} I_0$

☐ $U_1 = \frac{\frac{R_3}{R_1+R_2+R_3}}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}} I_0$

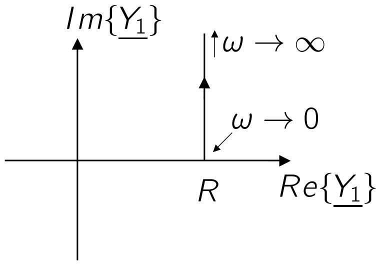
☐ Nichts trifft zu.

Aufgabe 5

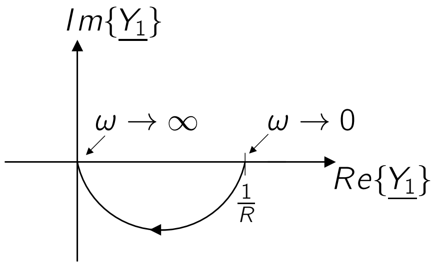
a) $\underline{Y} = j\omega C + \frac{1}{j\omega L+R}$

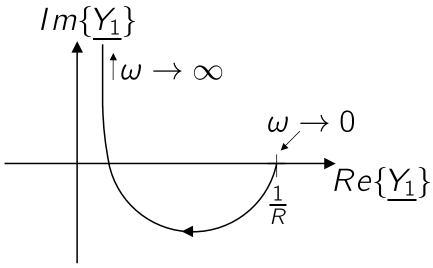
b) + c)

$\frac{1}{j\omega L+R}$



$j\omega L + R$





d)

$$\underline{S} = \frac{1}{2}\underline{UI}^*$$

$$= \frac{1}{2}\underline{UU}^*\underline{Y}^*$$

$$= \frac{1}{2}|\underline{U}|^2\Big(-j\omega C + \frac{1}{R - j\omega L}\Big)$$

e)

$$Im\underline{S} \overset{!}{=} 0 \qquad \underline{S} = \frac{1}{2}|\underline{U}|^2\Big(-j\omega C + \frac{R + j\omega L}{R^2 + (\omega L)^2}\Big)$$

$$Im\underline{S} = -\omega C + \frac{\omega L}{R^2 + (\omega L)^2} \overset{!}{=} 0c$$

$$\Leftrightarrow \quad -\omega C\big(R^2 + (\omega l)^2\big) + \omega L = 0$$

$$\Leftrightarrow \quad \underline{\omega = 0} \quad \vee \quad L = C\big(R^2 + (\omega L)^2\big)$$

$$\Leftrightarrow (\omega L)^2 = \frac{L}{C} - R^2$$

$$\Leftrightarrow \quad \underline{\underline{\omega = \pm\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}}} \quad \text{(nur positive Lösung sinnvoll)}$$

Aufgabe 6

a)

☐ $\begin{pmatrix} \underline{U}_1 \\ \underline{U}_2 \end{pmatrix} = \begin{pmatrix} j\omega \mathrm{L}_1 & +j\omega M \\ +j\omega M & j\omega L_2 \end{pmatrix} \begin{pmatrix} \underline{I}_1 \\ \underline{I}_2 \end{pmatrix}$

☐ $\begin{pmatrix} \underline{U}_1 \\ \underline{U}_2 \end{pmatrix} = \begin{pmatrix} j\omega \mathrm{L}_1 & -j\omega M \\ +j\omega M & j\omega L_2 \end{pmatrix} \begin{pmatrix} \underline{I}_1 \\ \underline{I}_2 \end{pmatrix}$

☐ $\begin{pmatrix} \underline{U}_1 \\ \underline{U}_2 \end{pmatrix} = \begin{pmatrix} j\omega \mathrm{L}_1 & +j\omega M \\ -j\omega M & j\omega L_2 \end{pmatrix} \begin{pmatrix} \underline{I}_1 \\ \underline{I}_2 \end{pmatrix}$

☒ $\begin{pmatrix} \underline{U}_1 \\ \underline{U}_2 \end{pmatrix} = \begin{pmatrix} j\omega \mathrm{L}_1 & -j\omega M \\ -j\omega M & j\omega L_2 \end{pmatrix} \begin{pmatrix} \underline{I}_1 \\ \underline{I}_2 \end{pmatrix}$

☐ Nichts trifft zu.

b)

☒ $\underline{Y} = j\omega C + \frac{1}{2R + \frac{1}{j\omega C}}$

☐ $\underline{Y} = j\omega 2C + \frac{1}{2R}$

☐ $\underline{Y} = \frac{2}{j\omega C} + \frac{2}{R}$

☐ Nichts trifft zu.

c)

☒ $u_2(t) = \mathrm{Re}\{\underline{U}_1 e^{j\phi} e^{j\omega_0 t}\}$

☒ $u_2(t) = U_1 \mathrm{Re}\{e^{j(\phi+\omega_0)t}\}$

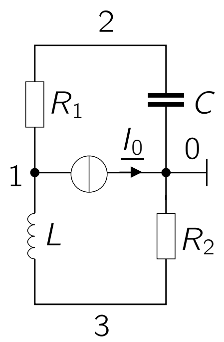
☐ $u_2(t) = e^{j\phi} \mathrm{Re}\{\underline{U}_1 e^{j\omega_0 t}\}$

☒ $u_2(t) = U_1 \mathrm{Re}\{\underline{U}_1 e^{j\phi} e^{j\omega_0 t}\}$

☐ Nichts trifft zu.

Aufgabe 7

a)



0 ist Bezugsknoten

b)

$$\left[\underline{Y}\right] = \begin{pmatrix} \frac{1}{R_1} + \frac{1}{j\omega L} & -\frac{1}{R_1} & -\frac{1}{j\omega L} \\ -\frac{1}{R_1} & \frac{1}{R_1} + j\omega C & 0 \\ -\frac{1}{j\omega L} & 0 & \frac{1}{R_2} + \frac{1}{j\omega L} \end{pmatrix}$$

$$\left[\underline{I_{qn}}\right] = \begin{pmatrix} -\underline{I}_0 \\ 0 \\ 0 \end{pmatrix} \qquad \left[\underline{U_n}\right] = \begin{pmatrix} \underline{U_{n1}} \\ \underline{U_{n2}} \\ \underline{U_{n3}} \end{pmatrix}$$

$$\left[\underline{Y}\right]\left[\underline{U_n}\right] = \left[\underline{I_{qn}}\right]$$

c) $\underline{U}_0 = \underline{U}_{n1}$

d)

$$\underline{U}_0 = \underline{U}_{n1} = \frac{\begin{vmatrix} -\underline{I}_0 & -\frac{1}{R_1} & -\frac{1}{j\omega L} \\ 0 & \frac{1}{R_1} + j\omega C & 0 \\ 0 & 0 & \frac{1}{R_2} + \frac{1}{j\omega L} \end{vmatrix}}{\left(\frac{1}{R_1} + \frac{1}{j\omega L}\right)\left(\frac{1}{R_1} + j\omega C\right)\left(\frac{1}{R_2} + \frac{1}{j\omega L}\right) - \left(\frac{1}{j\omega L}\right)^2\left(\frac{1}{R_1} + j\omega C\right) - \left(\frac{1}{R_1}\right)^2\left(\frac{1}{R_2} + \frac{1}{j\omega L}\right)}$$

$$= \frac{-\underline{I}_0\left(\frac{1}{R_1} + j\omega C\right)\left(\frac{1}{R_2} + \frac{1}{j\omega L}\right)}{\left(\frac{1}{R_1} + j\omega C\right)\left(\frac{1}{R_1}\frac{1}{R_2} + \frac{1}{j\omega L}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)\right) - \left(\frac{1}{R_2} + \frac{1}{j\omega L}\right)\left(\frac{1}{R_1}\right)^2}$$

Aufgabe 8

a)

$$I_0 = i_L + \frac{U_L}{R} \qquad \text{mit } u_L = L\frac{di_L}{dt}$$

$$I_0 = i_L + \frac{L}{R}\frac{di_L}{dt}$$

b)

$$0 = i_{L,h} + \frac{L}{R}\frac{di_{L,h}}{dt} \qquad \Big| \int$$

$$0 = \int_0^t 1dt + \frac{L}{R}\int_0^t \frac{1}{i_{L,h}}\frac{di_{L,h}}{dt}dt$$

$$0 = t + \frac{L}{R}\Big(ln\big(i_{L,h}(t)\big) - ln\big(i_{L,h}(0)\big)\Big)$$

$$\Leftrightarrow e^{-\frac{R}{L}t} = \frac{i_{L,h}(t)}{i_{L,h}(0)}$$

$$\Leftrightarrow i_{L,h}(t) = i_{L,h}(0)e^{-\frac{R}{L}t}$$

c)

$$i_{L,p} = K \qquad \Rightarrow \qquad I_0 = K \qquad \Rightarrow \qquad i_{L,p} = I_0$$

d)

$$i_l(t) = I_0 + i_{L,h}(0)e^{-\frac{R}{L}t}$$

$$\text{mit } i_L = 0 = 0 \qquad \Rightarrow \qquad I_0 + i_{L,h}(0) \stackrel{!}{=} \quad \Leftrightarrow \quad i_{L,h}(0) = -I_0$$

$$\rightarrow \quad \underline{\underline{i_L(t) = I_0\left(1 - e^{-\frac{R}{L}t}\right)}}$$