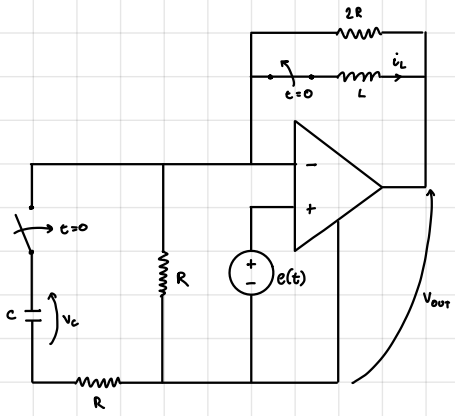
ESERCITAZIONE

ESERCIZIO 1

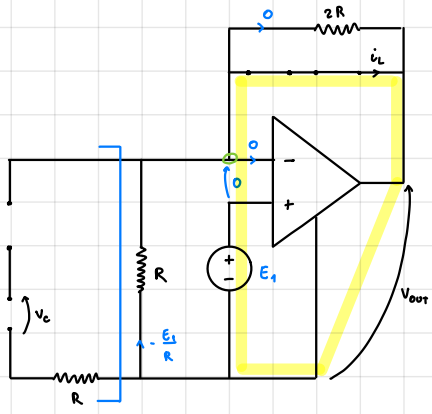


$e(t) = E_1 \quad t<0 \qquad V_C(-\infty)=0$

$e(t) = E_2 > E_1 \quad t>0$

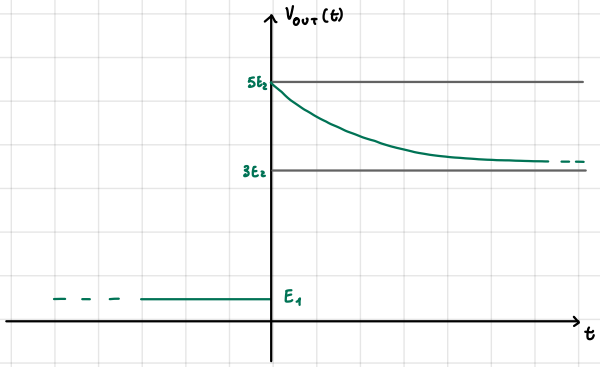
$V_{OUT}(t)$? $\quad i_L(t)$? $\quad V_C(t)$?

$t<0$

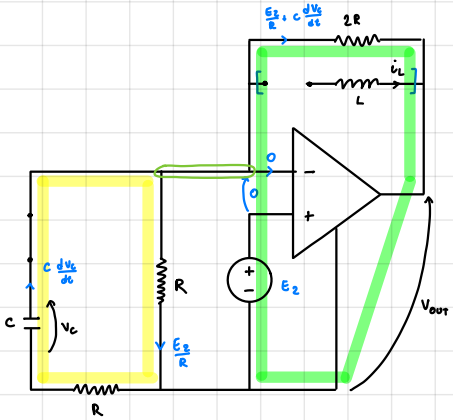


$V_C(0^-) = V_C(-\infty)$ $\quad$ $i_L(0^-) = -\frac{E_1}{R}$

$V_{OUT}(0^-) = E_1$



$t>0$



$i_L(t) = 0$

$V_C + RC\frac{dV_C}{dt} = E_2 \longrightarrow \frac{dV_C}{dt} = -\frac{1}{RC}V_C + \frac{E_2}{RC}$

$\Downarrow$

$V_C = Ke^{-\frac{t}{RC}} + H = E_2\left(1 - e^{-\frac{t}{RC}}\right)$

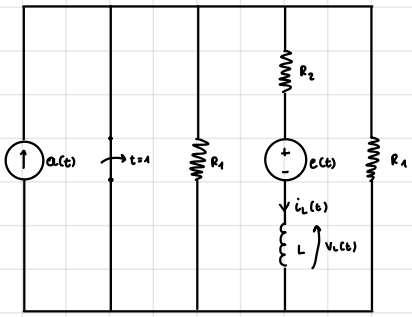
$\hookrightarrow \quad 0 = -\frac{H}{RC} + \frac{E_2}{RC} \rightarrow H = E_2$

$\hookrightarrow \quad V_C(0^-) = V_C(0^+) = 0 \rightarrow K = -E_2$

$V_{OUT}(t) = E_2 + 2R\left(\frac{E_2}{R} + C\frac{dV_C}{dt}\right) = 3E_2 + 2RC\frac{dV_C}{dt} =$

$3E_2 + 2RC\left[\frac{E_2}{RC}e^{-\frac{t}{RC}}\right] = E_2\left(3 + 2e^{-\frac{t}{RC}}\right)$

ESERCIZIO 2



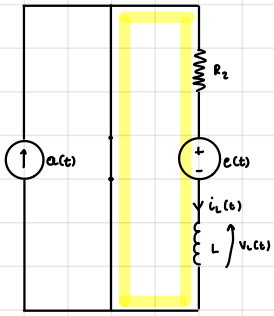
$e(t) = E \quad t < 1$

$e(t) = 0 \quad t > 1$

$a(t) = A \cos(\omega t)$

$i_L(t) \quad t \geq 1$

t < 1



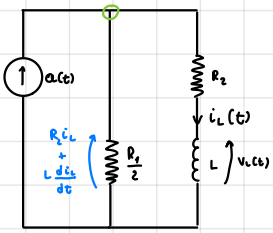
$$L\frac{di_L}{dt} + R_2 i_L + E = 0 \quad \rightarrow \quad \frac{di_L}{dt} = -\frac{R_2}{L} i_L - \frac{E}{L}$$

$$\Downarrow$$

$$i_L(t) = K e^{-\frac{R_2}{L}(t + \infty)} - \frac{E}{R} \qquad (t_0 \to +\infty)$$

$$i_L(1^-) = -\frac{E}{R}$$

t > 1



$$a(t) = i_L + 2\frac{R_2}{R_1} i_L + \frac{2L}{R_1}\frac{di_L}{dt} \Rightarrow \frac{di_L}{dt} = -\underbrace{\frac{R_1 + 2R_2}{2L}}_{\lambda_2} i_L + \frac{R_1}{2L} a(t)$$

$$\Downarrow$$

$$i_L(t) = K e^{\lambda_2 (t-1)} + i_{L,IP}(t)$$

$$\hookrightarrow (2j\omega L + R_1 + 2R_2)\,\bar{i}_{L,IP} = R_1 A \rightarrow \bar{i}_{L,IP} = \frac{R_1 A (R_1 + 2R_2 - 2j\omega L)}{(R_1 + 2R_2)^2 + (2\omega L)^2}$$

$$\hookrightarrow i_{L,IP}(t) = \mathrm{Re}(\bar{i}_{L,IP}) = \frac{R_1 A}{\gamma}\left[(R_1 + 2R_2)\cos\omega t + 2\omega L \sin\omega t\right]$$

$$\hookrightarrow K = \dots = -\gamma\left[(R_1 + 2R_2)\cos\omega t + 2\omega L \sin\omega t\right] - \frac{E}{R_2}$$