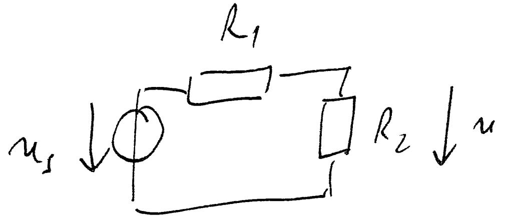
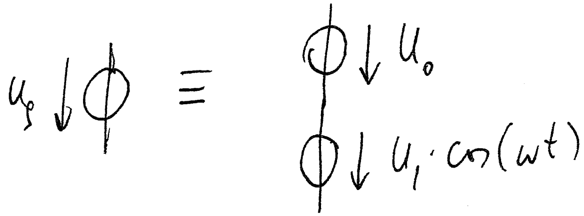
Szuperpozíció alkalmazása

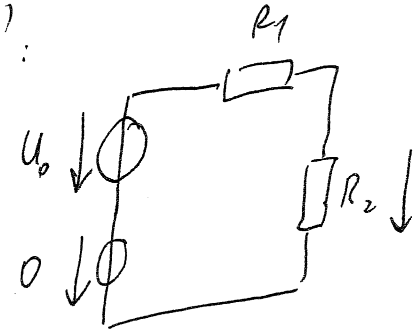


$$u_s(t) = U_0 + U_1 \cdot \cos(\omega t)$$



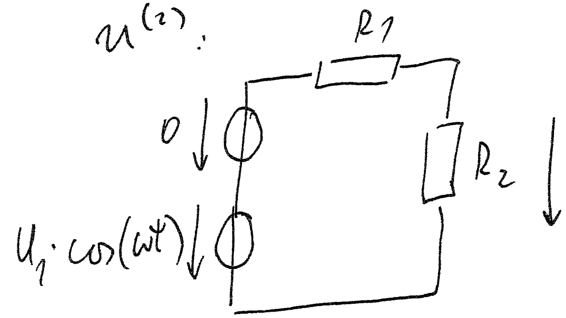
$\rightarrow \quad u = u^{(1)} + u^{(2)}$

$u^{(1)}$:



$$u^{(1)} = \frac{R_2}{R_1 + R_2} \cdot U_0$$

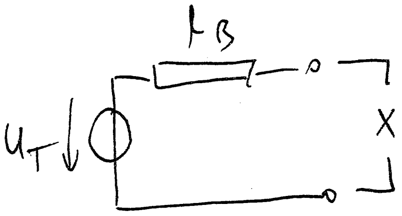
$u^{(2)}$:



$$u^{(2)} = \frac{R_2}{R_1 + R_2} \cdot U_1 \cdot \cos(\omega t)$$

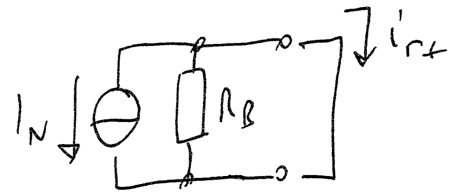
teljes megoldás: $u = u^{(1)} + u^{(2)} = \frac{R_2}{R_1 + R_2} \cdot U_0 + \frac{R_2}{R_1 + R_2} \cdot U_1 \cdot \cos(\omega t)$

Thévenin-tt. és Norton-tt.



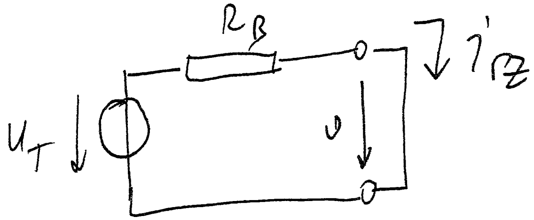
(üresjárási feszültség)

$$\boxed{U_{\text{üj}} = U_T}$$



$$i_{rz} + I_N = 0$$

$$\Leftarrow \boxed{I_N = -i_{rz}}$$



$$i_{rz} = \frac{U_T}{R_B} \Rightarrow$$

$$R_B = \frac{U_T}{i_{rz}} = \frac{U_T}{-I_N}$$

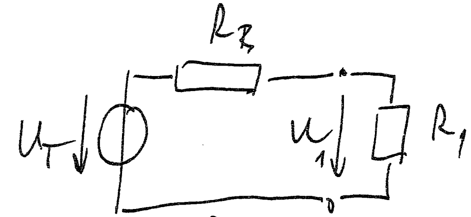
i_{rz} irányítása szimmetrikus!

$(\downarrow u \Rightarrow \uparrow i_{rz})$!

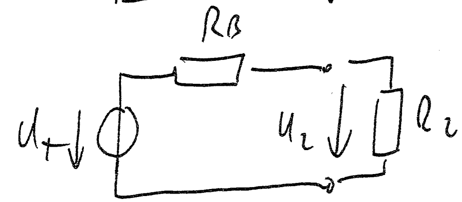
<u>Megjegyzés</u>: a rövidzár és szakadás speciális lezárás!

Különösen a rz. sokszor nem megvalósítható!

→ R_1 és R_2 lezáró ellenállással esetén:



$$U_1 = \frac{R_1}{R_1 + R_B} \cdot U_T$$



$$U_2 = \frac{R_2}{R_2 + R_B} \cdot U_T$$

adódik: (1) $U_1 R_1 + U_1 R_B = R_1 \cdot U_T$

(2) $U_2 R_2 + U_2 \cdot R_B = R_2 \cdot U_T$

→

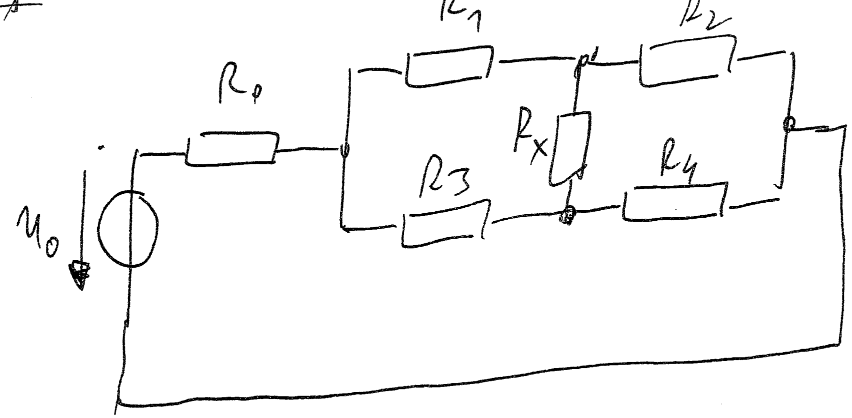
$$\begin{pmatrix} R_1 & -U_1 \\ R_2 & -U_2 \end{pmatrix} \begin{pmatrix} U_T \\ R_B \end{pmatrix} = \begin{pmatrix} U_1 R_1 \\ U_2 R_2 \end{pmatrix}$$

$$U_T = \frac{U_1 R_1 \cdot (-U_2) + U_1 (U_2 R_2)}{-R_1 U_2 + U_1 R_2} = \ldots$$

A)

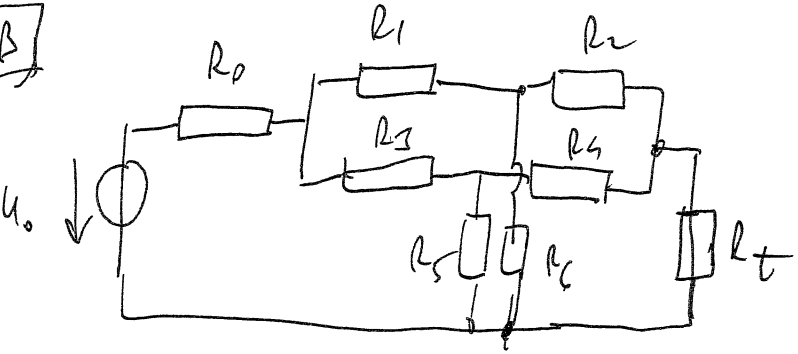
a) Mekkora R_x árama?

b.) Mi a feltétele, hogy R_x árama zérus legyen?



B)

a) Határozzuk meg R_t értékét teljesítményillesztéshez!

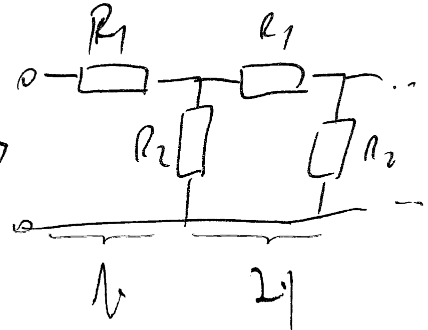


b.) Mekkora lesz ekkor R_5 és R_6 árama?

c) Át tudjuk rajzolni a hálózatot ekvivalens alakra?

C)

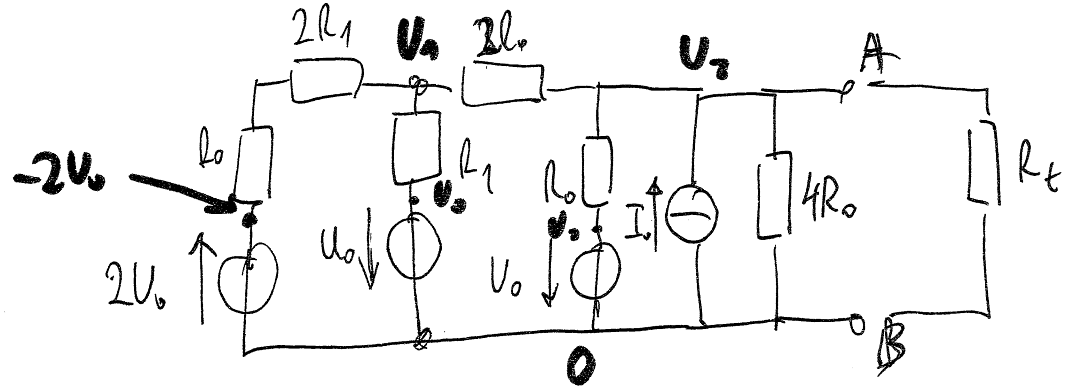
$R_B \Rightarrow$



Létrafeszültségosztás, ahol R_1 és R_2 ismert.

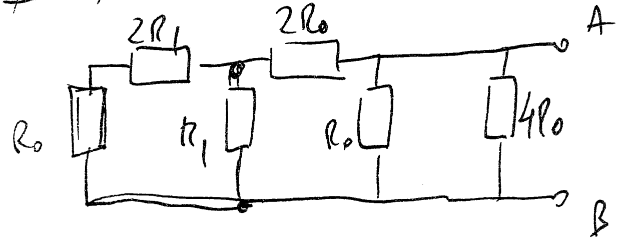
a) $R_B = ?$, ha $n \to \infty$

b.) véges n esetén ($n < \infty$) mutassuk meg a függőleges ág feszültségét és az eredő ellenállást!



$R_0 = 1\ k\Omega$; $R_1 = 5\ k\Omega$; $U_0 = 5V$; $I_0 = 2\ mA$

a) R_{AB} meghatározása:



$$R_{AB} = (4R_0 \times R_0) \times (2R_0 + R_1 \times (2R_1 + R_0))$$

$$R_{AB} = (4 \times 1) \times (2 + 5 \times \underbrace{(10+1)}_{11}) = \frac{4}{5} \times \left(\frac{32+55}{16}\right) =$$

$\frac{4}{5}$ $\quad \frac{55}{16}$ $\quad 11$ $\quad \frac{87}{16}$

$$= \frac{\frac{4}{5} \cdot \frac{87}{16}}{\frac{4}{5} + \frac{87}{16}} = \frac{\frac{4 \cdot 87}{80}}{\frac{64 + 5 \cdot 87}{80}} = 0{,}6974\ k\Omega$$

$$= \frac{348}{499}\ ✓$$

a) teljesítményillesztés: | NT 75TZ

b) Adjunk olyan helyettesítő képet ami alapján az áramforrás terhelő/fogyasztó jellegét meg lehet állapítani

c) Milyen U_0, I_0 tartományon lesz az áramforrás fogyasztó?

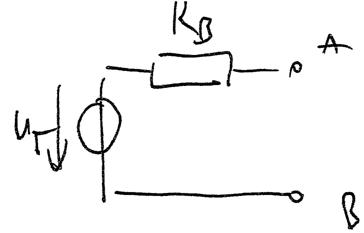
Csomóponti potenciálokkal:

(1) $$\frac{U_1 - (-2U_0)}{2R_1 + R_0} + \frac{U_1 - U_0}{R_1} + \frac{U_1 - U_2}{2R_0} = 0$$

(2) $$\frac{U_2 - U_1}{2R_0} + \frac{U_2}{4R_0} - I_0 + \frac{U_2 - U_0}{R_0} = 0$$

$$\begin{pmatrix} \frac{1}{11} + \frac{1}{5} + \frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{1}{2} + \frac{1}{4} + 1 \end{pmatrix} \begin{pmatrix} U_1 \\ U_2 \end{pmatrix} = \begin{pmatrix} \frac{U_0}{5} - \frac{2U_0}{11} \\ I_0 + U_0 \end{pmatrix}$$

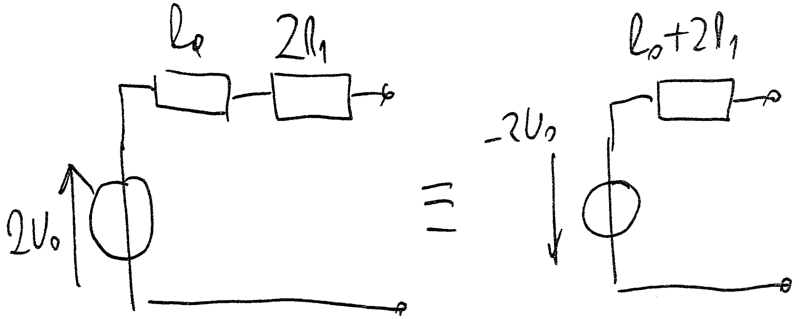
$$U_T = U_2 = 4{,}9218\ V$$

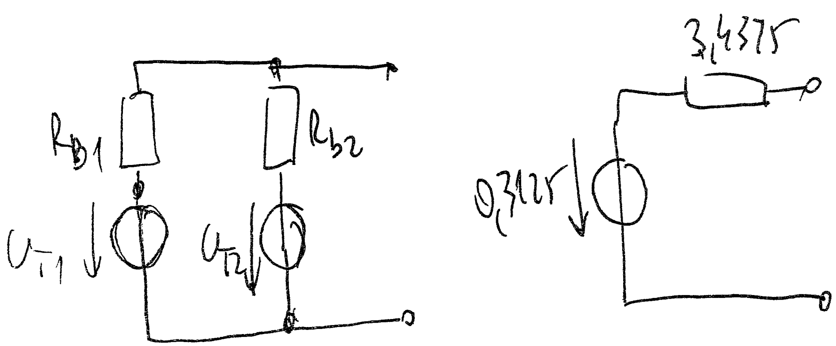


$R_B = 0{,}6974\ \Omega$

$U_T = 4{,}9218\ V$

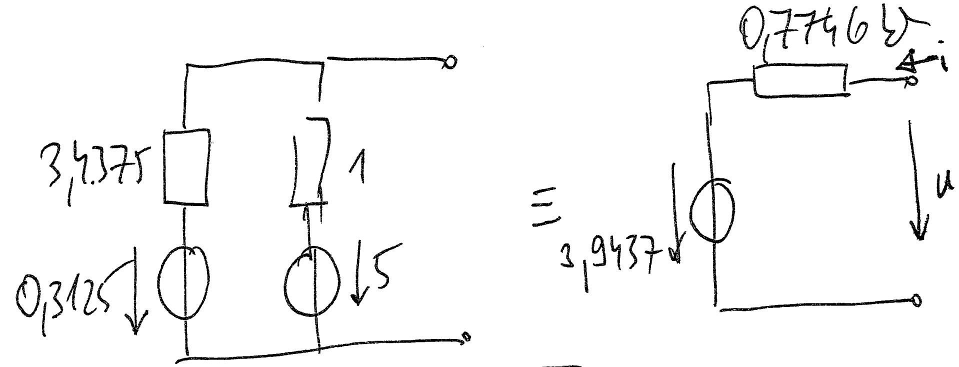
$$P_{max} = \frac{U_T^2}{4 \cdot R_B} = \underline{\underline{8{,}6839\ mW}}$$



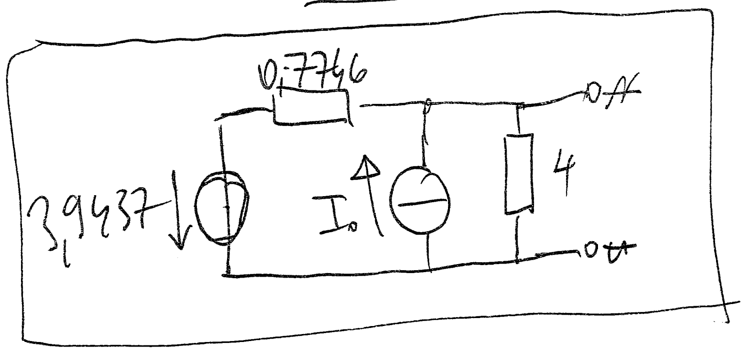


$$\frac{U_T - U_{T1}}{R_{b1}} + \frac{U_T - U_{T2}}{R_{b2}} = 0$$

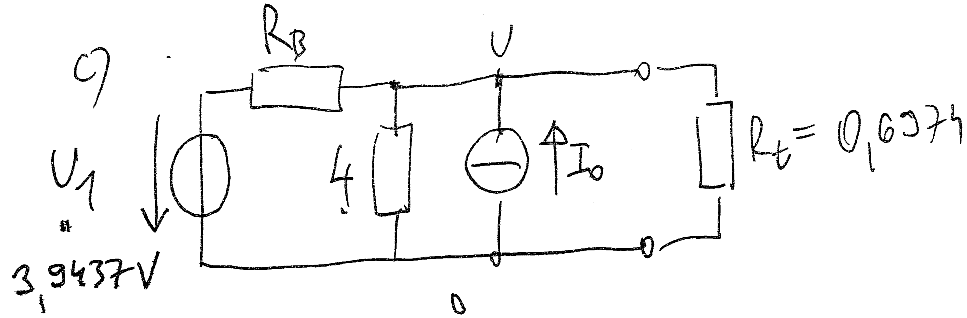
$$U_T = \frac{U_{T1}/R_{b1} + U_{T2}/R_{b2}}{\frac{1}{R_{b1}} + \frac{1}{R_{b2}}} = -$$



NT75TE
/2.



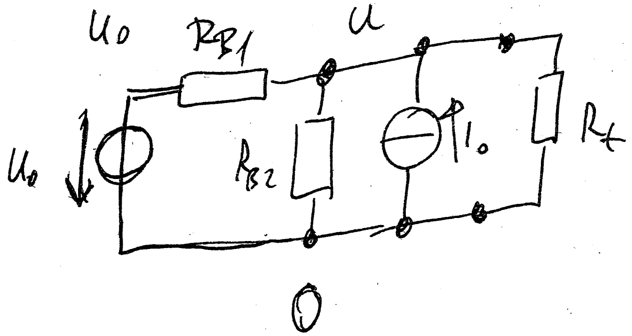
c)



$$\frac{U - U_1}{0{,}7746} + \frac{U}{4} + \frac{U}{0{,}6974} - I_0 = 0$$

$$(U)\big|_{I_0=2} = 2{,}3837\ V$$

$$U = \frac{U_1/0{,}7746 + I_0}{\frac{1}{0{,}7746} + \frac{1}{4} + \frac{1}{0{,}6974}} = \underset{\cancel{A}}{\bigcirc} + \underset{m}{\bigcirc} \cdot I_0$$



$$\frac{U-U_0}{R_{B1}}+\frac{U}{R_{B2}}+\frac{U}{R_t}-I_0=0$$

$$U\left(\frac{1}{R_{B1}}+\frac{1}{R_{B2}}+\frac{1}{R_t}\right)=I_0+\frac{U_0}{R_{B1}}$$

$$U=\frac{I_0+\frac{1}{R_{B1}}\cdot U_0}{\boxtimes}$$

$$\boxed{\boxtimes=\frac{1}{R_{B1}}+\frac{1}{R_{B2}}+\frac{1}{R_t}}$$

$$P_{I_0}=(-U)\,I_0=\frac{1}{\boxtimes}\cdot(-I_0)\left(\frac{U_0}{R_{B1}}+I_0\right)$$

Ekvipotenciális vonal (görbe?) → ?

$f(x,y)$ esetén $f(x,y)=f_0$

$$\boxed{P_{I_0}=\frac{-I_0^2-\frac{U_0}{R_{B1}}\cdot I_0}{\boxtimes}}$$

$$U_0\left(1-\frac{1}{\boxtimes R_{B1}}\right)$$

$$P_{U_0}=U_0\cdot\frac{(U-U_0)}{R_{B1}}=\frac{U_0}{R_{B1}}\cdot\left(\frac{1}{\boxtimes}\cdot\frac{U_0}{R_{B1}}+\frac{1}{\boxtimes}\cdot I_0-U_0\right)=U_0^2\cdot\underbrace{\frac{\boxtimes R_{B1}-1}{\boxtimes\cdot R_{B1}^2}}_{A_{U_0}}+\frac{I_0}{\boxtimes}\cdot U_0$$

NT75TZ/3.

~~áramforrás termelő/fogyasztó jellege a R_t-től független~~

→ ~~nem lehet így, mert ha $I_0>0$~~ (U mindig pozitív minden R_t esetén)

→ $\boxed{I_0<0}$

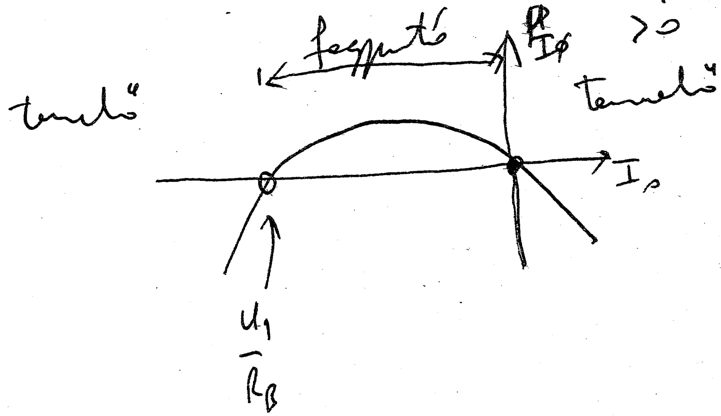
$$U(R_t) = \frac{\frac{1}{R_B}U_1 + I_0}{\frac{1}{0,7746}+\frac{1}{4}+\frac{1}{0,6974}} \Rightarrow$$

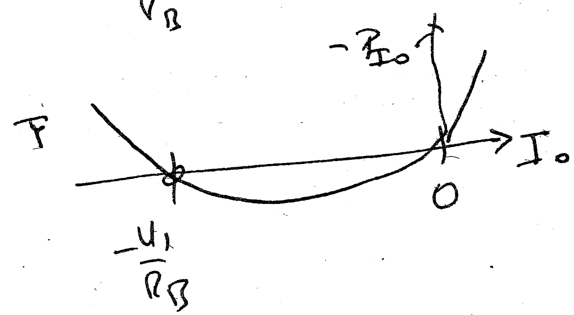
$P_{I_0} = I_0\cdot(-U) \Rightarrow$ mindig $I_0>0$ esetén termelő

$I_0<0$ esetén

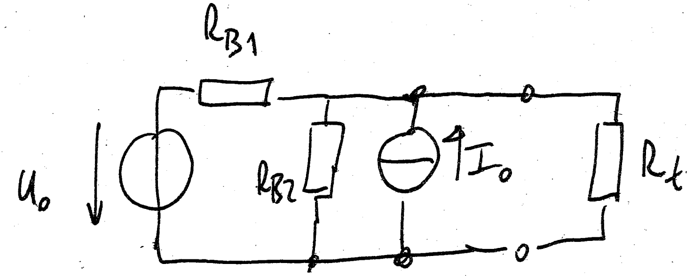
$$P_{I_0} = I_0 \cdot \left(\frac{U_1}{R_B}+I_0\right)\cdot \qquad >0$$

$$I_0\left(\frac{1}{R_B}U_1+I_0\right)>0$$



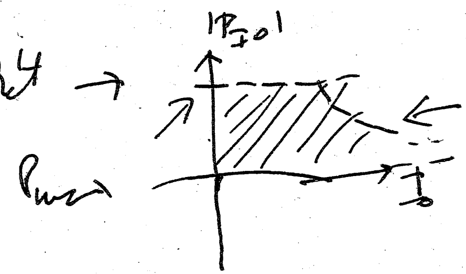


NT75TZ/c. általánosítása

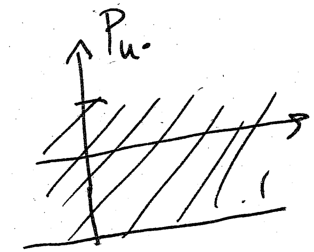


→ forrásod teljesítménye

→ ~~meg~~ I_0 értéke →



működési tartomány



Rajzolja fel U_0–I_0 koordinátarendszerben az egyes források fogyasztó tartományát!