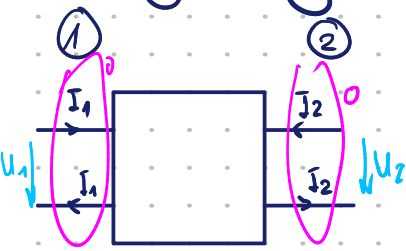


Streuparameter

Mehrfachgleichungen



Impedanzmatrix

$$U = Z \cdot I$$

$$\begin{pmatrix} U_1 \\ U_2 \end{pmatrix} = \begin{pmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix}$$

$$Z_{11} \Big|_{I_2=0} = \frac{U_1}{I_1} \quad Z_{12} \Big|_{I_1=0} = \frac{U_1}{I_2}$$

$$Z_{21} \Big|_{I_2=0} = \frac{U_2}{I_1} \quad Z_{22} \Big|_{I_1=0} = \frac{U_2}{I_2}$$

Admittanzmatrix

$$I = Y \cdot U$$

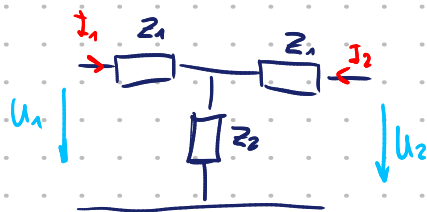
$$\begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{pmatrix} \begin{pmatrix} U_1 \\ U_2 \end{pmatrix}$$

$$Y_{11} \Big|_{U_2=0} = \frac{I_1}{U_1} \quad Y_{12} \Big|_{U_1=0} = \frac{I_1}{U_2}$$

$$Y_{21} \Big|_{U_2=0} = \frac{I_2}{U_1} \quad Y_{22} \Big|_{U_1=0} = \frac{I_2}{U_2}$$

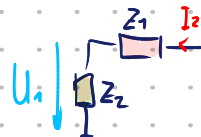
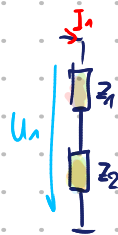
LL, weil kein Potentialunterschied

Bsp.: T-~~Top~~ G_{Hod}



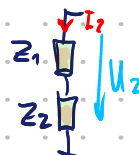
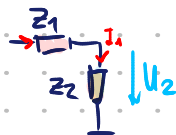
$$Z_{11} \Big|_{I_2=0} = \frac{U_1}{I_1} = Z_1 + Z_2$$

$$Z_{12} \Big|_{I_1=0} = \frac{U_1}{I_2} = Z_2$$



$$Z_{21} \Big|_{I_2=0} = \frac{U_2}{I_1} = Z_2$$

$$Z_{22} \Big|_{I_1=0} = \frac{U_2}{I_2} = Z_1 + Z_2$$



hinlaufende Welle
rücklaufende Welle

$$a_i = \frac{U_{hi}}{\sqrt{Z_{Li}}}$$

$$b_i = \frac{U_{ri}}{\sqrt{Z_{Li}}}$$

$$U_h = \frac{1}{2} (U_0 + I_0 Z_L)$$

$$U_r = \frac{1}{2} (U_0 - I_0 Z_L)$$

$$b_1 = \underline{S_{11}} \cdot a_1 + \underline{S_{12}} \cdot a_2$$

$$b_2 = \underline{S_{21}} \cdot a_1 + \underline{S_{22}} \cdot a_2$$

$$S_{11} = \left. \frac{b_1}{a_1} \right|_{a_2=0} = r_1$$

$$S_{12} = \left. \frac{b_1}{a_2} \right|_{a_1=0}$$

$$\frac{b_i}{a_i} \hat{=} \frac{U_{hi}}{U_{ri}} = r$$

$$S_{21} = \left. \frac{b_2}{a_1} \right|_{a_2=0}$$

$$S_{22} = \left. \frac{b_2}{a_2} \right|_{a_1=0} = r_2$$

$$P_{Wai} = \frac{1}{2} |a_i|^2 \quad P_{Wbi} = \frac{1}{2} |b_i|^2$$

$$\frac{U_{hi} U_{hi}^*}{2 Z_{Li}}$$

$$\frac{U_{ri} U_{ri}^*}{2 Z_{Li}} \quad \text{konj. kompl.}$$

$20 \log(S_{ii}) \dots$ return loss

$20 \log(S_{ij}) \dots$ insertion loss

Reziprok

$$S_{ij} = S_{ji}$$

vertauschen

Symmetrie

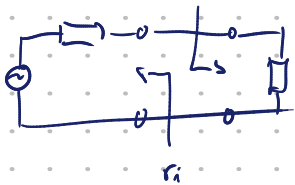
$$S_{ii} = S_{jj} \quad \text{und Reziprok}$$

Rechnungsfrei

$$S_{ij} = 0 \quad \text{und} \quad S_{ji} \neq 0$$

Anpassung

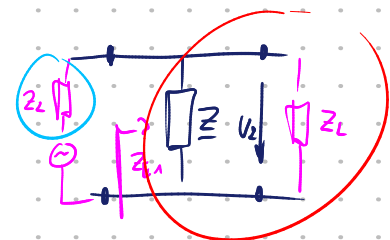
$$S_{ii} = 0, \quad r_i = r_a^*$$



$$S_{ii} = \frac{Z_{Li} - Z_{Li}}{Z_{Li} + Z_{Li}}$$

$$S_{ij} = \frac{2U_i}{U_{0i}} \sqrt{\frac{Z_{Li}}{Z_{Lj}}}$$

Bsp



$$S_{11} = \frac{Z_{Ei} - Z_{Li}}{Z_{Ei} + Z_{Li}}$$

Symm: $S_{11} = S_{22}$

$Z_{Ei} = Z \parallel Z_L + Z_{Li}$

$Z_L = Z_L$

Spiegel: $\frac{Z \parallel Z_E}{Z + Z \parallel Z_E}$

$$S_{ij} = \frac{2U_2}{U_{01}} \sqrt{\frac{Z_L}{Z_0}} = \frac{2U_2}{U_{01}}$$