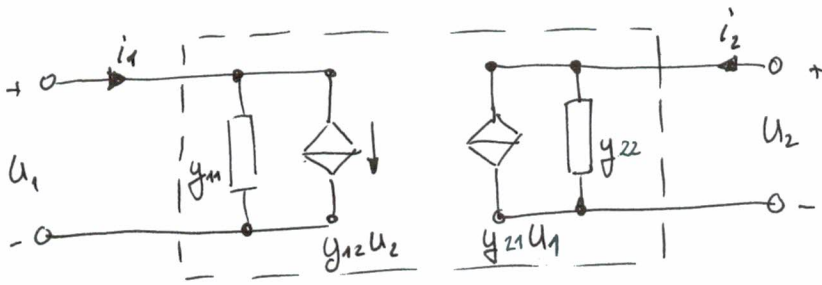


Linearno dvostrano vezje

Y parametri ~ admitančni parametri



$$i_1 = y_{11} \cdot U_1 + y_{12} \cdot U_2$$

$$i_2 = y_{21} \cdot U_1 + y_{22} \cdot U_2$$

$$\equiv \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \cdot \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

$$[I] = [Y] \cdot [U]$$

$$y_{11} = \frac{i_1}{U_1} \Big|_{U_2 = \emptyset}$$

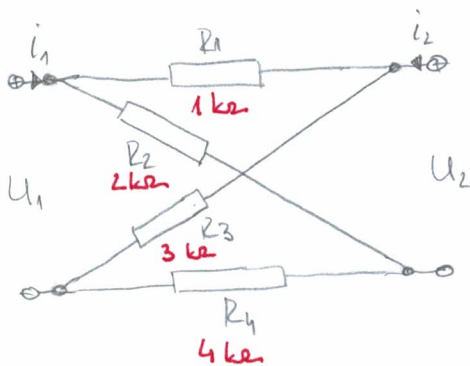
pogoj

$$y_{21} = \frac{i_2}{U_1} \Big|_{U_2 = \emptyset}$$

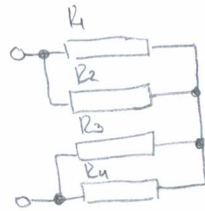
$$y_{12} = \frac{i_1}{U_2} \Big|_{U_1 = \emptyset}$$

$$y_{22} = \frac{i_2}{U_2} \Big|_{U_1 = \emptyset}$$

Primer:



$$y_{11} = \frac{i_1}{U_1} \Big|_{U_2 = \emptyset}$$



$$R_n = R_1 \parallel R_2 + R_3 \parallel R_4$$

$$= \underline{\underline{2380 \Omega}}$$

$$y_{11} = \frac{i_1}{U_1} = \frac{i_1}{U_1} = \frac{1}{R_n} = 2380^{-1} \text{ S} = \underline{\underline{42 \text{ mS}}}$$

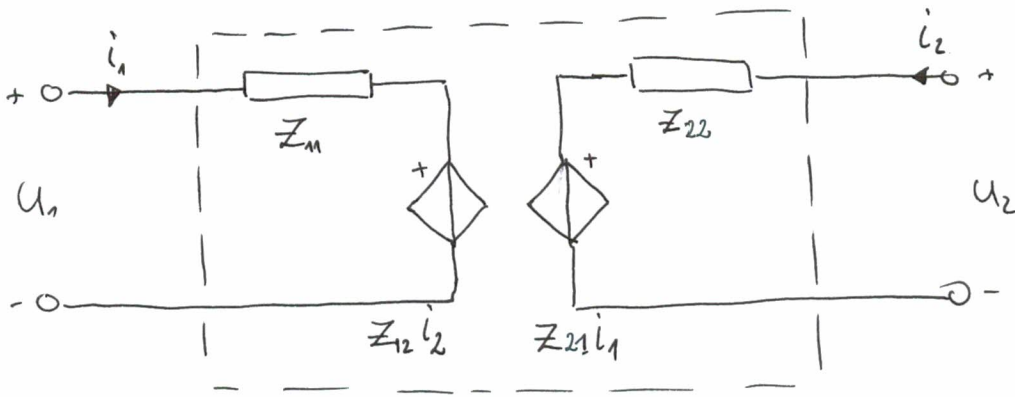
$$y_{21} = \frac{i_2}{U_1} = y_{12} = \underline{\underline{-42 \text{ mS}}}$$

$$y_{12} = \frac{i_1}{U_2} = \frac{\frac{U_2}{R_n}}{\frac{U_2}{2}} = -\frac{2}{R_n} = \underline{\underline{-42 \text{ mS}}}$$

$$y_{22} = \frac{i_2}{U_2} = \frac{i_2}{U_2} = \frac{1}{R_n} = \underline{\underline{42 \text{ mS}}}$$

1 tol teče v drugo smer, kot s o preučevali ni

Z parameter



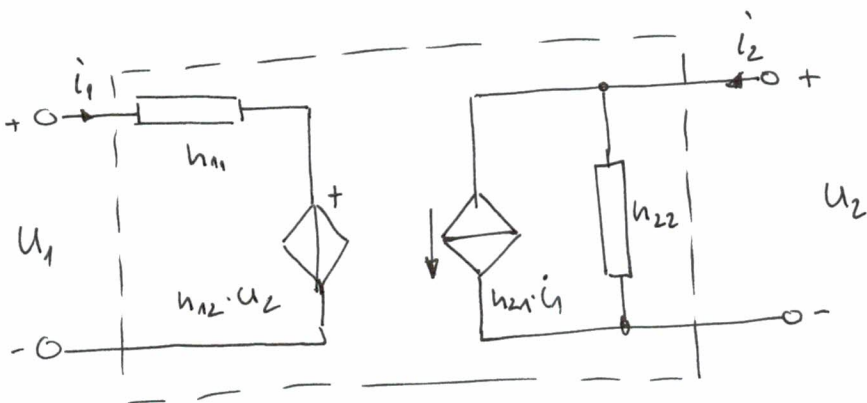
$$\begin{aligned} U_1 &= Z_{11}i_1 + Z_{12}i_2 \\ U_2 &= Z_{21}i_1 + Z_{22}i_2 \end{aligned} \quad \Rightarrow \quad \begin{bmatrix} U_1 \\ U_2 \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix} \cdot \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

$$[U] = [Z] \cdot [I]$$

$$Z_{11} = \frac{U_1}{i_1} \Big|_{i_2 = \emptyset} \quad Z_{21} = \frac{U_2}{i_2} \Big|_{i_1 = \emptyset}$$

$$Z_{12} = \frac{U_1}{i_2} \Big|_{i_1 = \emptyset} \quad Z_{22} = \frac{U_2}{i_2} \Big|_{i_1 = \emptyset}$$

H parameter



$$U_1 = h_{11}i_1 + h_{12}U_2$$

$$U_2 = h_{21}i_1 + h_{22}U_2$$

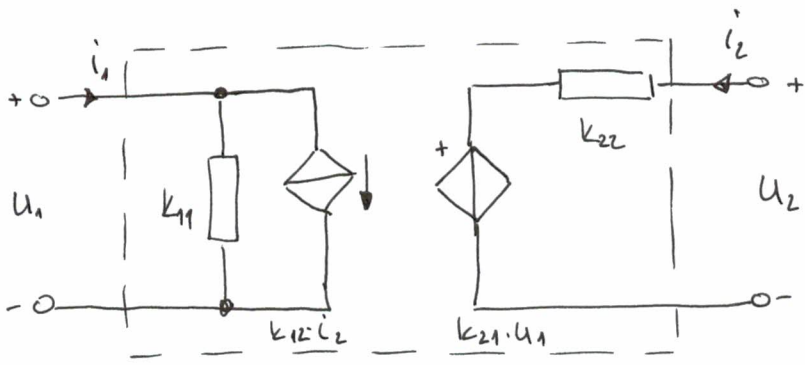
$$h_{11} = \frac{U_1}{i_1} \Big|_{U_2 = \emptyset}$$

$$h_{12} = \frac{U_1}{U_2} \Big|_{i_1 = \emptyset}$$

$$h_{21} = \frac{i_2}{i_1} \Big|_{U_2 = \emptyset}$$

$$h_{22} = \frac{i_2}{U_2} \Big|_{i_1 = \emptyset}$$

K parametri

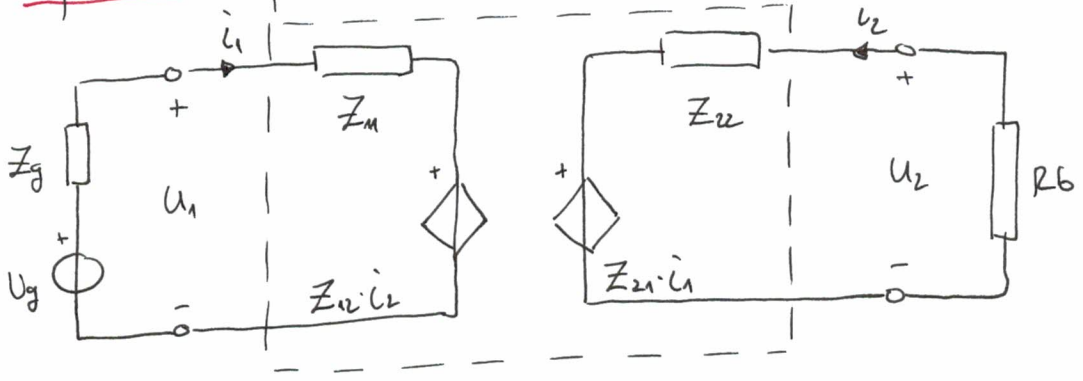


$$[k] = [h]^{-1} = \frac{1}{\det H} \cdot [h]^T$$

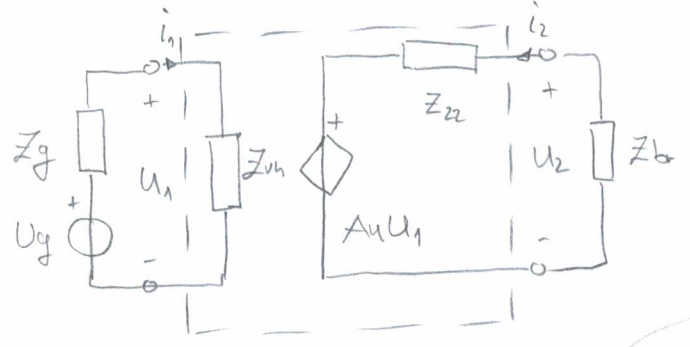
A - nemižni parameteri

$$\begin{bmatrix} U_1 \\ i_1 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \cdot \begin{bmatrix} U_2 \\ -i_2 \end{bmatrix}$$

Uprava parametror



$Z_{m1}, Z_{121}, A_u, A_i, A_v, A_g, A_p$



Enačbe za impedanco

$$Z_{vh} = \frac{U_1}{i_1}$$

① $U_1 = Z_{m1} i_1 + Z_{12} i_2$

$U_2 = Z_{21} i_1 + Z_{22} i_2$

② $U_g - Z_g i_1 - U_1 = 0$

$U_2 = -i_2 \cdot Z_b$

③

$-i_2 Z_b = Z_{21} i_1 + Z_{22} i_2$

$-i_2 (Z_b + Z_{22}) = Z_{21} i_1 \Rightarrow i_2 = -\frac{Z_{21} i_1}{Z_b + Z_{22}}$

④

$U_1 = Z_{m1} i_1 + Z_{12} i_2 = Z_{m1} i_1 + Z_{12} \cdot \frac{-Z_{21} i_1}{Z_b + Z_{22}}$

$U_1 = i_1 \left(Z_{m1} - \frac{Z_{12} Z_{21}}{Z_b + Z_{22}} \right) = i_1 \cdot \frac{Z_{m1} Z_b + Z_{m1} Z_{22} - Z_{12} Z_{21}}{Z_b + Z_{22}}$

$$[Z] = \begin{bmatrix} Z_{m1} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$$

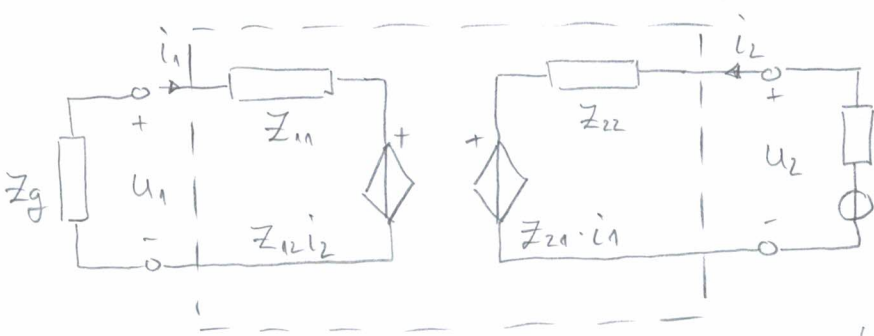
$\det Z = Z_{m1} Z_{22} - Z_{12} Z_{21}$

⑥

⑦

$$U_1 = i_1 \cdot \frac{Z_{m1} Z_b + \Delta Z}{Z_b + Z_{22}} \Rightarrow \frac{U_1}{i_1} = \frac{Z_{m1} Z_b + \Delta Z}{Z_b + Z_{22}} = Z_{vh}$$

Z_{in} (na ulozdu odstopino generatora, a njegovo impedanca obdelujemo!)
 (na izhodu pustimo generator, saj bi na tak način v realnosti nastali Z_{in} !)



$$Z_{in} = \frac{U_1}{i_1} \Big|_{\substack{i_2=0 \\ U_2=0}}$$

$$U_1 = Z_{11} i_1 + Z_{12} i_2$$

$$U_2 = Z_{21} i_1 + Z_{22} i_2$$

$$-i_1 Z_g = Z_{11} i_1 + Z_{12} i_2$$

$$-i_1 (Z_g + Z_{11}) = Z_{12} i_2 \Rightarrow i_1 = - \frac{Z_{12} i_2}{Z_g + Z_{11}}$$

$$[Z] = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$$

$$\det Z = Z_{11} Z_{22} - Z_{12} Z_{21}$$

$$U_2 = -Z_{21} \cdot \frac{Z_{12} i_2}{Z_g + Z_{11}} + Z_{22} i_2$$

$$U_2 = i_2 \left(Z_{22} - \frac{Z_{21} Z_{12}}{Z_g + Z_{11}} \right)$$

$$\frac{U_2}{i_2} = \frac{Z_{22} Z_g + Z_{22} Z_{11} - Z_{21} Z_{12}}{Z_g + Z_{11}}$$

$$\boxed{\frac{U_2}{i_2} = \frac{Z_{22} Z_g + \Delta Z}{Z_g + Z_{11}}}$$

Au

$$A_u = \frac{U_2}{U_1}$$

$$U_1 = Z_{11} i_1 + Z_{12} i_2$$

$$U_2 = Z_{21} i_1 + Z_{22} i_2$$

$$U_1 = Z_{11} i_1 + Z_{12} \left(-\frac{U_2}{Z_b}\right) \Rightarrow i_1 = \frac{1}{Z_{11}} U_1 + \frac{Z_{12}}{Z_b Z_{11}} U_2 \quad (1)$$

$$U_2 = Z_{21} i_1 + Z_{22} \left(-\frac{U_2}{Z_b}\right) \quad (2)$$

↓

$$U_2 = \frac{Z_{21}}{Z_{11}} U_1 + \frac{Z_{12} Z_{21}}{Z_b Z_{11}} U_2 - \frac{Z_{22}}{Z_b} U_2$$

$$U_2 \left(1 - \frac{Z_{12} Z_{21}}{Z_b Z_{11}} + \frac{Z_{22}}{Z_b}\right) = \frac{Z_{21}}{Z_{11}} U_1$$

$$U_2 \left(\frac{Z_b Z_{11} - Z_{12} Z_{21} + Z_{22} Z_{11}}{Z_b Z_{11}}\right) = \frac{Z_{21}}{Z_{11}} U_1$$

$$\frac{U_2}{U_1} = \frac{\frac{Z_{21}}{Z_{11}}}{\frac{Z_b Z_{11} - Z_{12} Z_{21} + Z_{22} Z_{11}}{Z_b Z_{11}}} = \frac{Z_b Z_{21} Z_{11}}{Z_{11} (Z_b Z_{11} - Z_{12} Z_{21} + Z_{22} Z_{11})}$$

$$[Z] = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$$

$$\det Z = Z_{11} Z_{22} - Z_{12} Z_{21}$$

$$\frac{U_2}{U_1} = \frac{Z_b Z_{21}}{Z_b Z_{11} - Z_{12} Z_{21} + Z_{22} Z_{11}} = \frac{Z_b Z_{21}}{Z_b Z_{11} + \Delta Z}$$

Ai

$$A_i = \frac{i_2}{i_1}$$

$$U_2 = -i_2 Z_b \rightarrow U_2 = Z_{21} i_1 + Z_{22} i_2$$

↓

$$-i_2 Z_b = Z_{21} i_1 + Z_{22} i_2$$

$$-i_2 (Z_b + Z_{22}) = Z_{21} i_1$$

$$\frac{-i_2}{i_1} = \frac{Z_{21}}{Z_b + Z_{22}} \Rightarrow \frac{i_2}{i_1} = \frac{-Z_{21}}{Z_b + Z_{22}}$$



A_p

$$A_p = A_i \cdot A_u$$

$$A_p = - \frac{Z_{21}}{Z_b + Z_{22}} \cdot \frac{Z_b Z_{21}}{Z_b Z_{11} - \Delta Z} = - \frac{Z_{21}^2 Z_b}{Z_b^2 Z_1 - Z_b \Delta Z + Z_b Z_{11} Z_{22} - Z_{22} \Delta Z}$$

$$= - \frac{Z_{21}^2 Z_b}{Z_b (Z_b Z_1 - \Delta Z + Z_{11} Z_{22}) - Z_{22} \Delta Z}$$

A