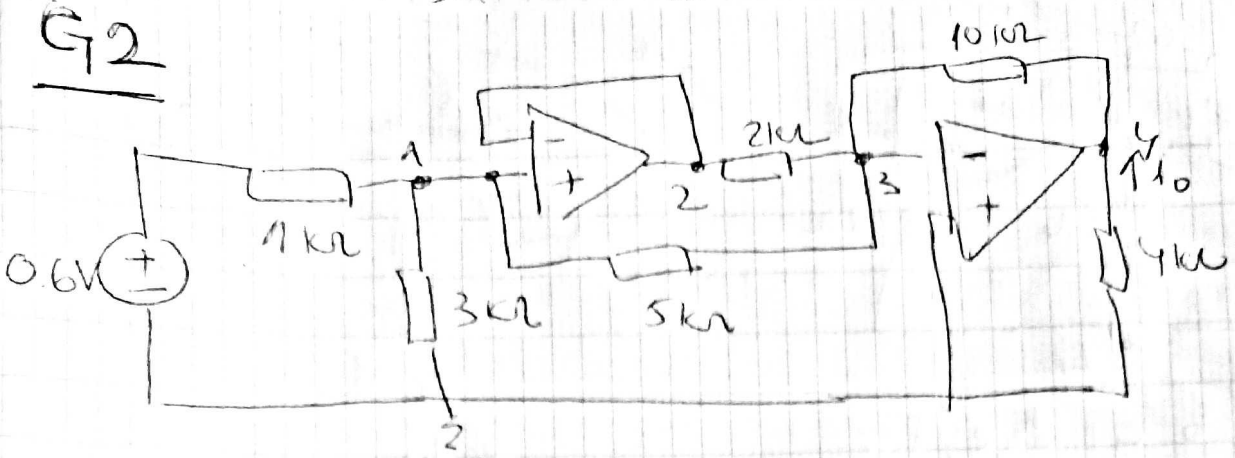
G2



$V_1 = V_2$

$V_3 = 0$

C1: $\left(\frac{1}{1} + \frac{1}{3} + \frac{1}{5}\right)V_1 - \frac{1}{5}\cdot V_3 = \frac{0.6}{1}$

$\frac{23}{15}V_1 - \frac{1}{5}V_3 = 0.6 \quad (1) \Rightarrow V_1 = \frac{9}{23}V$

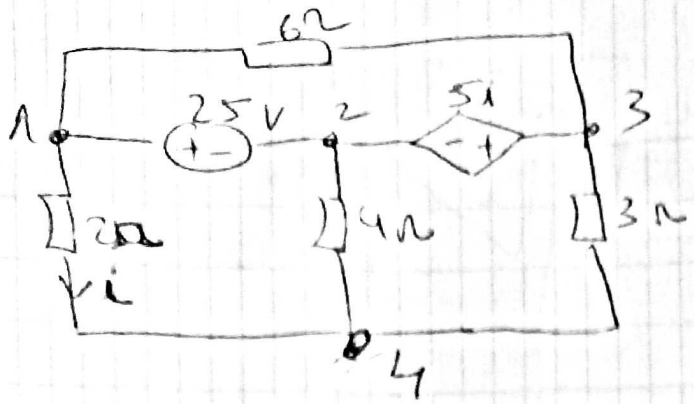
C3: $\left(\frac{1}{2} + \frac{1}{5} + \frac{1}{10}\right)V_3 - \frac{1}{10}\cdot V_4 - \frac{1}{2}V_2 - \frac{1}{5}V_1 = 0$

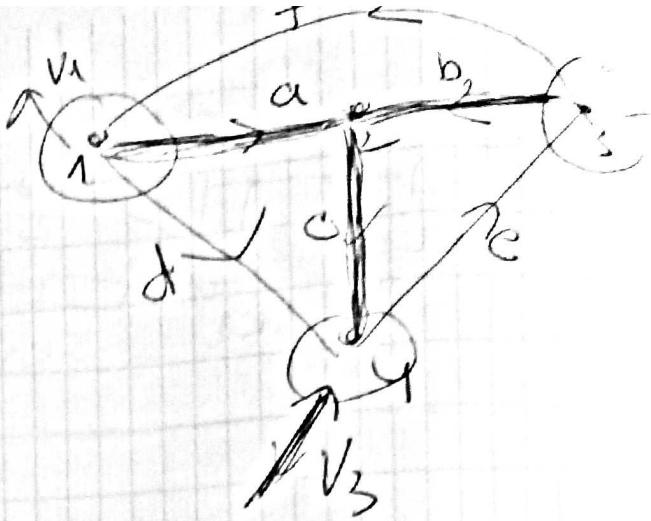
$\frac{1}{10}V_4 = -\frac{7}{10}V_1 \Rightarrow V_4 = -7V_1$

$\Rightarrow V_4 = -\frac{63}{23}[V] \approx -2.74V$

$I_0 = \frac{-V_4}{4k\Omega} = 0.685\,mA$

②





$$\underset{\sim}{Q_f} = \begin{array}{c} \\ U_1 \\ U_2 \\ U_3 \end{array} \begin{array}{c} \begin{array}{cccccc} a & b & c & d & e & f \end{array} \\ \left[\begin{array}{cccccc} 1 & 0 & 0 & 1 & 0 & -1 \\ 0 & 1 & 0 & 0 & -1 & 1 \\ 0 & 0 & 1 & 1 & -1 & 0 \end{array}\right] \end{array}$$

$$\underset{\sim}{U} = \underset{\sim}{Q_f}^T \underset{\sim}{U_f}$$

$$\Rightarrow \begin{bmatrix} U_a \\ U_b \\ U_c \\ U_d \\ U_e \\ U_f \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & -1 & -1 \\ -1 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} U_a \\ U_b \\ U_c \end{bmatrix} \Rightarrow \begin{aligned} U_d &= U_a + U_c \\ U_e &= -U_b - U_c \\ U_f &= -U_a + U_b \end{aligned}$$

$U_a = 25 \ [V]$

$U_b = 5i$

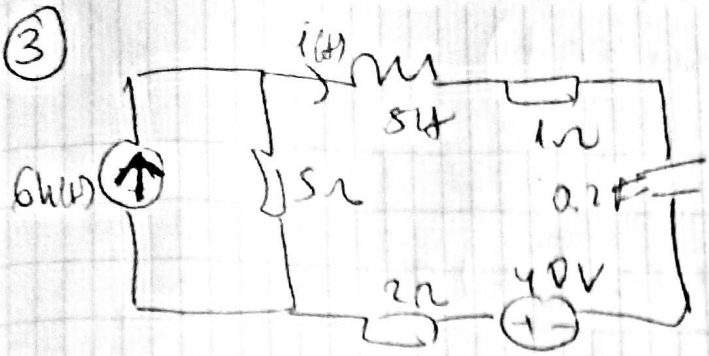
$\Rightarrow \begin{aligned} U_d &= 25 + U_c \\ U_e &= -5i - U_c \\ U_f &= -25 + 5i \end{aligned}$ $\xrightarrow{U_d = 2 \cdot i}$ $\begin{aligned} U_c &= 2i - 25 \\ U_e &= -5i - 2i + 25 = 25 - \\ U_f &= -25 + 5i \end{aligned}$

JKT:

$$i + \frac{U_c}{4} = \frac{U_e}{3} \Rightarrow i + \frac{i}{2} - \frac{25}{4} = \frac{25}{3} - \frac{7i}{3} \quad / 12$$

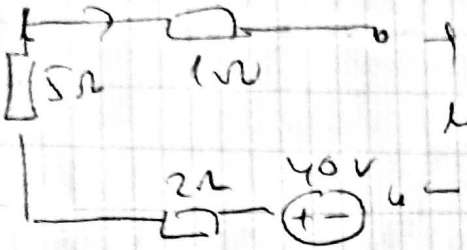
$$46i = 175 \Rightarrow i = \frac{175}{46}$$

③



$u(t) = ?$

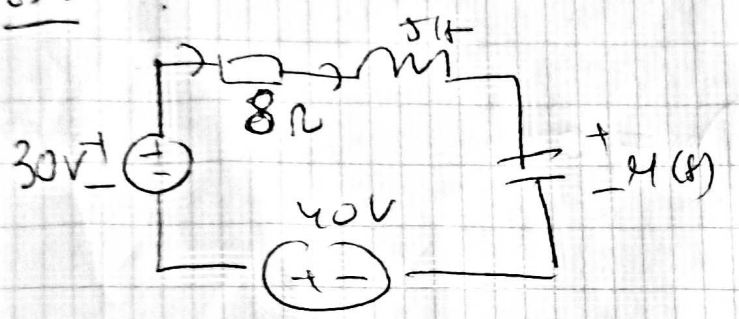
t<0



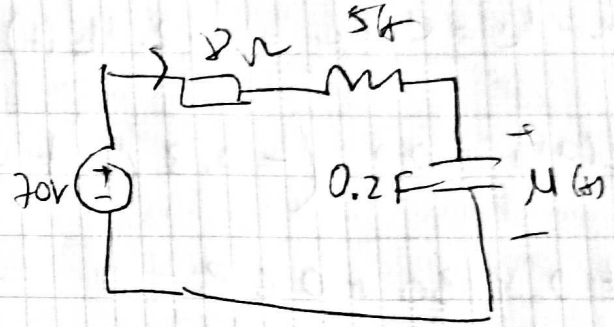
$u(0^-) = 40V$

$i_L(0^-) = 0\ A$

t>0



$\Leftrightarrow$



$$70 = u_L + u_C + u_L$$

$$u_L = L\frac{di_L}{dt} = L\frac{di_C}{dt} = LC\frac{d^2u_C}{dt^2}$$

$$u_R = R \cdot i_C = RC\frac{du_C}{dt}$$

$$\Rightarrow RC\frac{du_C}{dt} + u_C + LC\frac{d^2u_C}{dt^2} = 70 \quad /LC$$

$$\left(D^2 + \frac{R}{L}D + \frac{1}{LC}\right)u_C = \frac{70}{LC}$$

$$\left(D^2 + \frac{8}{5}D + 1\right)u_C = 70$$

$$s^2 + 1{,}6s + 1 = 0 \Rightarrow s_1 =$$

$$s_{1,2} = -\frac{1{,}6 \pm \sqrt{(1{,}6)^2 - 4}}{2} = -\frac{1{,}6 \pm j1{,}2}{2} = -0{,}8 \pm j0{,}6$$

$\Rightarrow u_{c(h)} = e^{-0,8t}(A\cos 0.6t + B\sin 0.6t)$

$u_{cp} = K = 70$

$u_c(t) = e^{-0,8t} \cdot (A\cos 0.6t + B\sin 0.6t) + 70$

$u_c(0^+) = u_c(0^-) = 40$

$\Rightarrow A + 70 = 40 \Rightarrow A = -30$

$i_L(0^+) = i_L(0^-) = 0\ A$

$i_L = i_C = C\frac{du_c}{dt} = 0.2\, u_c'(t)$

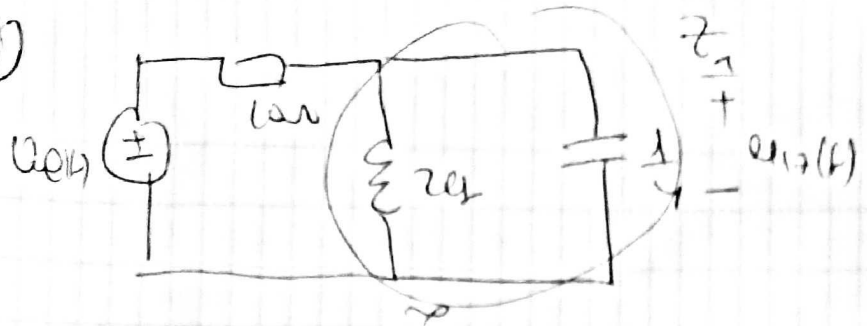
$i_L(0^+) = 0.2 \cdot (-0.8A + 0.6B) = 0$

$+ 0.8 \cdot 30 + 0.6B = 0 \Rightarrow$

$B = -40$

$\Rightarrow u_{c(t)} = e^{-0,8t}(-30\cos 0.6t - 40\sin 0,6t) + 70$

4)



$$u_{ul}(t) = -3 + \frac{4}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin(n\omega t) \rightarrow \boxed{\omega_n = n\omega}$$

За DC $\Rightarrow u_{iz} = 0$

$$\underline{Z}_1^{(n)} = \frac{j\omega_n L \cdot \frac{1}{j\omega_n C}}{j\omega_n L + \frac{1}{j\omega_n C}} = \frac{j\omega_n L}{1-\omega_n^2 LC}$$

$$U_{iz}^{(n)} = \frac{Z_1^{(n)}}{Z_1^{(n)}+10}\,u_{ul}^{(n)} = \frac{\frac{j\omega_n L}{1-\omega_n^2 LC}}{\frac{j\omega_n L}{1-\omega_n^2 LC}+10}\,u_{ul}^{(n)} = \frac{j\omega_n L}{j\omega_n L + 10 - 10\omega_n^2 LC}\,u_{ul}^{(n)}$$

$$U_{iz}^{(n)} = \frac{jn\pi\cdot 2}{jn\pi\cdot 2 + 10 - 10n^2\pi^2\cdot\frac{1}{2}}\,u_{ul}^{(n)}$$

За AC: $u_{ul}^{(n)} = \frac{4}{n\pi}\,10^{\circ}$

$$\underline{U}_{iz}^{(n)}(j\omega_n) = \frac{j8}{2jn\pi + 10 - 5n^2\pi^2} = \frac{8}{\sqrt{(10-5n^2\pi^2)^2 + 4n^2\pi^2}}$$

A_n

φ_n

$$\frac{\pi}{2} - \operatorname{arctg}\frac{2n\pi}{10-5n^2\pi^2}$$

$$u_{iz}(t) = \sum_{n=1}^{\infty} A_n \sin(n\pi t + \varphi_n)\ [V]$$

6) $U_{iz}^{(0)} = 0 \rightarrow$ ср. Средното