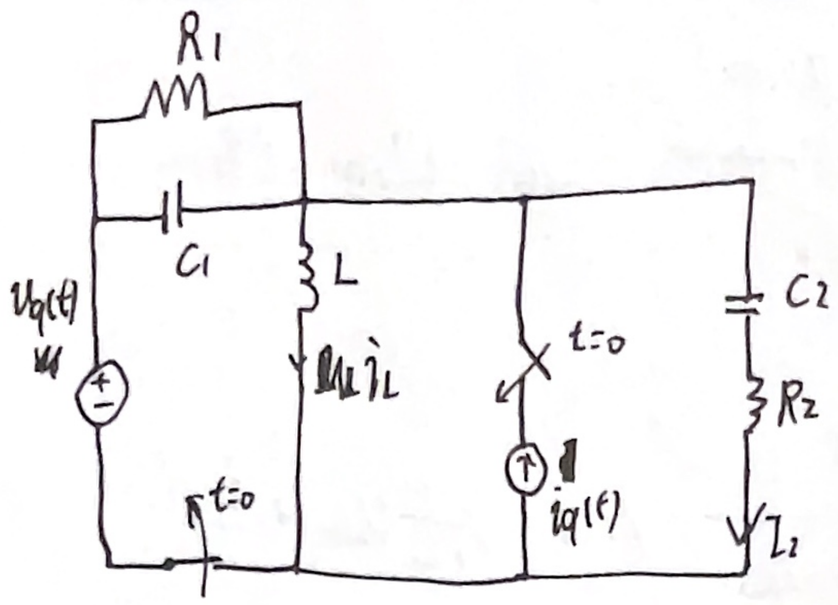
~~Schritte~~ Laplacebereich

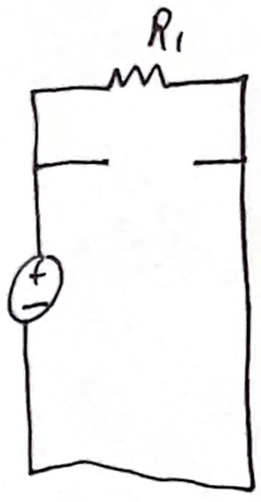


$u_q(t) = U_0$

$i_q(t) = I_0\,\theta(t)$

$t<0$, eingeschwungen

a. $i_2(t)$, $i_L(0^-)$, $u_{C1}(0^-)$, $u_{C2}(0^-)$, $t<0$



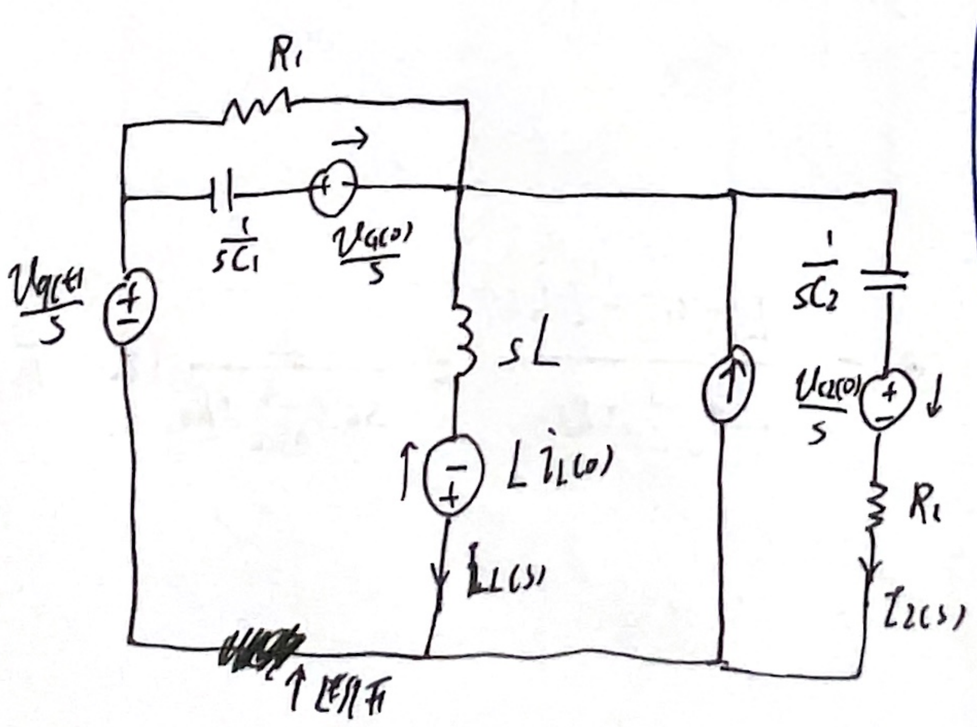
eingeschwungen, $u_{C1}(0^-) = u_0 = U_0$

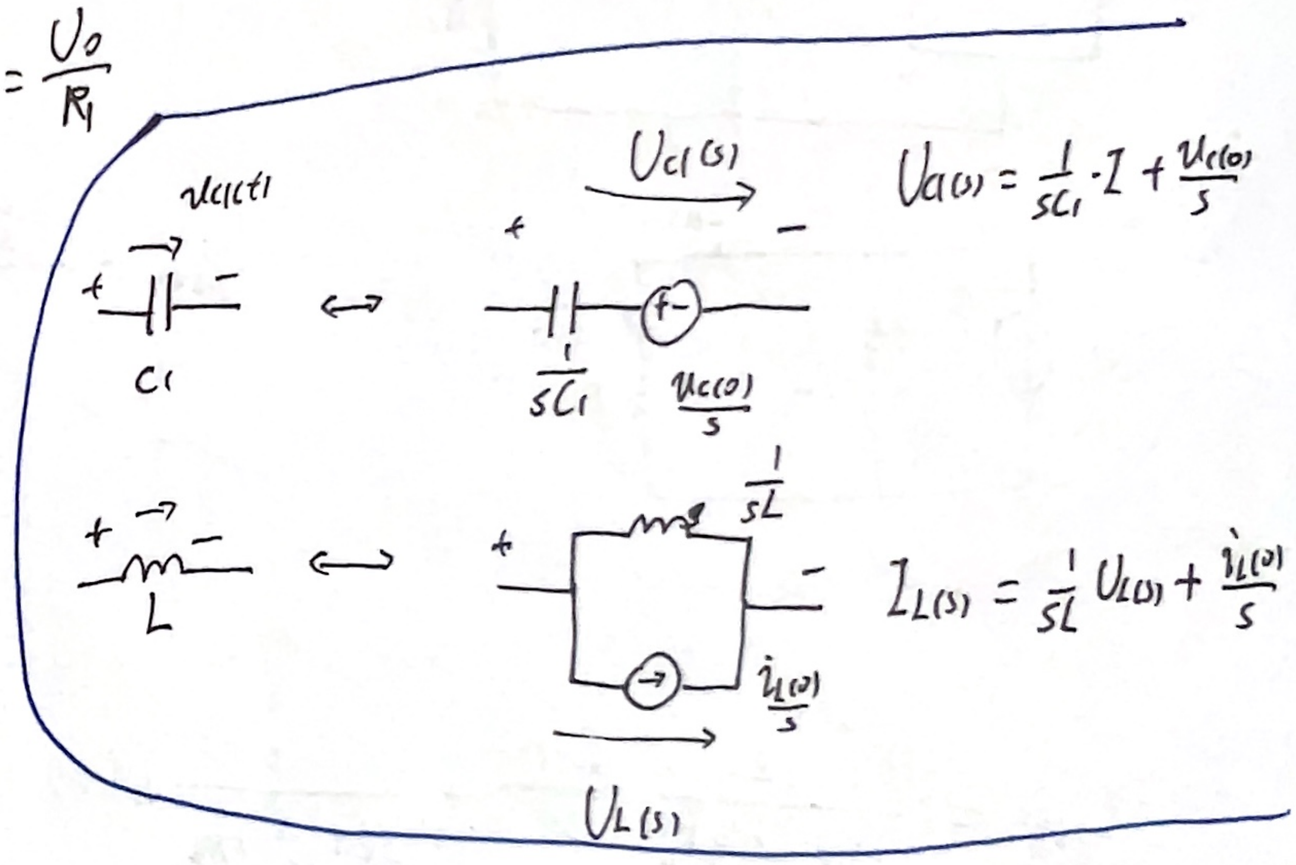
$u_{C2}(0^-) = 0$

$i_2(0^-) = 0$

$i_L(0^-) = \frac{U_0}{R_1}$

b. 变换到 Laplacebereich, $t>0$

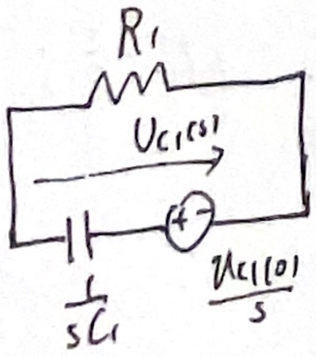




$U_{C1}(s) = \frac{1}{sC_1} \cdot I + \frac{u_{C1}(0)}{s}$

$I_{L(s)} = \frac{1}{sL} U_{L(s)} + \frac{i_{L(0)}}{s}$

C. $u_{C1}(t)$, $t>0$



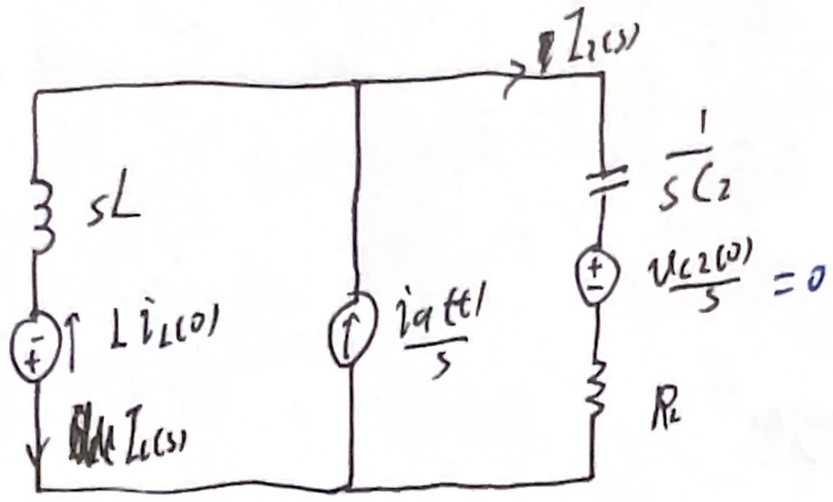
$$U_{C1(s)} = U_{R1(s)} = \frac{R_1}{R_1 + \frac{1}{sC_1}} \frac{u_{C1(0)}}{s} = \frac{sR_1C_1}{1+sR_1C_1} \frac{u_{C1(0)}}{s} = \frac{R_1C_1}{1+sR_1C_1} u_{C1(0)}$$

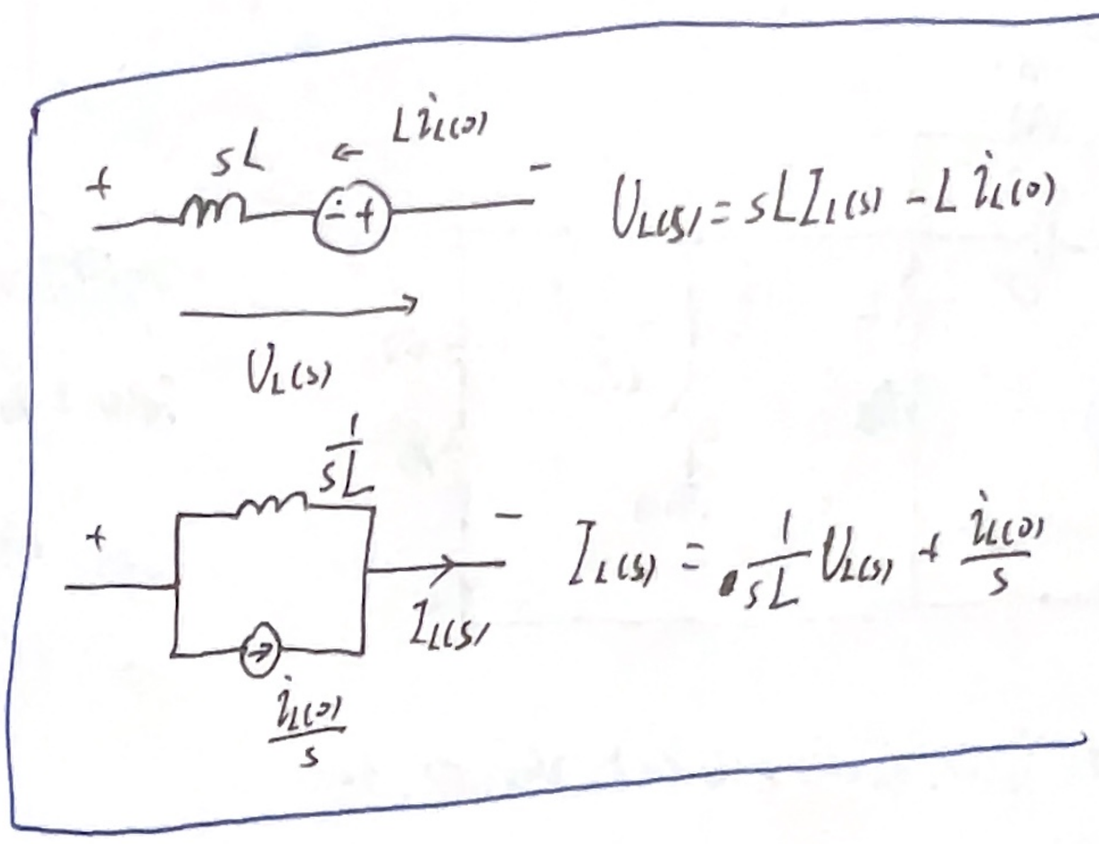
$$= \frac{1}{s + \frac{1}{R_1C_1}} u_{C1(0)}$$

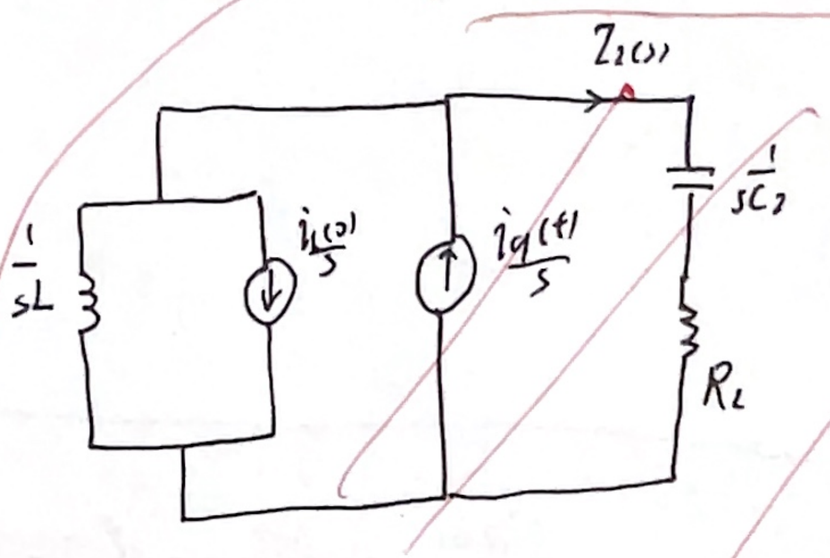
$$\frac{1}{s+a} \circ\!\!-\!\!\bullet\; e^{-at}\,\theta(t)$$

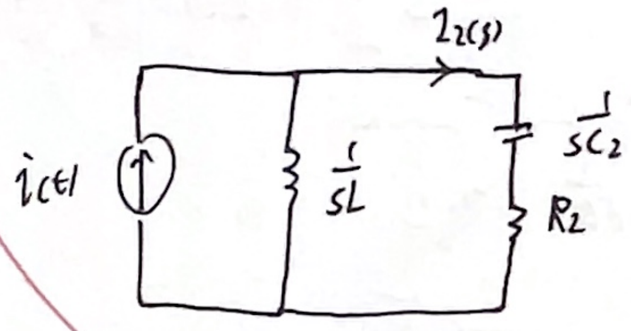
$$\Rightarrow u_{C1}(t) = u_{C1(0)}\, e^{-\frac{t}{R_1C_1}} = U_0\, e^{-\frac{t}{R_1C_1}}, \quad t>0$$

d. $i_2(t)$, $\frac{R_2}{L} = \frac{1}{\tau}$, $LC_2 = 4\tau^2$









$i(t) = \frac{i_q(t)}{s} - \frac{\dot{i}_L(0)}{s}$

有(0)記得

$I_{2(s)} = \frac{\frac{1}{sL}}{}$

$$I_{2(s)} = \underbrace{\frac{sL}{sL + \frac{1}{sC_2} + R_2}\ \frac{i_q(t)}{s}}_{\text{兩電流分流}} - \underbrace{\frac{1}{sL + \frac{1}{sC_2} + R_2}\ L\dot{i}_L(0)}_{I = \frac{V}{R}} = \frac{L\dot{i}_q(t) - L\dot{i}_L(0)}{sL + \frac{1}{sC_2} + R_2} = \frac{L}{sL + \frac{1}{sC_2} + R_2}\left(I_0 - \frac{V_0}{R_1}\right)$$

$$= \frac{sC_2L}{s^2LC_2 + sC_2R_2 + 1}\left(I_0 - \frac{V_0}{R_1}\right) = \frac{s}{s^2 + s\frac{R_2}{L} + \frac{1}{LC_2}}\left(I_0 - \frac{V_0}{R_1}\right) = \frac{s}{s^2 + s\frac{1}{\tau} + \frac{1}{4\tau^2}}\left(I_0 - \frac{V_0}{R_1}\right)$$

$$= \frac{s}{(s + \frac{1}{2\tau})^2}\left(I_0 - \frac{V_0}{R_1}\right)$$

$\frac{1}{s + \frac{1}{2\tau}} - \frac{1}{2\tau}\frac{1}{(s + \frac{1}{2\tau})^2} \circ\!\!-\!\!\bullet\ e^{-\frac{1}{2\tau}t} - \frac{1}{2\tau}te^{-\frac{1}{2\tau}t}$

$\cdots\cdots$ $\begin{cases} A_1 = 1 \\ A_2 = -\frac{1}{2\tau} \end{cases}$

$$i_2(t) = \left(e^{-\frac{1}{2\tau}t} - \frac{1}{2\tau}te^{-\frac{1}{2\tau}t}\right)\left(I_0 - \frac{V_0}{R_1}\right)$$