Мурочкин Павел, 8382

№ 24.+

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

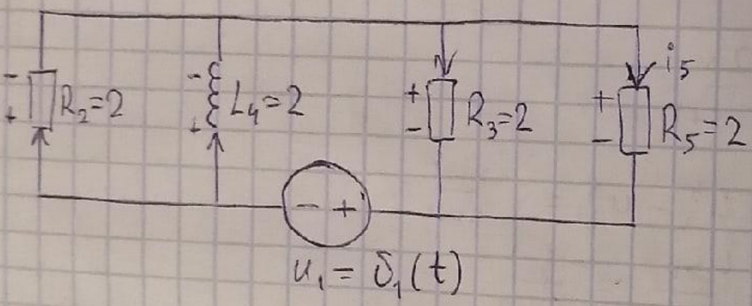
212 $R_2 = 2$

323 $R_3 = 2$

412 $L_4 = 2$

523 $R_5 = 2$

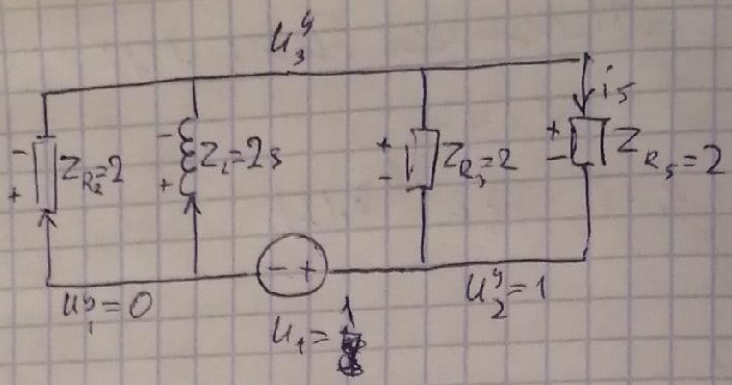
$f_2 = i_5$



1. передаточная ф-я:

$\exists\, U_1(s) = 1$, тогда

$$H(s) = \frac{F_2(s)}{F_1(s)} = \frac{I_5(s)}{U_1(s)} = I_5(s)$$



МУН:

$$\begin{cases} \left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2s}\right)u_3^y - u_2^y = 0 \\ u_2^y = 1 \end{cases}$$

$$\frac{3s+1}{2s}\,u_3^y = 1$$

$$u_3^y = \frac{2s}{3s+1}$$

$$u_{2R_5} = u_3^y - u_1^y = \frac{-s-1}{3s+1}$$

$$I_{2R_5} = \frac{u_{2R_5}}{2R_5} = \frac{-s-1}{6s+2}$$

$$H(s) = I_{2R_5}(s) = -\frac{s+1}{6s+2}$$

проверка:

п.1:

$$6s+2=0$$

$$s=-\frac{1}{3}$$

$$f_{2ob}(t) = A_1 e^{s_1 t} = A_1 e^{-\frac{t}{\tau}} \rightarrow \tau = \frac{1}{|s_1|}$$

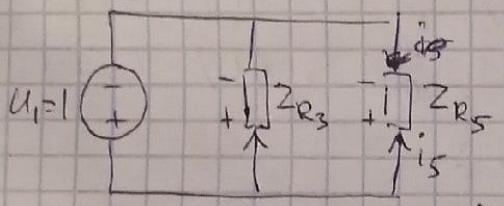
из 2.4 $\tau = 3 = \frac{1}{i_{5,1}}$, верно

п.2:

$s=0$

$H(s) = -\frac{0+1}{0+2} = -\frac{1}{2}$

$2 \to$ КЗ



$U_{Z_{R_5}} = 1 \qquad \bar{I}_{Z_{R_5}} = \bar{I}_5 = \frac{1}{2}$

$H(>) = \bar{I}_5 = \frac{1}{2}$ (по модулю)

п.3

$s \to \infty$

$H(\infty) = -\frac{1}{6}$

$i_5 = \frac{1}{6}$ (см. 2.4), верно

2. Частотные характеристики

$$H(s)|_{s=j\omega} = \frac{-j\omega - 1}{6j\omega + 2} = A(\omega) e^{j\varphi(\omega)}$$

$$A(\omega) = \frac{\sqrt{\omega^2 + 1}}{6\sqrt{\omega^2 + 1/9}}$$

$$\varphi(\omega) = \operatorname{arctg}(\omega) - \operatorname{arctg}(3\omega)$$

Контрольные точки:

$$A(\omega) \approx \begin{cases} \omega < \frac{1}{3}, & \frac{1}{2} \\ \frac{1}{3} \le \omega \le 1, & \frac{1}{6\omega} \\ \omega > 1, & \frac{1}{6} \end{cases}$$

$A(\frac{1}{3}) = 0{,}373$

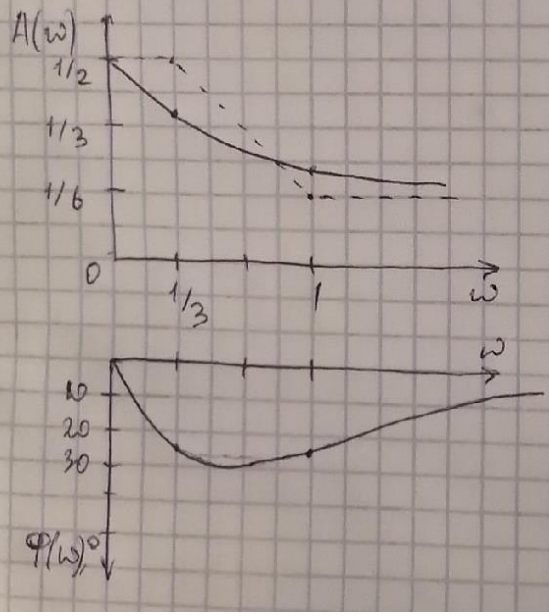
$A(1) = 0{,}224$

$\varphi(0) = 0$

$\varphi(\frac{1}{3}) = -26{,}57$

$\varphi(1) = -26{,}57$

$\varphi(\infty) = 0$



3. $h(t)$ и $h_1(t)$

$$H(s) = \frac{s+1}{6s+2} = A_0 + \frac{A_1}{s+1/3}$$

$$A_0 = \frac{1}{6} \qquad A_1 = \frac{1}{9}$$

$$h(t) = \frac{1}{6}\delta(t) + \frac{1}{9}e^{-t/3}\delta_1(t), \text{ верно}$$

$$h_1(t) = L^{-1}\left(\frac{s+1}{s(6s+2)}\right) = L^{-1}\left(\frac{1}{2s} - \frac{1}{3s+1}\right) =$$

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

(вставить гр-ки)

4. Реакция на аналитически заданную ф-ю

$$H(s) = \frac{I_5(s)}{U_1(s)} \rightarrow I_5(s) = U_1(s) \cdot H(s)$$

$$I_5(s) = \frac{30}{s+2} \cdot \frac{s+1}{6s+2} = \frac{6}{3s+1} + \frac{3}{s+2}$$

$$I_5(t) = \left(2e^{-t/3} + 3e^{-t\cdot 2}\right)\delta_1(t), \text{ верно}$$

5. Р-я но графически заданное в-е

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

$$u_1(s) = -\frac{2}{s}e^{-2s} + \frac{2}{s^2}e^{-s} - \frac{2}{s^2}e^{-2s}$$

$$L^{-1}\left(\frac{2(s+1)}{s(6s+2)}\right) = \frac{1}{s} - \frac{2}{3s+1} = \left(1 - \frac{2}{3}e^{-t/3}\right)\delta_1(t)$$

$$L^{-1}\left(\frac{2(s+1)}{s^2(6s+2)}\right) = \frac{1}{s^2} - \frac{2}{s} + \frac{6}{3s+1} = \left(t - 2 + 2e^{-t/3}\right)\delta_1(t)$$

$$I_5(t) = u_1(s)\cdot H(s) = -\left(1 - \frac{2}{3}e^{-\frac{t-2}{3}}\right)\delta_1(t-2) +$$
$$+\left(t - 3 + 2e^{-\frac{t-1}{3}}\right)\delta_1(t-1) - \left(t - 4 + 2e^{-\frac{t-2}{3}}\right)\delta_1(t-2)$$