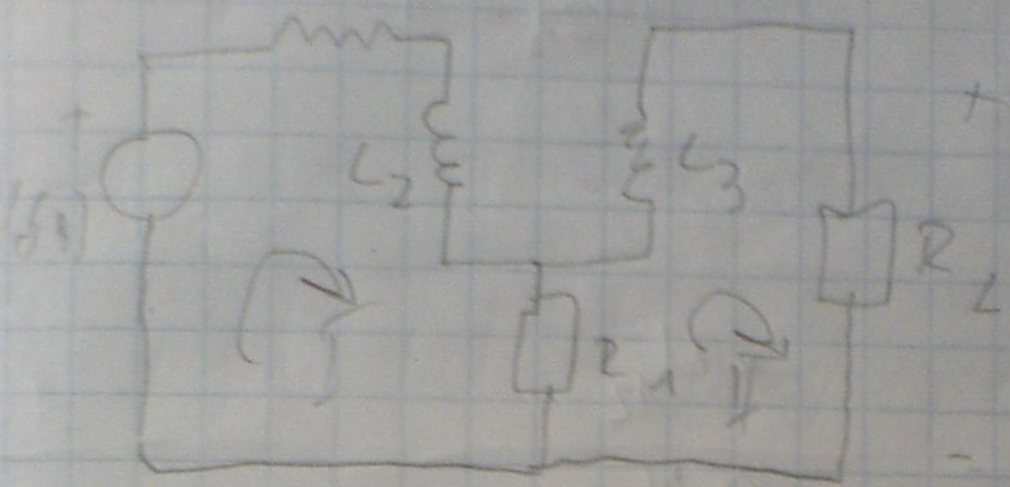


$$\bar{I}_1(sL_1+sL_2+R_1)-\bar{I}_2(R_1)=U$$

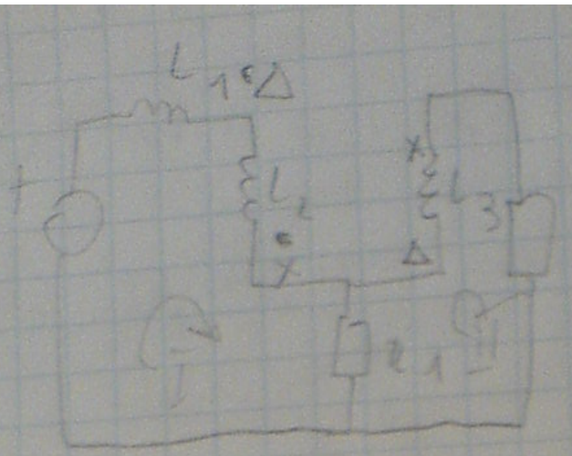
$$-\bar{I}_1(R_1)+\bar{I}_2(R_1+R_2+sL_3)=0$$

$$\bar{I}_1(1+3s)-\bar{I}_2=\frac{1}{s}$$

$$-\bar{I}_1+\bar{I}_2(2+4s)=0 \Rightarrow \bar{I}_1$$

$$\bar{I}_2(2+4s)(1+3s)-\bar{I}_2=\frac{1}{s}$$

$$\bar{I}_2=\frac{1}{s(12s^2+10s+1)}$$



$M_{13} = 2$

$M_{23} = 3$

• M_{12}

△ M_{13}

× M_{23}

ISTI POLARITCI

$$\bar{I}_1 \cdot sL_1 + \bar{I}_1 \cdot sL_2 + (\bar{I}_1 - \bar{I}_2)R_1 + \bar{I}_1 \cdot sM_{12} - \bar{I}_2 s$$

$$+ \bar{I}_2 sM_{23} = U_0$$

$$-(\bar{I}_1 - \bar{I}_2)R_1 + \bar{I}_2 sL_3 + \bar{I}_2 R_2 - \bar{I}_1 sM_{13} + \bar{I}_1 sM_2$$

$$\bar{I}_1[s(L_1 + L_2 + 2M_{12}) + R_1] - \bar{I}_2[R_1 + s(M_{13} - M_{23})]$$

$$-\bar{I}_1[R_1 + s(M_{13} - M_{23})] + \bar{I}_2(R_1 + R_2 + sL_3) = 0$$

$$\bar{I}_1(1 + 4s) - \bar{I}_2(1 - s) = \frac{1}{s}$$

$$-\bar{I}_1(1 - s) + \bar{I}_2(2 + 4s) = 0 \rightarrow \bar{I}_1 = \frac{\bar{I}_2(2 + 4s)}{1 - s}$$

15 15

$$= \frac{A}{s} + \frac{B}{s-s_1} + \frac{C}{s-s_2}$$

$$U_{R_2} = I_2 \cdot R_2$$

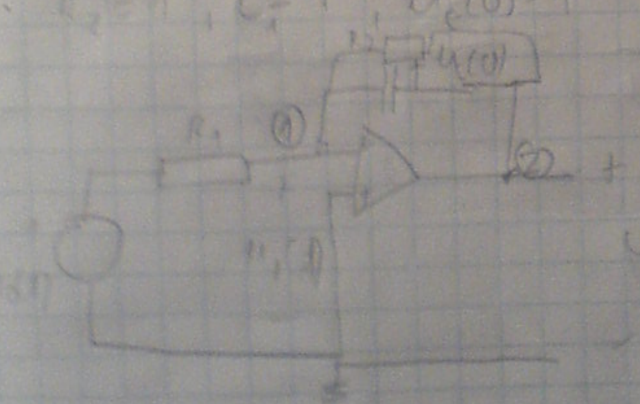
$$\frac{1}{s} + \frac{1,28624}{s+0,8554} - \frac{1,28624}{s+0,078}$$

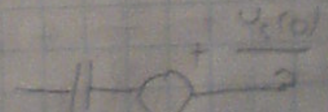
$$u_2(t) = S(t) + 1,28624\left(e^{-0,8554t} - e^{-0,078t}\right) S(t)$$

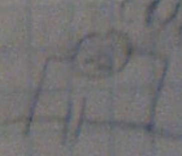
Zadatak

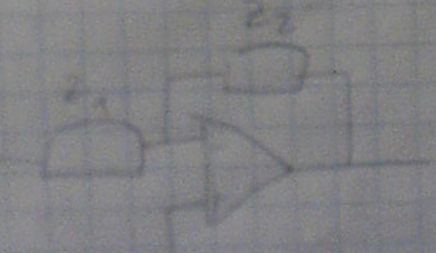
[illegible] $u_2(t)$ [illegible]: $u_1(t) = S(t)$, $R_1 =$ [illegible]

$R_2 = 1$, $C = 1$, $u_C(0) = 1$









$$U_2 = -\frac{Z_2}{Z_1} U_1$$

[illegible]

- piše se jednadžba za ulaz ne za izlaz kod čvora

(1)

$$U_1\left(\frac{1}{R_1}+\frac{1}{R_2}+sC_1\right)-U_2\left(\frac{1}{R_2}+sC_1\right)=\frac{U_0}{R_1}-C_1u_C(0)$$

$U_1=0 \rightarrow$ virt. kr. sp.

$$U_2\left(\frac{1}{R_2}+sC_1\right)=-\frac{U_0}{R_1}+C_1u_C(0)$$

$$U_2(s)=\frac{C_1R_2u_C(0)}{1+sC_1R_2}-\frac{R_2 U_0}{R_1(1+sC_1R_2)}=\frac{1}{s+1}-\underbrace{\frac{1}{s(s+1)}}_{\text{rastav}}$$

$U_0 = \frac{1}{s}$

$$\frac{1}{s(s+1)}=\frac{A}{s}+\frac{B}{s+1} \quad / \cdot s(s+1)$$

$$1=A(s+1)+B(s)$$

$$1=(A+B)s+A$$

$$A+B=0$$

$$A=1 \rightarrow B=-1$$

$$U_2(s)=\frac{1}{s+1}-\frac{1}{s}+\frac{1}{s+1}=\frac{2}{s+1}-\frac{1}{s}$$

$$=\left(2e^{-t}-1\right)S(t)$$

$u_0(t) = \delta(t) \circ\!\!-\!\!\bullet\ U_0(s) = 1$

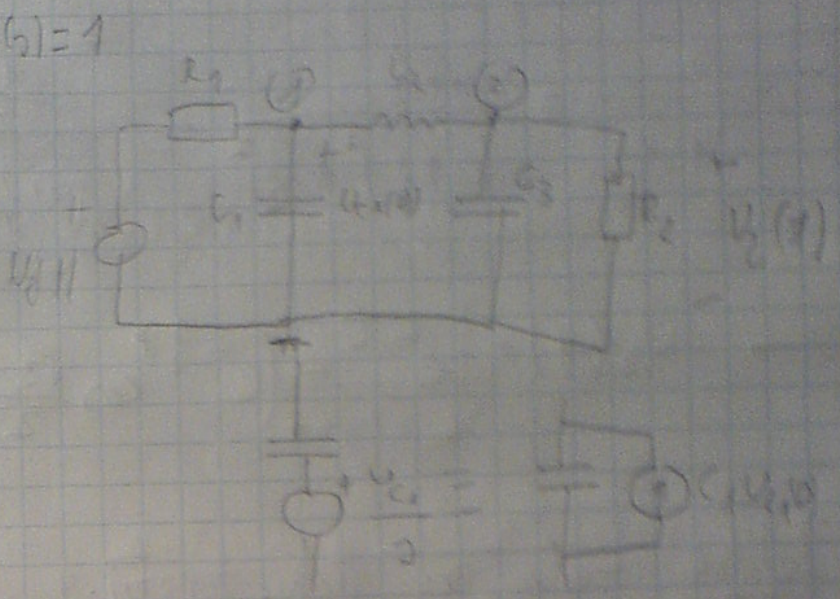
$u_{c_1}(0) = 1$

$R_1 = R_2 = 1$

$C_1 = C_3 = 1$

$L_2 = 2$

$u_2(t) = ?$



s φetlja

– C_3 i R_2 se mogu smatrati jednom impedancijom ...

– čvorni je lakše rješiti

$$U_1\left(\frac{1}{R_1} + sC_1 + \frac{1}{sL_2}\right) - U_2\left(\frac{1}{sL_2}\right) = \frac{U_0}{R_1} + C_1 u_{c_1}(0)$$

$$-U_1\left(\frac{1}{sL_2}\right) + U_2\left(\frac{1}{sL_2} + sC_3 + \frac{1}{R_2}\right) = 0$$

$$U_1\left(1 + s + \frac{1}{2s}\right) - \frac{U_2}{2s} = 1 + 1$$

$$-U_1\frac{1}{2s} + U_2\left(\frac{1}{2s} + s + 1\right) = 0$$

$$U_2 = \frac{1}{(s+1)(s^2+s+1)} = \frac{A}{s+1} + \frac{Bs+C}{s^2+s+1} \Big/ (s+1)(s^2+s+1)$$

$$1 = A(s^2+s+1) + (Bs+C)(s+1)$$

$$1 = As^2 + As + A + Bs^2 + Bs + sC + C$$

$$\begin{cases} A + B = 0 \rightarrow A = 1 \\ A + B + C = 0 \quad B = -1 \end{cases}$$

$$\frac{s}{s^2+s+1} = \frac{s+\frac{1}{2}}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2} - \frac{\frac{1}{2}\cdot\frac{\sqrt{3}}{2}}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}\cdot\frac{2}{\sqrt{3}}$$

$$\circ\!\!-\!\!\bullet \quad u_2(t) = \left[e^{-t} - \left(e^{-\frac{1}{2}t}\cos\frac{\sqrt{3}}{2}t - \frac{1}{\sqrt{3}}e^{-\frac{1}{2}t}\sin\frac{\sqrt{3}}{2}t\right)\right.$$

<u>Zad.</u> – rješ. na sjed. petlje

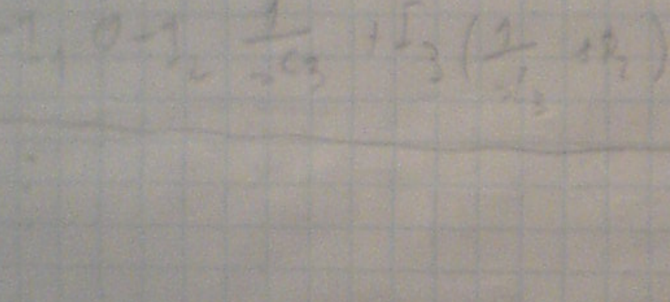
$$I_1\left(R_1+\frac{1}{sC_1}\right) - I_2\left(\frac{1}{sC_1}\right) - I_3\cdot 0 = U_0 - \frac{u_{C_1}(0)}{s}$$

$$-I_1\frac{1}{sC_1} + I_2\left(\frac{1}{sC_1}+sL_2+\frac{1}{sC_3}\right) - I_3\frac{1}{sC_3} = \frac{u_{C_1}(0)}{s}$$

$$-I_1\,0 - I_2\frac{1}{sC_3} + I_3\left(\frac{1}{sC_3}+R_2\right) = 0$$

Jedn. čvora kad je strujni izvor u seriji s nekim elementom!

<u>Riješ.</u>



$$U_1\left(\cancel{\frac{1}{R_1}} + \frac{1}{R_2} + \frac{1}{R_3}\right) = I_0 + \frac{U_0}{R_3}$$

$I_{R_3}(t) = ?$

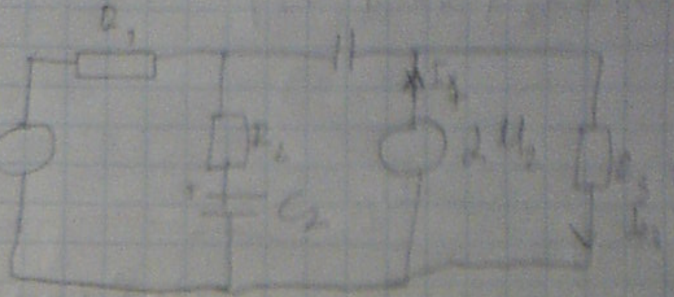
$U_0(t) = \delta(t)$

$R_1 = R_2 = 1$

$R_3 = 2$

$C_1 = C_2 = 2$

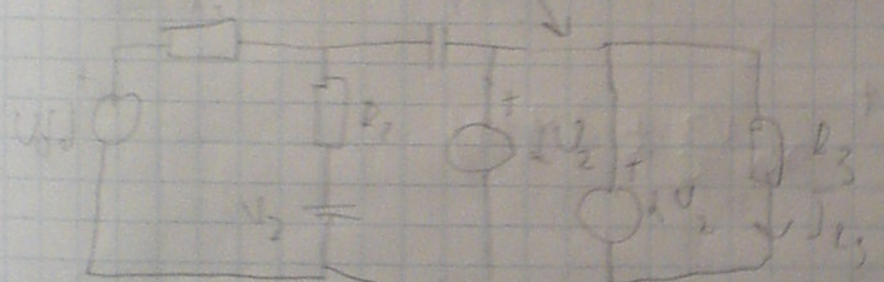
$\alpha = 2$

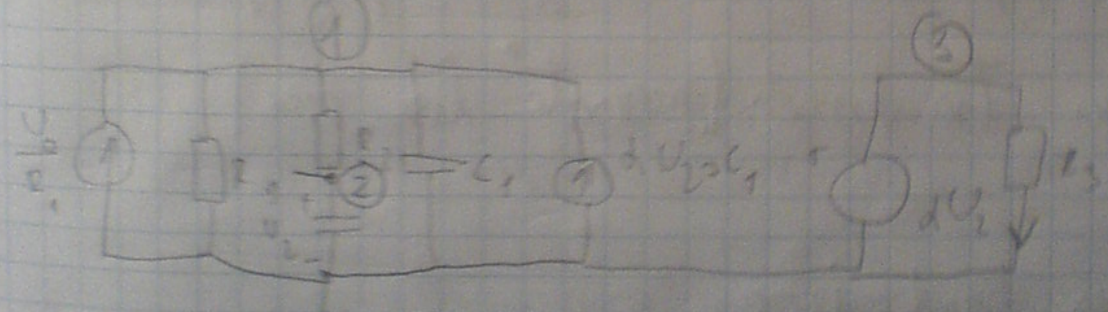


I NAČIN

- transformacija naponskog izvora u strujni + ...

ne teče struja





$U_1\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{Z_1}\right) - U_2\left(\frac{1}{R_2}\right) = \frac{U_0}{R_1} + \alpha U_2 s C_1$

$-U_1\left(\frac{1}{R_2}\right) + U_2\left(sC_2 + \frac{1}{R_2}\right) = 0$

$U_3 = \alpha U_2$

$$U_2(s) = \frac{U_0}{1+s\left[R_1C_1(1-2)+R_2C_2+R_1C_2\right]+s^2R_1R_2C_1C_2}$$

$$= \frac{1}{4s^2+2s+1}$$

$$I_{R_3}(s) = \frac{U_3(s)}{R_3} = \frac{2U_2(s)}{R_3} = \frac{1}{4s^2+2s+1}$$

$\mathcal{L}^{-1}$

$$= \frac{1}{4\left(s^2+\frac{1}{2}s+\frac{1}{4}\right)} = \frac{1}{4} \cdot \frac{\frac{\sqrt{3}}{4}}{\left(s+\frac{1}{4}\right)^2+\left(\frac{\sqrt{3}}{4}\right)^2} \cdot \frac{1}{\sqrt{3}}$$

$$I_{R_3}(t) = \left(\frac{1}{\sqrt{3}} e^{-\frac{1}{4}t} \sin\frac{\sqrt{3}}{4}t\right) S(t)$$

- ako je naponski izvor sam u grani prije jedn. čv. treba ga transformirati („pogurati" kroz čvor)

$\overline{\text{II}}$ način

- lošije, bez transf. izvora

(1) $U_1\left(\frac{1}{R_1}+\frac{1}{R_2}+sC_1\right) - U_2\left(\frac{1}{R_2}\right) - U_3\left(sC_1\right) = \frac{U_0}{R_1}$

(2) $-U_1\left(\frac{1}{R_2}\right) + U_2\left(\frac{1}{R_2}+sC_2\right) = 0$

(3) $-U_1\left(sC_1\right) + U_3\left(sC_1+\frac{1}{R_3}\right) = \overline{I}_x$

$I_1 = \frac{U_3}{R_3} + (U_3 - U_1) s C_1$

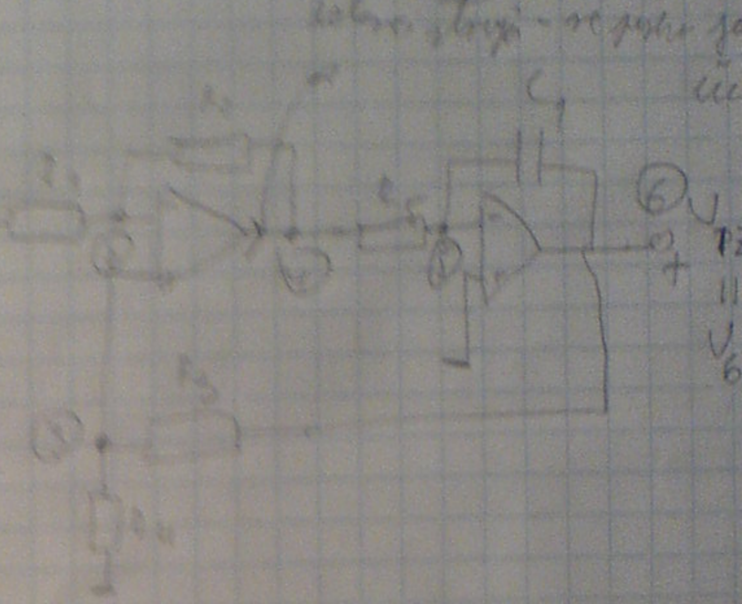
Zadatak

Odrediti $U_{12}(s) = ?$

$U_1(s) = \frac{1}{s}$

$R_1 = R_2 = R_3 = R_4 = R_5 = 1$

$C_1 = 1$



- ako pojačalo više nema invertirajući ulaz

(2) $U_2 \left(\frac{1}{R_1} + \frac{1}{R_2} \right) - U_4 \left(\frac{1}{R_2} \right) = \frac{U_1}{R_1}$

(3) $U_3 \left(\frac{1}{R_3} + \frac{1}{R_4} \right) - U_6 \left(\frac{1}{R_3} \right) = 0$

(4) $U_4 = A(U_3 - U_2)$ → ne pojačanje (1 + (-1))

(5) $U_5 \left(\frac{1}{R_5} + sC_1 \right) - U_4 \frac{1}{R_5} - U_6 s C_1 = 0$

(6) $U_6 = A(0 - U_5) = -A U_5$

$U_6 = \frac{1}{s(s+1)}$

iz (4) $A \to \infty$ $U_3 = U_2$

(2) $U_3 \left(\frac{1}{R_1} + \frac{1}{R_2} \right) + U_6 \frac{1}{R_2 s C_1 R_5} = \ldots$

(6) $A \to \infty$ $U_5 = 0$

$U_3 \left(\frac{1}{R_3} + \frac{1}{R_4} \right) = \frac{U_6}{R_3}$

(5) $\frac{U_4}{R_5} = -U_6 s C_1 \Rightarrow U_4$