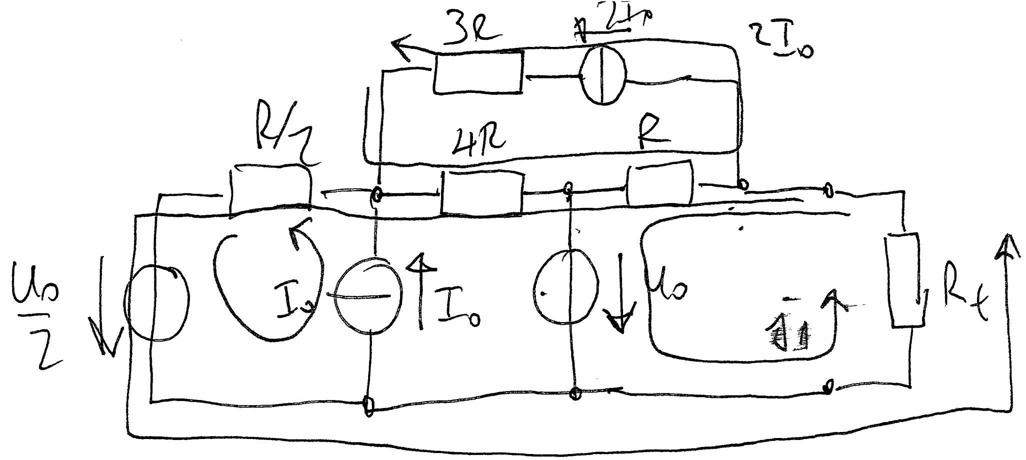


$\boxed{\text{RT27NH}}$

$U_0 = 10\ V$

$I_0 = 2\ mA$

$R = 1\ k\Omega$

$R_t = 2\ k\Omega$

Források teljesítménye:

$$P_{U_0/2} = \frac{U_0}{2}\cdot(I_0 + j_2) = \underline{21,11\ mW}$$

$$P_{U_0} = U_0 \cdot j_1 = \underline{-8,8889\ mW}$$

$$P_{I_0} = I_0 \cdot \left(-\frac{U_0}{2} - (I_0+j_2)\frac{R}{2}\right) = \underline{-14,222\ mW}$$

$$U_{2I_0} + 3R\cdot 2I_0 + (2I_0 - j_2)4R + R\cdot(2I_0 - j_2 - j_1) = 0$$

$$P_{2I_0} = \underline{-87,111\ mW}$$

$\boxed{j_1:}$ $R(j_1 + j_2 - 2I_0) + U_0 + R_t\cdot(j_1+j_2) = 0$

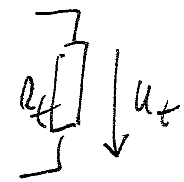
$\boxed{j_2:}$ $R(j_2+j_1-2I_0) + 4R(j_2 - 2I_0) + \frac{R}{2}(j_2+I_0) + \frac{U_0}{2} + R_t(j_1+j_2) = 0$

$$j_1(R+R_t) + j_2(R+R_t) = 2RI_0 - U_0$$

$$\cancel{j_1\left(R+4R+\frac{R}{2}+R_t\right)+}$$

$$j_1(R+R_t) + j_2\underbrace{\left(R+4R+\frac{R}{2}+R_t\right)}_{5,5R+R_t} = 2I_0R + 2I_0\cdot 4R - I_0\cdot\frac{R}{2} - \frac{U_0}{2}$$

$$= 9,5RI_0 - \frac{U_0}{2}$$



$j_1 = -0,8889\ mA$ $\quad j_2 = 2,2222\ mA$

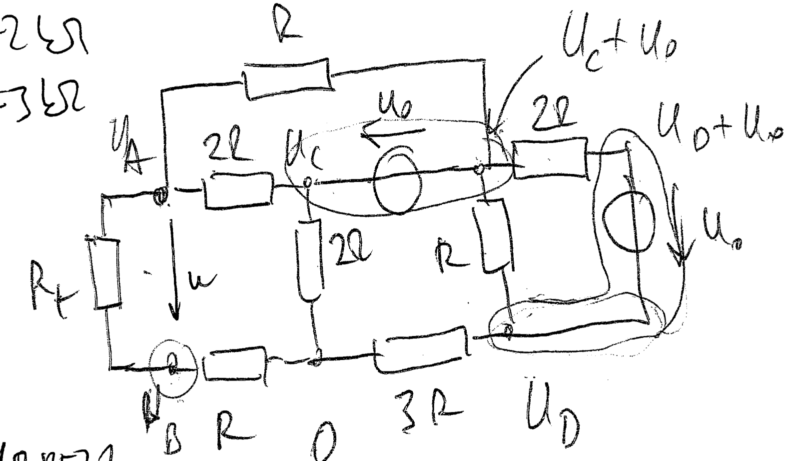
$$U_t = R_t\cdot(-1)(j_1+j_2) = -2,6667$$

Határozzuk meg (adott I_0 esetén), az U_0 azon intervallumait, amelyekben ~~egyik fgr. másik~~ egy, két vagy semmi fgr. forrás termelő!

$U_0 = 10V$

$R = 2k\Omega$

$R_t = 3k\Omega$



$$① \rightarrow (R+R_t)\,U_B - R\cdot U_A = 0$$

$$② \; (2R+3R_t)\,U_A - 2R\cdot U_B + U_C(-3R_t) = 2R_t\cdot U_0$$

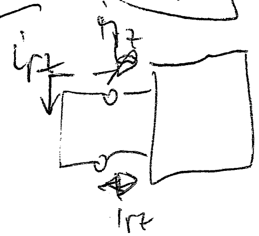
$$③ \; U_A(-3) + U_B(0) + U_C(7) + U_D(-3) = 4U_0$$

$$④ \; U_A\cdot 0 + U_B\cdot 0 + U_C(-9) + U_D\cdot 11 = 6U_0$$

$R_t \to 0$ ① $(-1 \quad +1 \quad 0 \quad 0)$

$R_t \to \infty$ ② $(0 \quad 1 \quad 0 \quad 0)$

$$\boxed{I_{rz} = U_B/R}$$



$I_N = -i_{rz}$

tutsmölys 2

$$\begin{array}{cccc} U_A & U_B & U_C & U_D \end{array}$$

$$\begin{pmatrix} -R & R+R_t & 0 & 0 \\ 2R+3R_t & -2R & -3R_t & 0 \\ -3 & 0 & 7 & -3 \\ 0 & 0 & -9 & 11 \end{pmatrix} \begin{pmatrix} U_A \\ U_B \\ U_C \\ U_D \end{pmatrix} = \begin{pmatrix} 0 \\ 2R_t\cdot U_0 \\ 4U_0 \\ 6U_0 \end{pmatrix}$$

Válni: $U = 18{,}8571$

$$① \; \frac{U_B - U_A}{R_t} + \frac{U_B}{R} = 0$$

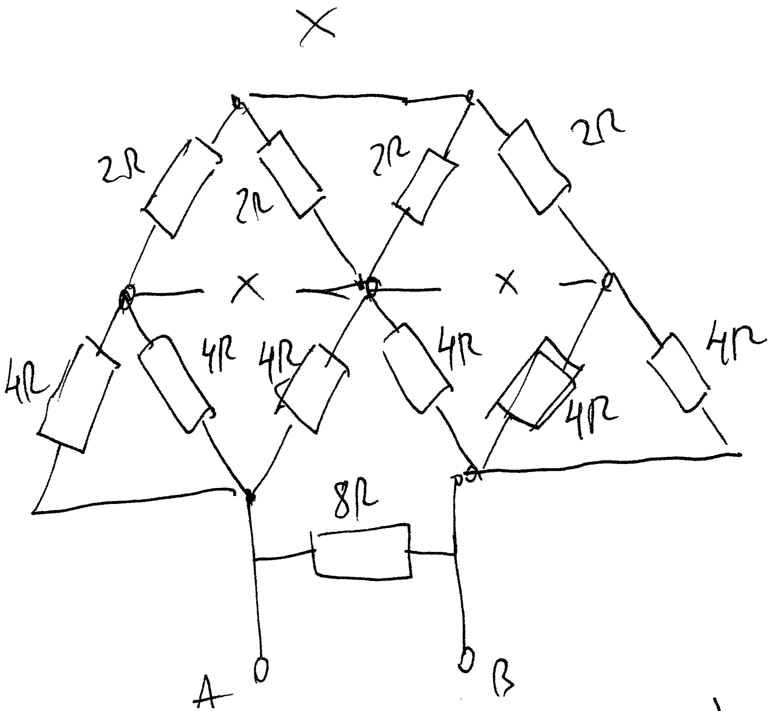
$$② \; \frac{U_A - U_B}{R_t} + \frac{U_A - U_C}{2R} + \frac{U_A - (U_C+U_0)}{R} = 0$$

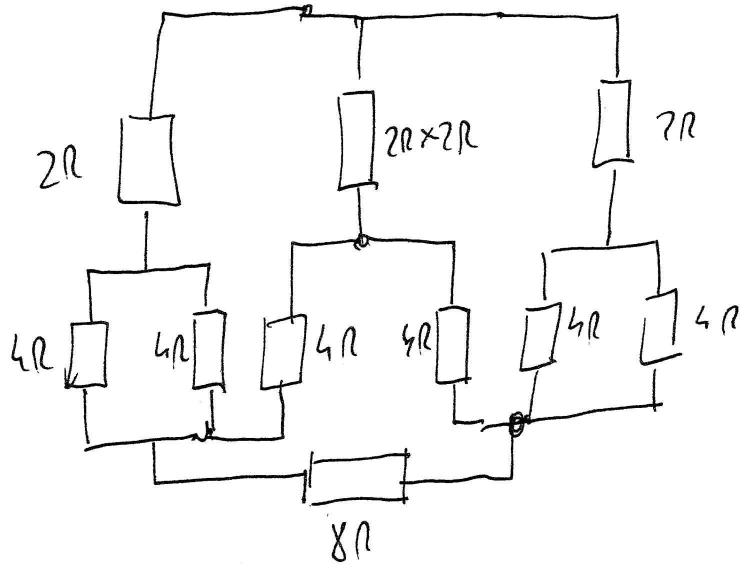
$$③ \; \frac{U_C}{2R} + \frac{U_C - U_A}{2R} + \frac{U_C^{+U_0} - U_D}{R} + \frac{U_C + U_0 - U_A}{R} + \frac{U_C + U_0 - (U_D + U_0)}{2R} = 0$$

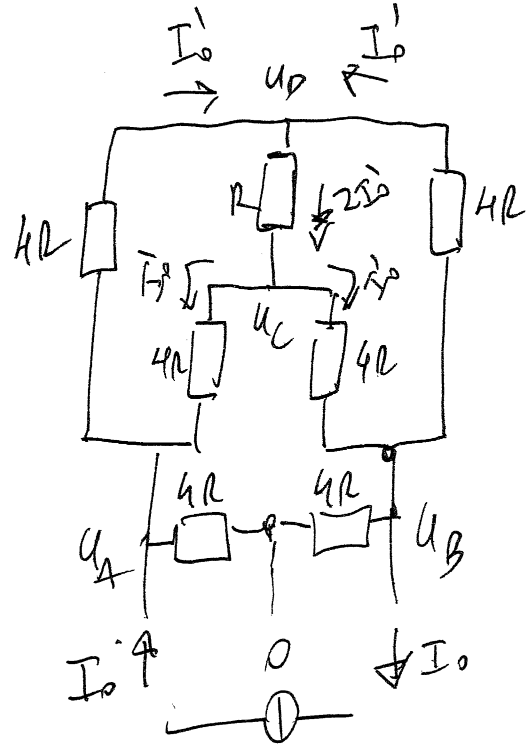
$$④ \; \frac{U_D + U_0 - (U_C + U_0)}{2R} + \frac{U_D}{3R} + \frac{U_D - (U_C + U_0)}{R} = 0$$

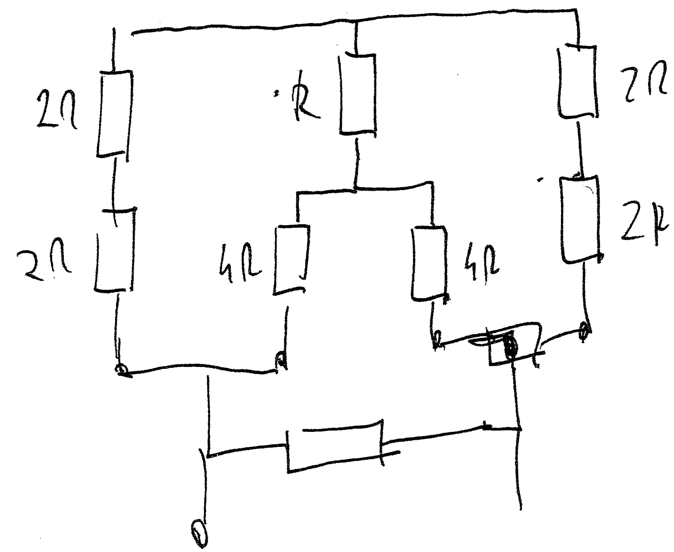
$$\begin{array}{cccc} U_A & U_B & U_C & U_D \end{array}$$

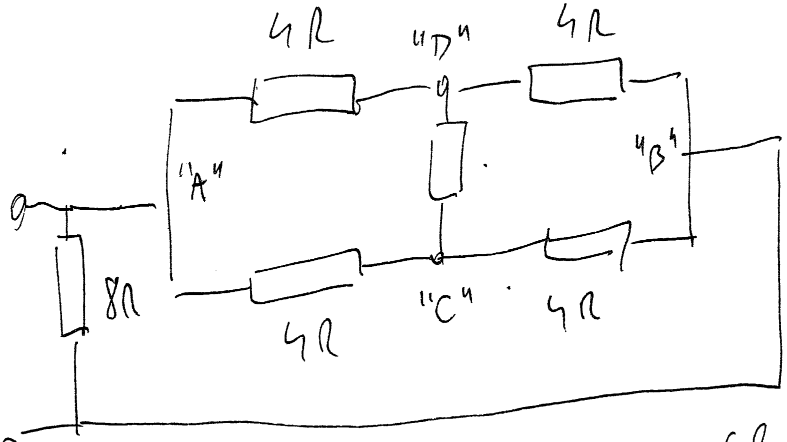
$$\begin{pmatrix} \frac{3}{R_t}\frac{2}{R} & \cdot & \cdot & \cdot \\ \frac{1}{R_t}\frac{R}{R_t} & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \end{pmatrix} \begin{pmatrix} U_A \\ U_B \\ U_C \\ U_D \end{pmatrix} = \begin{pmatrix} \\ \\ \\ \end{pmatrix}$$


2R
2R
2R
2R
4R
4R
4R
4R
4R
4R
8R
A
B


2R
2R×2R
2R
4R
4R
4R
4R
4R
4R
8R


I_0'
u_D
I_0'
4R
R
$2I_0'$
4R
4R
u_C
4R
4R
4R
u_A
u_B
I_0
0
I_0

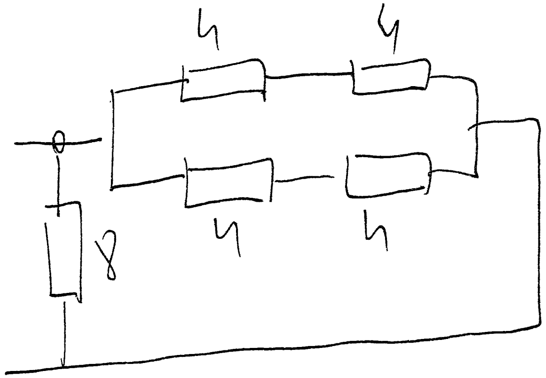

2R
R
2R
2R
2R
4R
4R



$$\Downarrow \quad I_{CD} = 0$$ (kiegyenlített híd!)

$$\Downarrow$$

miért is (szimmetria!)



$$8 \times (8 \times 8) = 8 \times 4 = \frac{4 \cdot 8}{4+8} = 2{,}6667$$

$$R_{AB} = \frac{2{,}666\ V}{1\ A} = \underline{\underline{2{,}666\ \Omega}}$$

$\boxed{\text{Karacsonyfa}}$

$$\frac{U_A}{4R} + \frac{U_A - U_C}{4R} + \frac{U_A - U_D}{4R} \cancel{=0} - I_0 = 0$$

$$\frac{U_B}{4R} + \frac{U_B - U_C}{4R} + \frac{U_B - U_D}{4R} \cancel{=0} + I_0 = 0$$

$$\frac{U_D - U_C}{R} + \frac{U_D - U_A}{4R} + \frac{U_D - U_B}{4R} = 0$$

$$\frac{U_C - U_A}{4R} + \frac{U_C - U_B}{4R} + \frac{U_C - U_D}{R} = 0$$

$$\begin{array}{cccc} U_A & U_B & U_C & U_D \\ \end{array}$$

$$\begin{pmatrix} 3 & 0 & -1 & -1 \\ 0 & 3 & -1 & -1 \\ -1 & -1 & 6 & -4 \\ -1 & -1 & -4 & 6 \end{pmatrix} \begin{pmatrix} U_A \\ U_B \\ U_C \\ U_D \end{pmatrix} = \begin{pmatrix} 4RI_0 \\ -4RI_0 \\ 0 \\ 0 \end{pmatrix}$$

$$\left.\begin{array}{l} U_A = 1{,}3333\ V \\ U_B = -1{,}3333\ V \end{array}\right\} \quad U_{AB} = R_{AB} \cdot I_0 = U_A - U_B$$

(Gyémánt) Tetraéder ellenállásrács

Tetraéder csúcsai + középpont
("A", "B", "C", "D") ("O")

- minden csúcs minden csúccsal összekötve ellenállással

⇓

ellenállás $R = R_0 \cdot \frac{d}{a_0}$

ahol a_0 a körülírható gömb sugara
$(a_0 = 0{,}61 \cdot a)$

magassága (gúláé) $m = 0{,}82\,a$