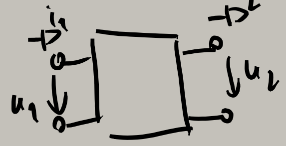
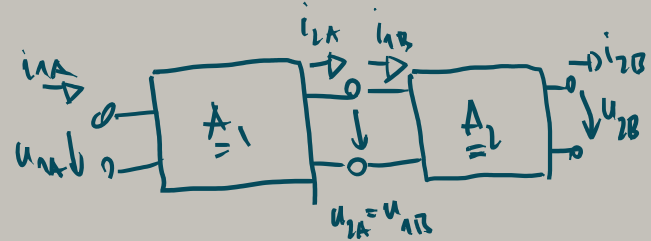
Lánckarakterisztika alkalmazása

1) $\underline{\underline{A}} \to \begin{pmatrix} u_1 \\ i_1 \end{pmatrix} = \underline{\underline{A}} \cdot \begin{pmatrix} u_2 \\ i_2 \end{pmatrix}$ ahol



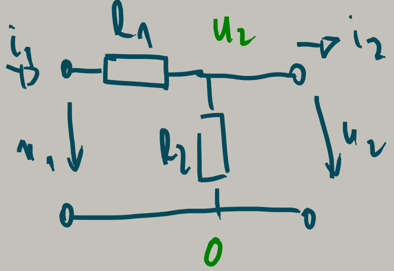
lánc referencia irány



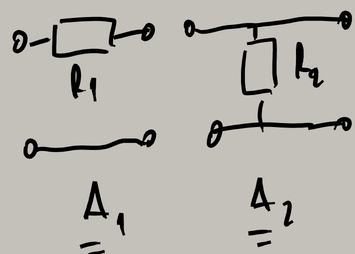
$$\begin{pmatrix} u_{1A} \\ i_{1A} \end{pmatrix} = \underline{\underline{A}}_1 \cdot \begin{pmatrix} u_{2A} \\ i_{2A} \end{pmatrix} = \underbrace{\underline{\underline{A}}_1 \cdot \Big(\underline{\underline{A}}_2}_{\underline{\underline{A}}_{12} = \underline{\underline{A}}_1 \cdot \underline{\underline{A}}_2} \cdot \begin{pmatrix} u_{2B} \\ i_{2B} \end{pmatrix} \Big)$$

$$\begin{pmatrix} u_2 \\ i_2 \end{pmatrix} = \underline{\underline{B}} \cdot \begin{pmatrix} u_1 \\ i_1 \end{pmatrix} \Leftrightarrow \underbrace{\underline{\underline{B}}^{-1}}_{\underline{\underline{A}}} \cdot \begin{pmatrix} u_2 \\ i_2 \end{pmatrix} = \underline{\underline{E}} \cdot \begin{pmatrix} u_1 \\ i_1 \end{pmatrix} = \begin{pmatrix} u_1 \\ i_1 \end{pmatrix}$$

2)

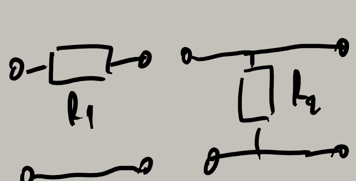


Felbontás:

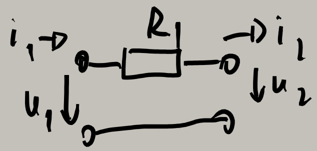


$$\left.\begin{aligned} &① \quad u_2 = u_1 - i_1 \cdot R_1 \\ &② \quad i_2 + \frac{1}{R_2} \cdot u_2 - i_1 = 0 \end{aligned}\right\} \quad \underline{\underline{A}} = \begin{pmatrix} 1 + \frac{R_1}{R_2} & R_1 \\ \frac{1}{R_2} & 1 \end{pmatrix}$$

$i_1 = \frac{1}{R_2} u_2 + i_2$ $\qquad u_1 = u_2 + R_1 \left(\frac{1}{R_2} u_2 + i_2 \right) = \left(1 + \frac{R_1}{R_2} \right) u_2 + R_1 i_2$



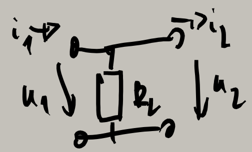
$\underline{\underline{A}}_1$ $\quad$ $\underline{\underline{A}}_2$



$i_1 = i_2$

$u_1 = u_2 + R_1 \cdot i_2$

$\underline{\underline{A}}_1 = \begin{pmatrix} 1 & R_1 \\ 0 & 1 \end{pmatrix}$



$u_1 = u_2$

$i_1 = \frac{1}{R_2} u_2 + i_2$

$\underline{\underline{A}}_2 = \begin{pmatrix} 1 & 0 \\ \frac{1}{R_2} & 1 \end{pmatrix}$

$$\underline{\underline{A}}_{12} = \begin{pmatrix} 1 & R_1 \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 \\ \frac{1}{R_2} & 1 \end{pmatrix} = \begin{pmatrix} 1 \cdot 1 + R_1 \cdot \frac{1}{R_2} & 1 \cdot 0 + R_1 \cdot 1 \\ 0 \cdot 1 + 1 \cdot \frac{1}{R_2} & 0 \cdot 0 + 1 \cdot 1 \end{pmatrix} = \begin{pmatrix} 1 + \frac{R_1}{R_2} & R_1 \\ \frac{1}{R_2} & 1 \end{pmatrix}$$

2.) $\underline{\underline{H}} \rightarrow \underline{\underline{A}}$

$(i_{2v} = -i_2)$

$$\left.\begin{aligned} u_1 &= H_{11} \cdot i_1 + H_{12} \cdot u_2 \\ i_2 &= H_{21} \cdot i_1 + H_{22} \cdot u_2 \end{aligned}\right\}$$

$H_{21} \cdot i_1 = -H_{22} \cdot u_2 + i_2$

$i_1 = -\frac{H_{22}}{H_{21}} \cdot u_2 - \frac{1}{H_{21}} \cdot i_{2v}$

$u_1 = H_{11}\left(-\frac{H_{22}}{H_{21}} \cdot u_2 - \frac{1}{H_{21}} \cdot i_{2v}\right)$

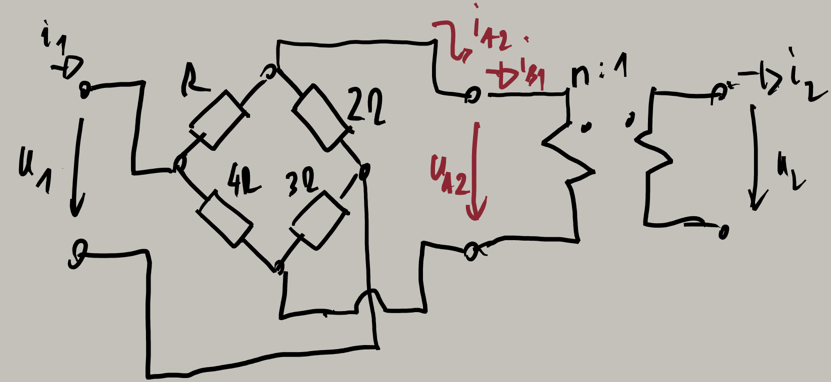
$+ H_{12} \cdot u_2$

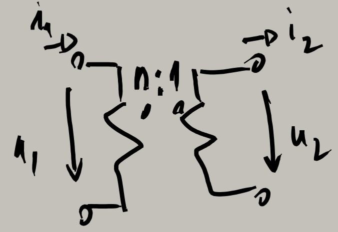
$u_1 = \left(H_{12} - \frac{H_{11} \cdot H_{22}}{H_{21}}\right) u_2 - \frac{H_{11}}{H_{21}} \cdot i_{2v}$

$$\underline{\underline{A}} = \begin{pmatrix} \frac{H_{21} \cdot H_{12} - H_{11} \cdot H_{22}}{H_{21}} & -\frac{H_{11}}{H_{21}} \\ -\frac{H_{22}}{H_{21}} & -\frac{1}{H_{21}} \end{pmatrix}$$

$H_{21} \neq 0$, hogy $\underline{\underline{A}}$ értelmezett legyen!

3.)

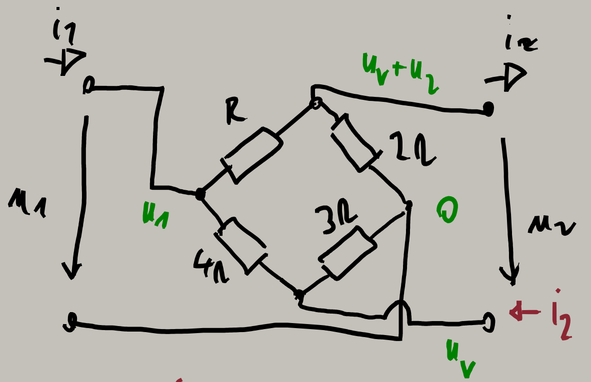




$u_1 = n \cdot u_2$

$i_2 = n \cdot i_1$

$$\begin{pmatrix} u_1 \\ i_1 \end{pmatrix} = \begin{pmatrix} n & 0 \\ 0 & 1/n \end{pmatrix} \begin{pmatrix} u_2 \\ i_2 \end{pmatrix}$$



③ $-i_1 + \frac{u_1 - (u_v + u_2)}{R} + \frac{u_1 - (u_v)}{4R} = 0$

② $i_2 + \frac{(u_v + u_2) - u_1}{R} + \frac{u_v + u_2}{2R} = 0$

③ $-i_2 + \frac{u_v - u_1}{4R} + \frac{u_v}{3R} = 0$

$5u_1 - 5u_v - 4u_2 - 4R\, i_1 = 0$

$-2u_1 + 3u_v + 3u_2 + 2R\, i_2 = 0$

$-3u_1 + 7u_v \quad - 12R \cdot i_2 = 0$

$$u_v = \frac{3u_1 + 12R\, i_2}{7}$$

③ → ② $-2u_1 + 3 \cdot \frac{3u_1 + 12R\, i_2}{7} + 3u_2 + 2R\, i_2 = 0$

$\underbrace{\left(2 - \frac{9}{7}\right)}_{5/7} u_1 = 3u_2 + R i_2 \left(2 + \frac{36}{7}\right) \to u_1 = \frac{3}{\underbrace{5/7}_{21/5}} u_2 + \underbrace{\frac{50}{7} R \cdot i_2 \cdot \frac{7}{5}}_{10R\, i_2}$

→ ① $4R\, i_1 = 5\left(\frac{21}{5} u_2 + 10R\, i_2\right) - 5 \cdot \frac{1}{7}\left(3 \cdot \left\{\frac{21}{5} u_2 + 10R\, i_2\right\} + 12R\, i_2\right) - 4u_2$

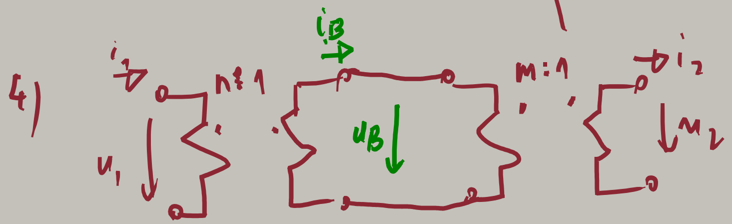
$i_1 = \frac{1}{4R}(u_2)\left(21 - \frac{63}{7} - 4\right) + i_2\left(50 - \frac{5}{7} 42 - 4\right)/4$

rendezés után:

$$\underline{\underline{A}}_1 = \begin{pmatrix} 4,2 & 10\,R \\ 2/R & 5 \end{pmatrix} \; ; \; \underline{\underline{A}}_2 = \begin{pmatrix} n & 0 \\ 0 & 1/n \end{pmatrix}$$

$$\underline{\underline{A}} = \underline{\underline{A}}_1 \cdot \underline{\underline{A}}_2 = \begin{pmatrix} n \cdot 4,2 & \frac{1}{n} \cdot 10\,R \\ \frac{2}{R} \cdot n & 5/n \end{pmatrix} = \begin{pmatrix} 4,2 \cdot n & \frac{10R}{n} \\ \frac{2n}{R} & \frac{5}{n} \end{pmatrix}$$

4)



$$u_1 = n \cdot u_B$$
$$i_B = n \cdot i_1$$
$$i_2 = m \cdot i_B$$
$$u_B = m \cdot u_2$$

$$u_1 = n \cdot m \cdot u_2$$

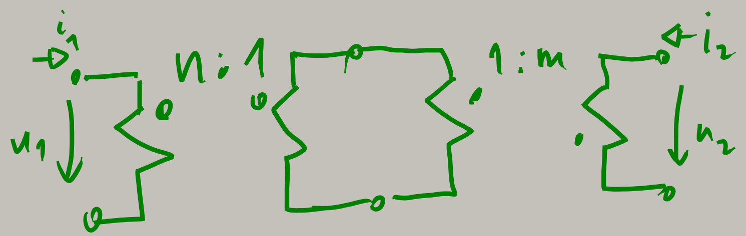
$$\frac{i_2}{m} = n \cdot i_1 \rightarrow i_1 = \frac{1}{m \cdot n} \cdot i_2$$

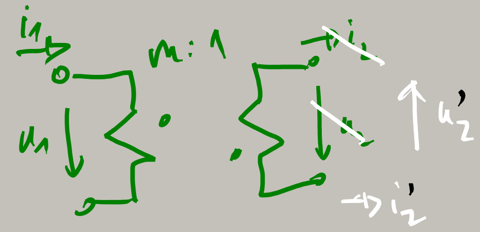
$$\underline{\underline{A}} = \begin{pmatrix} n \cdot m & 0 \\ 0 & \frac{1}{m \cdot n} \end{pmatrix}$$

$$\begin{pmatrix} n & 0 \\ 0 & 1/n \end{pmatrix} \cdot \begin{pmatrix} m & 0 \\ 0 & 1/m \end{pmatrix}$$

$$\begin{pmatrix} n \cdot m & 0 \\ 0 & \frac{1}{m \cdot n} \end{pmatrix}$$

4/b.





$i_2' = -i_2$

$u_2' = -u_2$

$$\begin{pmatrix} n & 0 \\ 0 & 1/n \end{pmatrix} \qquad \begin{pmatrix} -\frac{1}{m} & 0 \\ 0 & -m \end{pmatrix}$$

$m:1 \downarrow 1:m$

$$u_1 = m \cdot u_2' = m \cdot (-u_2) = (-m) \cdot u_2$$
$$i_2' = m \cdot i_1 = m(-i_2) = (-m) \cdot i_2$$

$$\begin{pmatrix} -\frac{n}{m} & 0 \\ 0 & -\frac{m}{n} \end{pmatrix}$$

lánc

referenciairány

$$\begin{pmatrix} n & 0 \\ 0 & 1/n \end{pmatrix} \qquad \begin{pmatrix} -m & 0 \\ 0 & -1/m \end{pmatrix}$$

$$\underline{\underline{A}} = \begin{pmatrix} -n \cdot m & 0 \\ 0 & -\frac{1}{n \cdot m} \end{pmatrix}$$

$m \to \frac{1}{m}$ miért?

$$\left.\begin{aligned} u_2 &= m \cdot u_1 \\ i_1 &= m \cdot i_2 \end{aligned}\right\}$$

$$u_1 = \frac{1}{m} \cdot u_2$$
$$i_2 = \frac{1}{m} \cdot i_1$$