Широчин Павел, 8382

№2.4

131 ЦП $u_1 = f_1 = 30\, e^{-2t} \cdot \delta_1(t)$

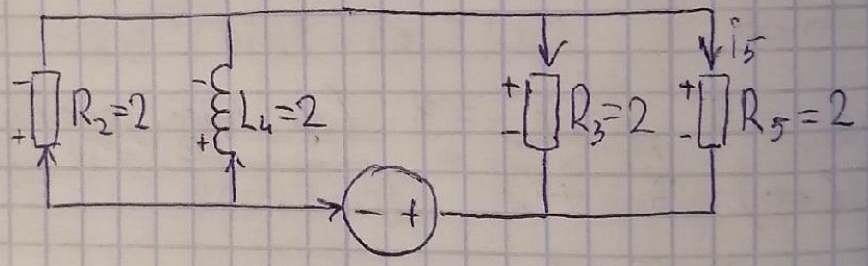
212 $R_2 = 2$

323 $R_3 = 2$

412 $L_4 = 2$

523 $R_5 = 2$

$f_2 = i_5$



$h_1(t)$	$h_1(0+)$	$h_1(\infty)$	τ
$i_5(t)$	$1/6$	$1/2$	3

$t \to \infty$: $L = K3$

$u_1 = 1$

$u_{R_5} = u_1 \rightarrow i_5 = \frac{1}{2}$ →

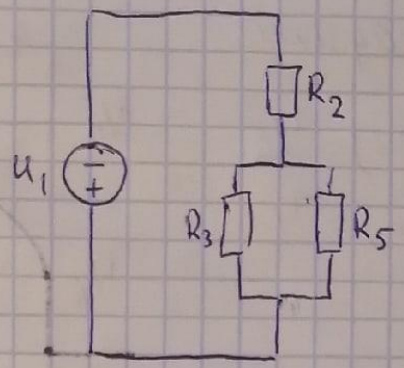
$t \to 0+$: $L = XX$

$u_1 = 1$

$R_{цепи} = 2 + 1 = 3$

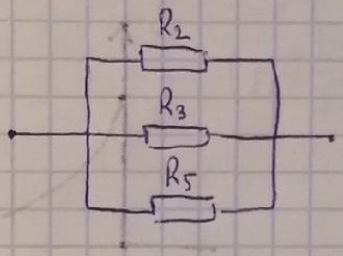
$i_2 = 1/3$

$i_5 = \frac{i_2}{2} = \frac{1}{6}$



τ : $u_1 \to КЗ$

$R_э = \frac{1}{\frac{1}{2} + \frac{1}{2} + \frac{1}{2}} = \frac{2}{3}$



$\tau = \frac{L}{R_э} = 3$

$h(t), h_1(t), h_2(t)$:

$h_1(t) = (i_{5\,уст} + A e^{-t/\tau})\,\delta_1(t) = \langle A = \frac{1}{6} - \frac{1}{2} = -\frac{1}{3} \rangle =$

$= (\frac{1}{2} - \frac{1}{3} e^{-t/3})\,\delta_1(t)$

$h(t) = h_1'(t) = \frac{1}{9} e^{-t/3}\,\delta_1(t) + \frac{1}{6}\,\delta(t)$

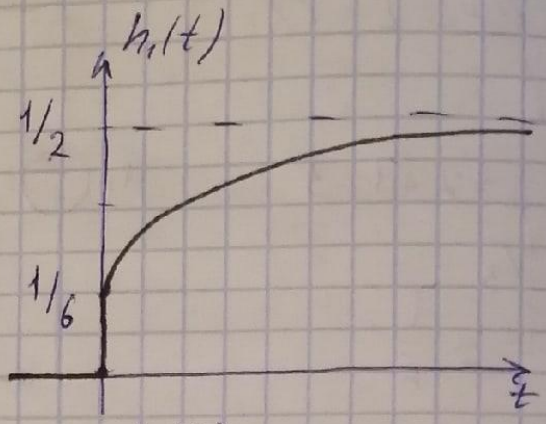
$h_2(t) = \int_0^t h_1(t)\,dt = \delta_1(t) \int_0^t (\frac{1}{2} - \frac{1}{3} e^{-t/3})\,dt =$

$= \delta_1(t)\,(\frac{1}{2} t + e^{-t/3} - 1)$

графики

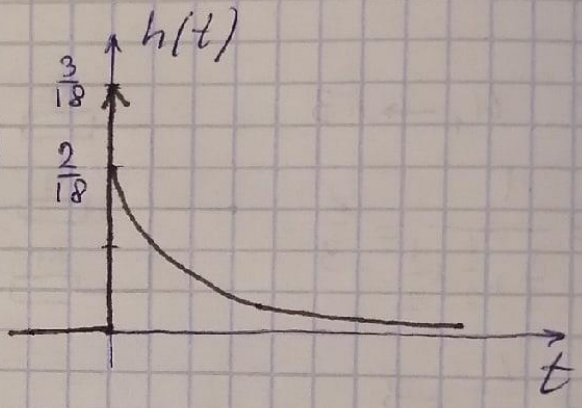
$h_1(0+) = 1/6$

$h_1(\infty) = 1/2$



$h(\infty) = 0$

$h(0+) = \frac{1}{9} + \frac{1}{6}\delta(t)$



Найдём реакции:

Через ф-л свёртки

$$f_2(t) = \left(h_1(0+) f_1(t) + \int_0^t f_1(\tau) h_0(t-\tau)\, d\tau\right) \delta_1(t) =$$

$$= \frac{1}{6} \cdot 30 e^{-2t} + \int_0^t 30 e^{-2\tau} \cdot \frac{1}{9} e^{(\tau - t)/3}\, d\tau =$$

$$= 5e^{-2t} + e^{-t/3} \cdot 10 \left(-\frac{1}{5} e^{-\frac{5}{3}\tau}\right)\Big|_0^t =$$

$$= 5e^{-2t} - 2e^{-t/3}\left(e^{-5t/3} - 1\right) =$$

$= (3e^{-2t} + 2e^{-t/3})\,\delta_1(t)$

Через $\int$-л Дюамеля:

$$f_2(t) = \delta_1(t)\left(f_1(0+)h_1(t) + \int_0^t f_1'(\tau)h_1(t-\tau)\,d\tau\right) =$$

$$= 30\left(\frac{1}{2} - \frac{1}{3}e^{-t/3}\right) + \int_0^t \left(-60e^{-2\tau}\left(\frac{1}{2} - \frac{1}{3}e^{(\tau-t)/3}\right)\right)d\tau =$$

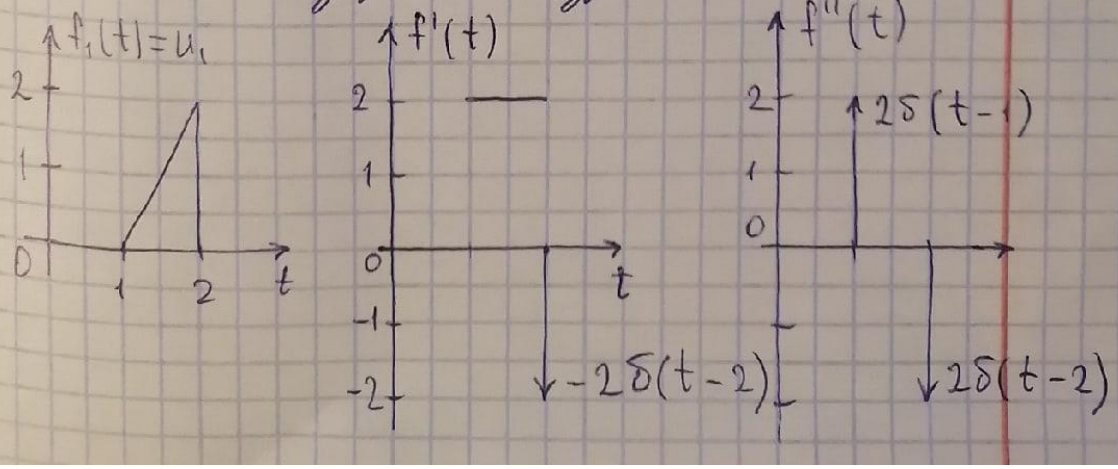
$$= 15 - 10e^{-t/3} + \int_0^t \left(-30e^{-2\tau} + 20e^{-5/3\tau}\cdot e^{-t/3}\right)d\tau =$$

$$= 15 - 10e^{-t/3} + \left(15e^{-2\tau} - 12e^{-5/3\tau}\cdot e^{-t/3}\right)\Big|_0^t =$$

$$= 15 - 10e^{-t/3} + \left(15e^{-2t} - 12e^{-5/3t}e^{-t/3} - 15 + 12e^{-t/3}\right) =$$

$$= \delta_1(t)\left(3e^{-2t} + 2e^{-t/3}\right),\ \text{сошлось}$$

Графически заданное воздействие



$$f_1(t) = -2\delta_1(t-2) + 2\delta_2(t-1) - 2\delta_2(t-2)$$

$$f_2(t) = i_5(t) = -2h_1(t-2) + 2h_2(t-1) - 2h_2(t-2) =$$

$$= -2\left(\frac{1}{2} - \frac{1}{3}e^{-(t-2)/3}\right)\delta_1(t-2) + 2\left(\frac{1}{2}(t-1) + \right.$$

$$\left. + e^{-(t-1)/3} - 1\right)\delta_1(t-1) - 2\left(\frac{1}{2}(t-2) + e^{-(t-2)/3} - 1\right) \cdot \delta_1(t-2)$$