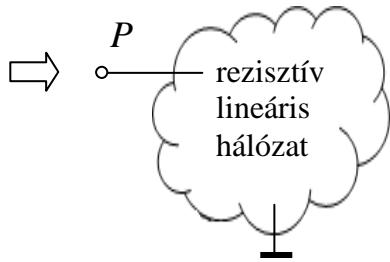


Lineáris hálózat adott P pontjára vonatkozó Thevennin és Norton helyettesítőkép értelmezése:



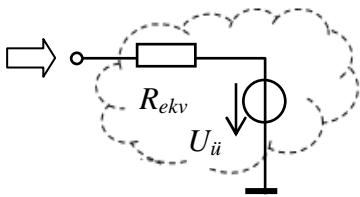
Rezisztív hálózat:

- ellenállásokat,
- vezérelt áram és feszültség forrásokat,
- és független áram és feszültség forrásokat tartalmazhat.

dezaktivált hálózat:

- független áram forrás szakadással,
- független feszültség forrást rövidzárral helyettesítünk.
- (vezérelt források maradnak!)

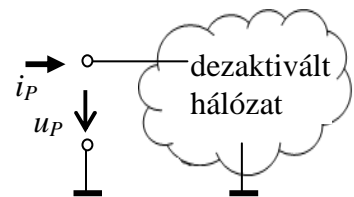
Thevennin:



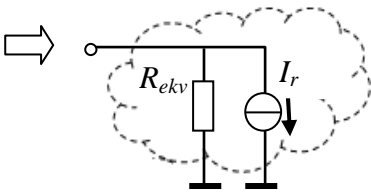
A paraméterek:

be- (vagy ki-)menő ellenállás:

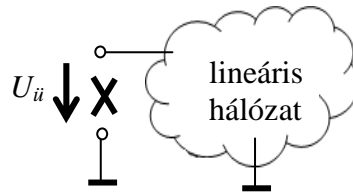
$$R_{ekv} = \frac{u_P}{i_P}$$



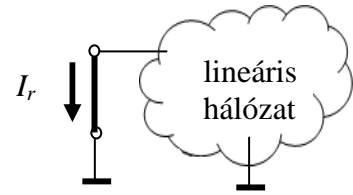
Norton:



üresiárasi feszültség:

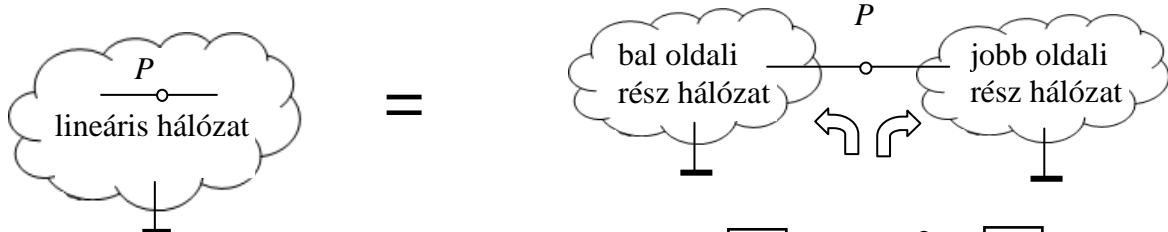


rövidzárási áram:

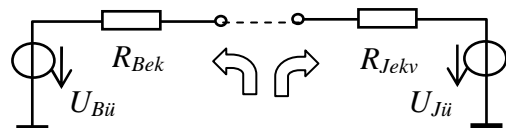


Független feszültség és áram forrást nem tartalmazó hálózat Thevennin és Norton helyettesítő képe egyaránt egy ellenállás: R_{ekv} .

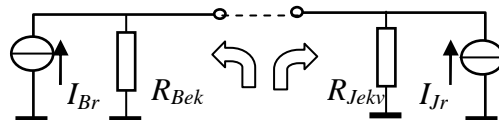
Adott P ponton kettévágható lineáris hálózat jobb és baloldali részeinek Thevennin és Norton helyettesítő képei:



Jobb és bal oldali Thevennin:



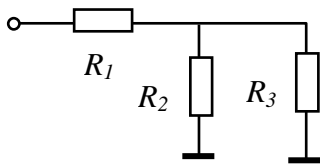
Jobb és bal oldali Norton:



Határozza meg az alábbi hálózatok, adott ponton látható Thevennin és Norton helyettesítő képeinek paramétereit!

$$R_{ekv} = ? \quad U_{ü} = ? \quad I_r = ?$$

1. feladat



$$R_1 = 2 \text{ k}\Omega$$

$$R_2 = 9 \text{ k}\Omega$$

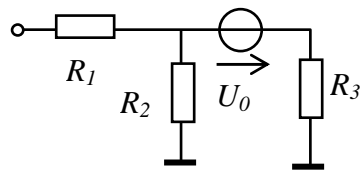
$$R_3 = 1 \text{ k}\Omega$$

$$R_{ekv} = 2,9 \text{ k}\Omega$$

$$U_{ü} = 0$$

$$I_r = 0$$

2. feladat



$$R_1 = 800 \text{ }\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega$$

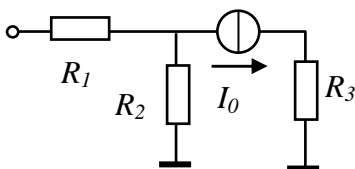
$$U_0 = 10 \text{ V}$$

$$R_{ekv} = 2 \text{ k}\Omega$$

$$U_{ü} = 4 \text{ V}$$

$$I_r = 2 \text{ mA}$$

3. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 3 \text{ k}\Omega$$

$$R_3 = 6 \text{ k}\Omega$$

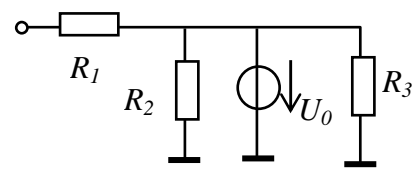
$$I_0 = 5 \text{ mA}$$

$$R_{ekv} = 4 \text{ k}\Omega$$

$$U_{ü} = -15 \text{ V}$$

$$I_r = -3,75 \text{ mA}$$

4. feladat



$$R_1 = 2 \text{ k}\Omega$$

$$R_2 = 3 \text{ k}\Omega$$

$$R_3 = 6 \text{ k}\Omega$$

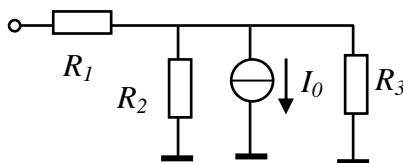
$$U_0 = 8 \text{ V}$$

$$R_{ekv} = 2 \text{ k}\Omega$$

$$U_{ü} = 8 \text{ V}$$

$$I_r = 4 \text{ mA}$$

5. feladat



$$R_1 = 1,8 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega$$

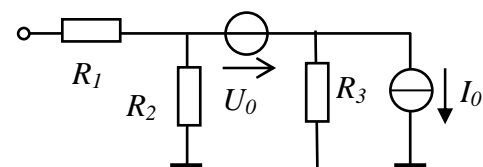
$$I_0 = 2 \text{ mA}$$

$$R_{ekv} = 3 \text{ k}\Omega$$

$$U_{ü} = -2,4 \text{ V}$$

$$I_r = -0,8 \text{ mA}$$

6. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega$$

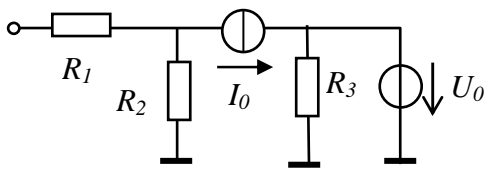
$$I_0 = 1,1 \text{ mA}, U_0 = 1 \text{ V}$$

$$R_{ekv} = 2,2 \text{ k}\Omega$$

$$U_{ü} = 3,8 \text{ V}$$

$$I_r = 1,4 \text{ mA}$$

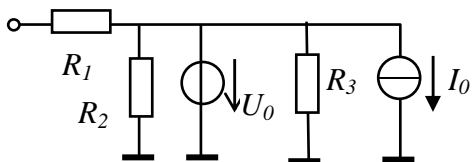
7. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 I_0 &= 3 \text{ mA}, U_0 = 11 \text{ V}
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= 3 \text{ k}\Omega \\
 U_{ii} &= -6 \text{ V} \\
 I_r &= -2 \text{ mA}
 \end{aligned}$$

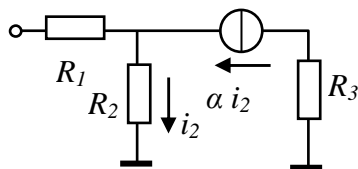
8. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 I_0 &= 3 \text{ mA}, U_0 = 11 \text{ V}
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= 1 \text{ k}\Omega \\
 U_{ii} &= 11 \text{ V} \\
 I_r &= 11 \text{ mA}
 \end{aligned}$$

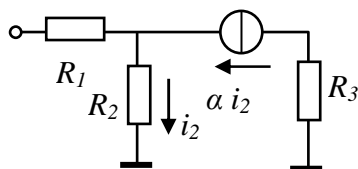
9a. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 \alpha &= 1
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= \infty \\
 U_{ii} &= 0 \\
 I_r &= 0
 \end{aligned}$$

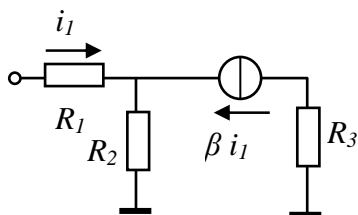
9b. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 \alpha &= 0,9
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= 21 \text{ k}\Omega \\
 U_{ii} &= 0 \\
 I_r &= 0
 \end{aligned}$$

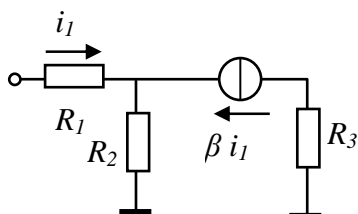
10a. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 \beta &= \infty
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= \infty \\
 U_{ii} &= 0 \\
 I_r &= 0
 \end{aligned}$$

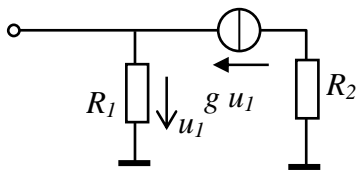
10b. feladat



$$\begin{aligned}
 R_1 &= 1 \text{ k}\Omega \\
 R_2 &= 2 \text{ k}\Omega \\
 R_3 &= 3 \text{ k}\Omega \\
 \beta &= 9
 \end{aligned}$$

$$\begin{aligned}
 R_{ekv} &= 21 \text{ k}\Omega \\
 U_{ii} &= 0 \\
 I_r &= 0
 \end{aligned}$$

11a. feladat



$$R_1 = 2 \text{ k}\Omega$$

$$R_2 = 3 \text{ k}\Omega$$

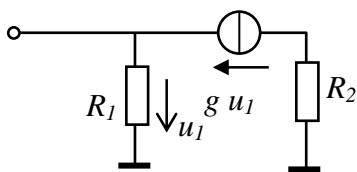
$$g = 0,5 \text{ mS}$$

$$R_{ekv} = \infty$$

$$U_{ii} = 0$$

$$I_r = 0$$

11b. feladat



$$R_1 = 2 \text{ k}\Omega$$

$$R_2 = 3 \text{ k}\Omega$$

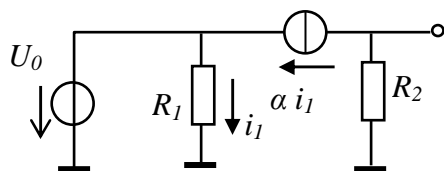
$$g = 0,0004 \text{ S}$$

$$R_{ekv} = 10 \text{ k}\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

12. feladat



$$R_1 = 0,5 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$U_0 = 5 \text{ V}$$

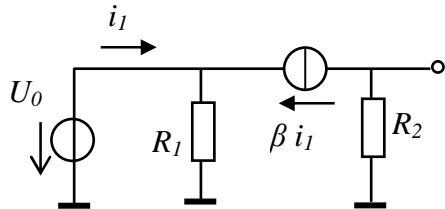
$$\alpha = 0,9$$

$$R_{ekv} = 2 \text{ k}\Omega$$

$$U_{ii} = -18 \text{ V}$$

$$I_r = -9 \text{ mA}$$

13. feladat



$$R_1 = 0,5 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$U_0 = 5 \text{ V}$$

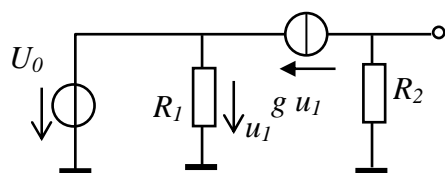
$$\beta = 9$$

$$R_{ekv} = 2 \text{ k}\Omega$$

$$U_{ii} = -18 \text{ V}$$

$$I_r = -9 \text{ mA}$$

14. feladat



$$R_1 = 0,5 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

$$U_0 = 5 \text{ V}$$

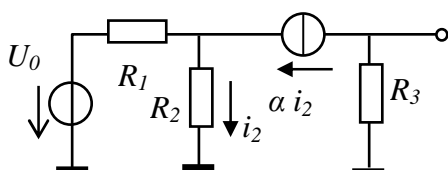
$$g = 2 \text{ mS}$$

$$R_{ekv} = 2 \text{ k}\Omega$$

$$U_{ii} = -20 \text{ V}$$

$$I_r = -10 \text{ mA}$$

15a. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega \quad U_0 = 2 \text{ V}$$

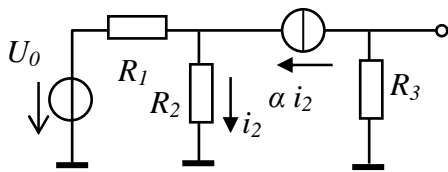
$$\alpha = 1$$

$$R_{ekv} = 3 \text{ k}\Omega$$

$$U_{ii} = -3 \text{ V}$$

$$I_r = -1 \text{ mA}$$

15b. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega \quad U_0 = 2V$$

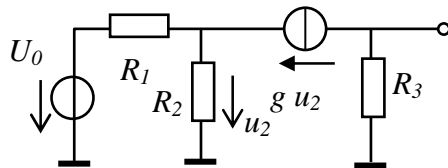
$$\alpha = 0,8$$

$$R_{ekv} = 3k\Omega$$

$$U_{ii} = -2,18V$$

$$I_r = -0,727mA$$

16. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega \quad U_0 = 2V$$

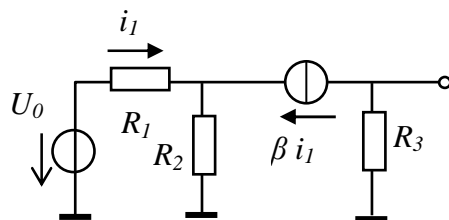
$$g = 0,4mS$$

$$R_{ekv} = 3k\Omega$$

$$U_{ii} = -2,18V$$

$$I_r = -0,727mA$$

17. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 2 \text{ k}\Omega$$

$$R_3 = 3 \text{ k}\Omega \quad U_0 = 2V$$

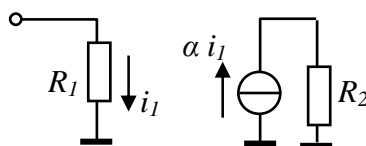
$$\beta = 4$$

$$R_{ekv} = 3k\Omega$$

$$U_{ii} = -2,18V$$

$$I_r = -0,727mA$$

18. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

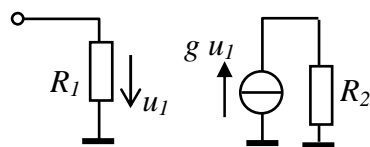
$$\alpha = 0,8$$

$$R_{ekv} = 1k\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

19. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

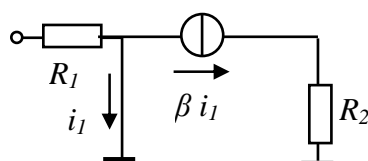
$$g = 0,8mS$$

$$R_{ekv} = 1k\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

20. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 2 \text{ k}\Omega$$

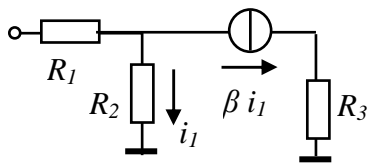
$$\beta = 4$$

$$R_{ekv} = 1k\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

21. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 10 \text{ k}\Omega$$

$$R_{ekv} = 3 \text{ k}\Omega$$

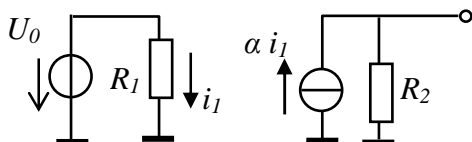
$$R_3 = 2 \text{ k}\Omega$$

$$U_{ii} = 0$$

$$\beta = 4$$

$$I_r = 0$$

22. feladat



$$R_1 = 1 \text{ k}\Omega, \quad R_2 = 2 \text{ k}\Omega$$

$$R_{ekv} = 2 \text{ k}\Omega$$

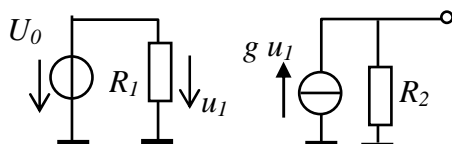
$$U_0 = 2 \text{ V}$$

$$U_{ii} = 3,2 \text{ V}$$

$$\alpha = 0,8$$

$$I_r = 1,6 \text{ mA}$$

23. feladat



$$R_1 = 1 \text{ k}\Omega, \quad R_2 = 2 \text{ k}\Omega$$

$$R_{ekv} = 2 \text{ k}\Omega$$

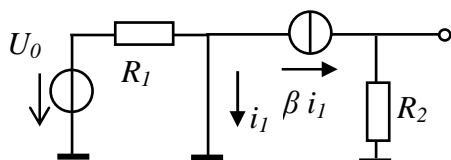
$$U_0 = 2 \text{ V}$$

$$U_{ii} = 3,2 \text{ V}$$

$$g = 0,8 \text{ mS}$$

$$I_r = 1,6 \text{ mA}$$

24. feladat



$$R_1 = 1 \text{ k}\Omega, \quad R_2 = 2 \text{ k}\Omega$$

$$R_{ekv} = 2 \text{ k}\Omega$$

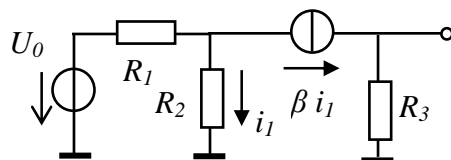
$$U_0 = 2 \text{ V}$$

$$U_{ii} = 3,2 \text{ V}$$

$$\beta = 4$$

$$I_r = 1,6 \text{ mA}$$

25. feladat



$$R_1 = 1 \text{ k}\Omega, \quad R_2 = 10 \text{ k}\Omega$$

$$R_{ekv} = 2 \text{ k}\Omega$$

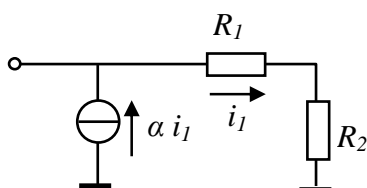
$$R_3 = 2 \text{ k}\Omega \quad U_0 = 2 \text{ V}$$

$$U_{ii} = 1,067 \text{ V}$$

$$\beta = 4$$

$$I_r = 0,533 \text{ mA}$$

26. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_{ekv} = 25 \text{ k}\Omega$$

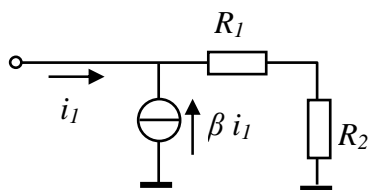
$$R_2 = 4 \text{ k}\Omega$$

$$U_{ii} = 0$$

$$\alpha = 0,8$$

$$I_r = 0$$

27. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 4 \text{ k}\Omega$$

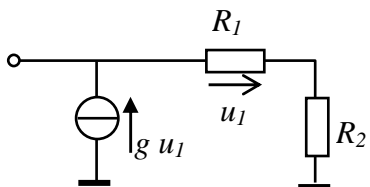
$$\beta = 4$$

$$R_{ekv} = 25 \text{ k}\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

28. feladat



$$R_1 = 1 \text{ k}\Omega$$

$$R_2 = 4 \text{ k}\Omega$$

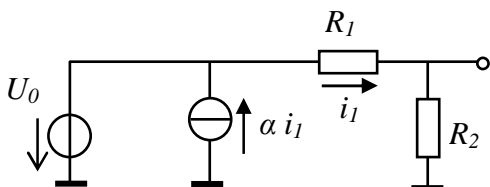
$$g = 0,8 \text{ mS}$$

$$R_{ekv} = 25 \text{ k}\Omega$$

$$U_{ii} = 0$$

$$I_r = 0$$

29. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 4 \text{ k}\Omega$$

$$U_0 = 2 \text{ V}$$

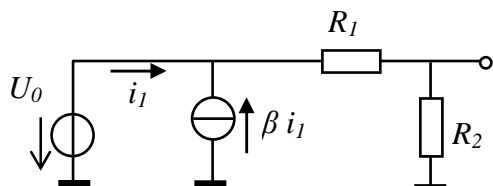
$$\alpha = 0,8$$

$$R_{ekv} = 0,8 \text{ k}\Omega$$

$$U_{ii} = 1,6 \text{ V}$$

$$I_r = 2 \text{ mA}$$

30. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 4 \text{ k}\Omega$$

$$U_0 = 2 \text{ V}$$

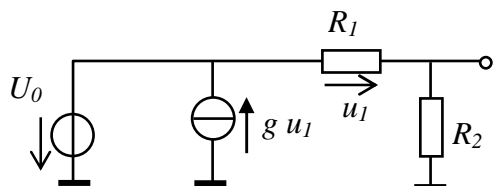
$$\beta = 4$$

$$R_{ekv} = 0,8 \text{ k}\Omega$$

$$U_{ii} = 1,6 \text{ V}$$

$$I_r = 2 \text{ mA}$$

31. feladat



$$R_1 = 1 \text{ k}\Omega \quad R_2 = 4 \text{ k}\Omega$$

$$U_0 = 2 \text{ V}$$

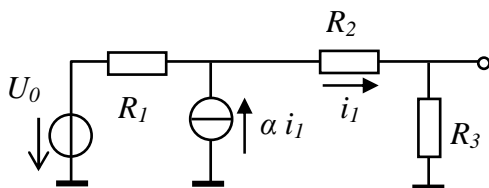
$$g = 0,8 \text{ mS}$$

$$R_{ekv} = 0,8 \text{ k}\Omega$$

$$U_{ii} = 1,6 \text{ V}$$

$$I_r = 2 \text{ mA}$$

32. feladat



$$R_1 = 2 \text{ k}\Omega, \quad R_2 = 1 \text{ k}\Omega$$

$$R_3 = 4 \text{ k}\Omega \quad U_0 = 2 \text{ V}$$

$$\alpha = 0,8$$

$$R_{ekv} = 1,04 \text{ k}\Omega$$

$$U_{ii} = 1,48 \text{ V}$$

$$I_r = 1,43 \text{ mA}$$