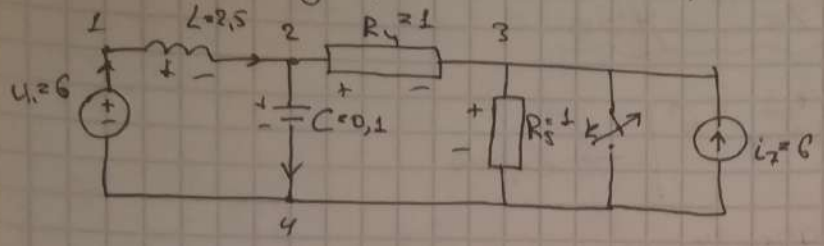
гр.8382 Звегинцев Владислав

Вариант 6

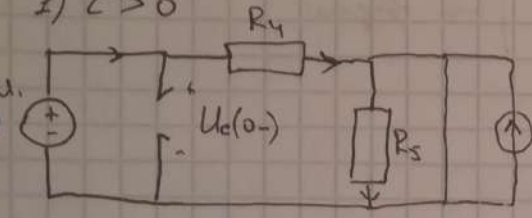
Задача 1.2.3 +

Цепь 114 - ИН $u_1 = 6$, 212 - $L = 2,5$, 324 - $C = 0,1$, 423 - $R_4 = 1$, 534 - $R_5 = 1$

634 - К, разм., 743 - ИТ $i_7 = 6$



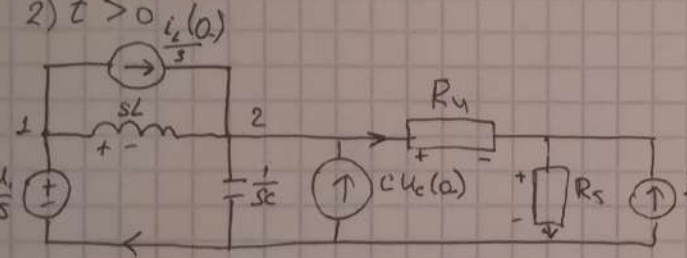
1) $t > 0$



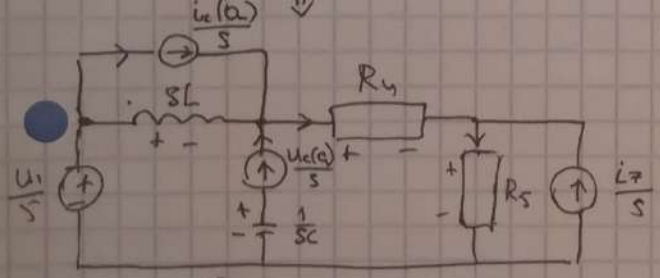
$u_c(0_-) = u_1 = 6$

$i_L(0_-) = \frac{u_1}{R_4} = \frac{6}{1} = 6$

2) $t > 0$



$\Downarrow$



$u_4^y = 0$

$u_1^y = \frac{u_1}{s}$

$$\begin{cases} -\frac{1}{sL}u_1^y + \left(\frac{1}{sL} + sC + G_4\right)u_2^y - G_4 u_3^y = \frac{i_L(0)}{s} + u_c(0)C \\ -G_4 u_2^y + (G_5 + G_4)u_3^y = \frac{i_7}{s} \end{cases}$$

$$\begin{cases} -\frac{2}{5s}u_1^y + \left(\frac{2}{5s} + \frac{s}{10} + 1\right)u_2^y - u_3^y = \frac{6}{s} + \frac{6}{10} \\ -u_2^y + 2u_3^y = \frac{6}{s} \end{cases}$$

$$\begin{cases} u_2^y = \frac{6s^2 + 90s + 24}{s^3 + 5s^2 + 4s} \\ u_3^y = \frac{6s^2 + 60s + 24}{s^3 + 5s^2 + 4s} \end{cases}$$

$$u_c(s) = u_2^y - u_4^y = \frac{6s^2 + 90s + 24}{s^3 + 5s^2 + 4s} = \frac{A}{s} + \frac{B}{s+1} + \frac{C}{s+4}$$

$$A = \lim_{s \to 0} s u_c(s) = \lim_{s \to 0} \frac{6s^2 + 90s + 24}{s^2 + 5s + 4} = 6$$

$$B = \lim_{s \to -1} (s+1) u_c s = \lim_{s \to -1} \frac{6s^2 + 90s + 24}{s(s+4)} = 20$$

$$C = \lim_{s \to -4} (s+4) u_c(s) = \lim_{s \to -4} \frac{6s^2 + 90s + 24}{s(s+1)} = -20$$

$$u_c(t) = \mathcal{L}^{-1}\{u_c(s)\} = 6 + 20e^{-t} - 20e^{-4t} \quad t > 0$$

$$I_L(s) = \frac{i_L(0)}{s} + \frac{U_1^u - U_2^u}{sL} = \frac{6s+30}{s^2+5s+4} = \frac{A}{s+1} + \frac{B}{s+4}$$

$$A = \lim_{s\to -1}(s+1)I_L(s) = \lim_{s\to -1}\frac{6s+30}{s+4} = 8$$

$$B = \lim_{s\to -4}(s+4)I_L(s) = \lim_{s\to -4}\frac{6s+30}{s+1} = -2$$

$$i_L(t) = \mathcal{L}^{-1}\{I_L(s)\} = 8e^{-t} - 2e^{-4t}, \quad t>0$$

$$i_L(0_+) = \lim_{s\to\infty} sI_L(s) = \lim_{s\to\infty}\frac{6s^2+30s}{s^2+5s+4} = 6 \;\Big|\; \to \text{верно}$$

$$i_L(0_+) = i_L(0_-) = 6$$

$$u_C(0_+) = \lim_{s\to\infty} sU_C(s) = \lim_{s\to\infty}\frac{6s^2+90s+24}{s^2+5s+4} = 6 \;\Big|\; \to \text{верно}$$

$$u_C(0_+) = u_C(0_-) = 6$$