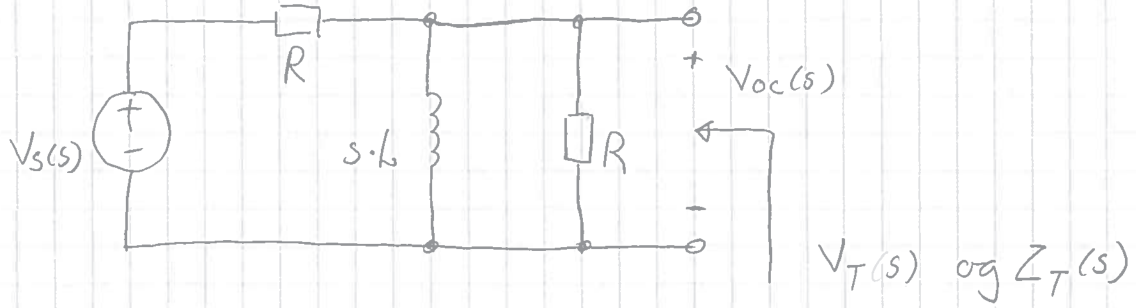
Sol Opg. 10-17, kun Thevenin ækvivalent.



$$V_T(s) = V_{oc}(s)$$

$$Z_{RL}(s) = sL // R = \frac{1}{\frac{1}{sL} + \frac{1}{R}} = \frac{1}{\frac{R + sL}{sRL}}$$

$$Z_{RL}(s) = \frac{sRL}{R + sL}$$

$$V_{oc}(s) = \frac{V_s(s) \cdot Z_{RL}(s)}{R + Z_{RL}(s)} = \frac{V_s(s) \cdot \frac{sRL}{R + sL}}{R + \frac{sRL}{R + sL}}$$

$$V_{oc}(s) = V_s(s) \cdot \frac{sRL}{R(R + sL) + sRL} = \frac{V_s(s) \cdot sL}{2sL + R}$$

$\Downarrow$

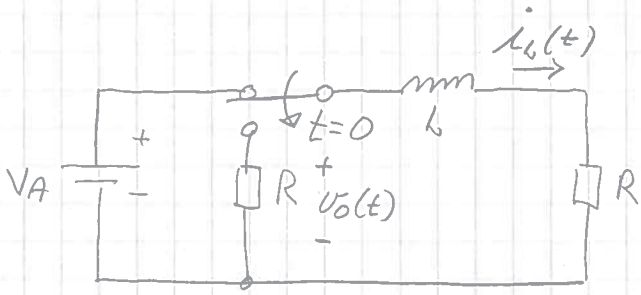
$$\underline{\underline{V_T(s) = \frac{V_s(s) \cdot sL}{2sL + R}}}$$

$$I_{sc}(s) = \frac{V_s(s)}{R} \quad \text{(kortsluttet udgang)}$$

$$Z_T(s) = \frac{V_T(s)}{I_{sc}(s)} = \frac{V_s(s) \cdot sL \cdot R}{(2sL + R) \cdot V_s(s)} = \underline{\underline{\frac{sLR}{2sL + R}}}$$

E2ASB T., R. og T. Ed. 7 E2012 AJU

Sol Opg. 10-19.

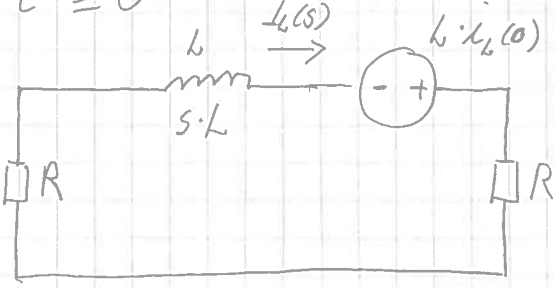


$t < 0$

transformer til s-domæne og beregn:
$I_L(s)$, $i_L(t)$, $V_o(s)$ og $v_o(t)$ på symbolsk form

Det er en fordel at anvende en spændingskilde i serie med spolen som startbetingelse for L, da strømmen let beregnes som spænding divideret med samlet impedans (seriefor-bindelse)

$t \geqq 0$

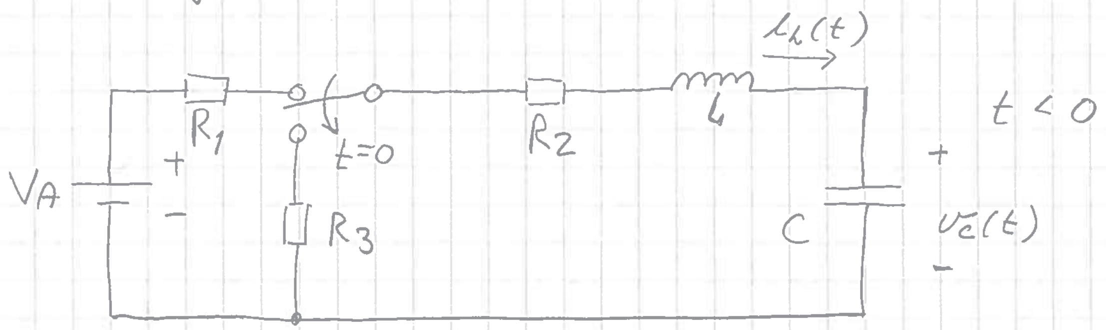


$$i_L(0) = \frac{V_A}{R}$$

$$I_L(s) = \frac{\frac{L \cdot V_A}{R}}{sL + 2R} = \underline{\underline{\frac{\frac{V_A}{R}}{s + \frac{2R}{L}}}} \xrightarrow{\mathcal{L}^{-1}} i_L(t) = \underline{\underline{\frac{V_A}{R} \cdot e^{-\frac{2R}{L} \cdot t}}}$$

$$V_o(s) = -I_L(s) \cdot R = \underline{\underline{\frac{-V_A}{s + \frac{2R}{L}}}} \xrightarrow{\mathcal{L}^{-1}} v_o(t) = \underline{\underline{-V_A \cdot e^{-\frac{2R}{L} \cdot t}}}$$

Sol Opg. 10-25



Transformer til s-domæne

Beregn $I_L(s)$ på symbolsk form

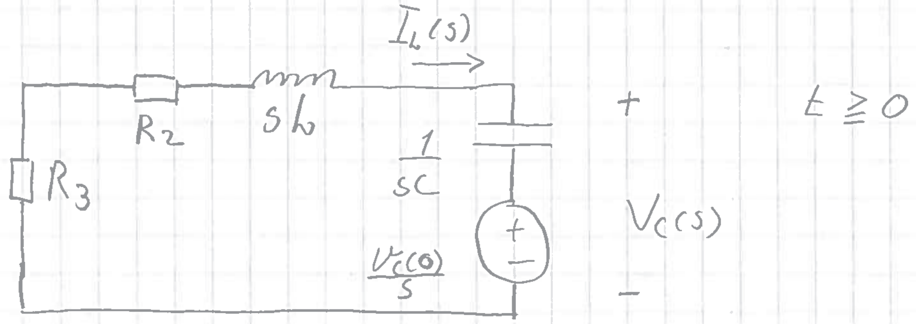
Beregn $I_L(s)$ med værdierne:

$R_1 = R_2 = 500\,\Omega$, $R_3 = 1\,k\Omega$, $L = 500\,mH$, $C = 0{,}2\,\mu F$

$V_A = 15\,V$

Begyndelsesbetingelse for L $i_L(0) = 0$

for C $v_C(0) = V_A$



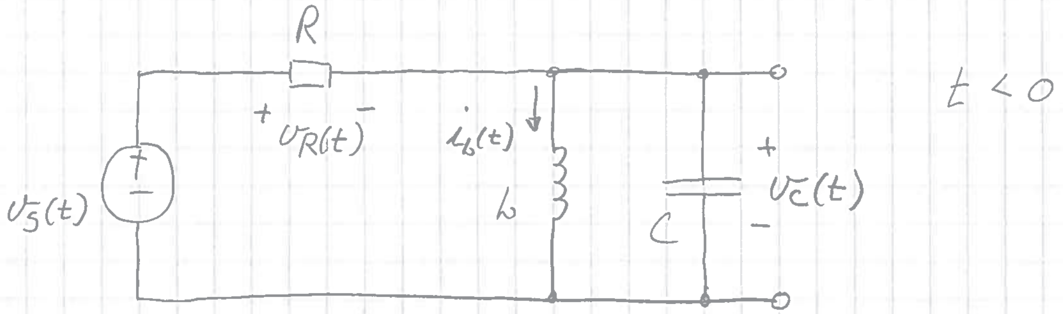
$$I_L(s) = \frac{-\frac{v_C(0)}{s}}{\frac{1}{sC} + sL + R_2 + R_3} = \frac{-v_C(0)\cdot C}{s^2 LC + sC(R_2+R_3) + 1}$$

$$I_L(s) = \frac{-\frac{V_A}{L}}{s^2 + s\cdot\frac{R_2+R_3}{L} + \frac{1}{LC}}$$

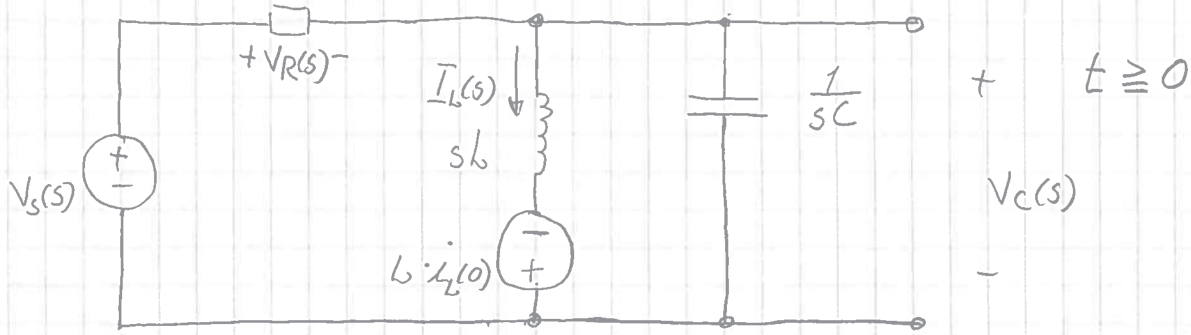
$$I_L(s) = \frac{-30}{s^2 + s\cdot 3000 + 10\cdot 10^6}$$

E2ASB T., R. og T. Ed. 7 E2012 AJU

Sol Opg. 10-29



$v_C(0) = 0$, $i_L(0) = I_0$



Zero state $V_{CZS}(s)$, Zero input $V_{CZI}(s)$

<u>Zero state:</u> $V_{CZS}(s) = V_S(s) \cdot \dfrac{sL // \frac{1}{sC}}{R + sL // \frac{1}{sC}}$

$$V_{CZS}(s) = \frac{V_S(s) \cdot \left(\frac{1}{sL} + sC\right)^{-1}}{R + \left(\frac{1}{sL} + sC\right)^{-1}} = \frac{V_S(s)}{R\left(\frac{1}{sL} + sC\right) + 1}$$

$$V_{CZS}(s) = \frac{V_S(s) \cdot sL}{s^2 LC \cdot R + sL + R} = \underline{\underline{\frac{V_S(s) \cdot \frac{1}{RC} \cdot s}{s^2 + s \cdot \frac{1}{RC} + \frac{1}{LC}}}}$$

<u>Zero input:</u> $V_{CZI}(s) = \dfrac{-L \cdot i_L(0) \cdot R // \frac{1}{sC}}{sL + R // \frac{1}{sC}}$

E2ASB T., R. og T. Ed. 7 E2012 AJU

Sol Opg. 10-29

$$V_{CZI}(s) = \frac{-L \cdot I_0 \cdot \left(\frac{1}{R} + sC\right)^{-1}}{sL + \left(\frac{1}{R} + sC\right)^{-1}} = \frac{-L \cdot I_0}{sL \cdot \left(\frac{1}{R} + sC\right) + 1}$$

$$V_{CZI}(s) = \frac{-L \cdot I_0}{s^2 LC + s \cdot \frac{L}{R} + 1} = \underline{\underline{\frac{-\frac{I_0}{C}}{s^2 + s \cdot \frac{1}{RC} + \frac{1}{LC}}}}$$