

Two port network, Network Theory, 6th sem, EES
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(10) h-parameters in terms of z-parameters

Form z-parameters eqn.

$$V_2 = z_{21}I_1 + z_{22}I_2$$

$$\Rightarrow I_2 = \left[-\frac{z_{21}}{z_{22}} \right] I_1 + \left[\frac{z_{22}}{z_{22}} \right] V_2 \quad (1)$$

and $V_1 = z_{11}I_1 + z_{12}I_2$ (11)

put the value of I_2 in eqn (11)

$$V_1 = z_{11}I_1 + z_{12} \left[-\frac{z_{21}}{z_{22}} I_1 + \frac{z_{22}}{z_{22}} V_2 \right] \quad (12)$$

Comparing eqn (1) & (12) with standard form of h-parameters

$$h_{11} = \frac{z_{11}z_{22} - z_{12}z_{21}}{z_{22}}$$

$$h_{12} = \frac{z_{12}}{z_{22}}$$

$$h_{21} = -\frac{z_{21}}{z_{22}}$$

$$\text{and } h_{22} = \frac{1}{z_{22}}$$

(11) h-parameters in terms of y-parameters

Form y-parameters eqn

$$I_1 = y_{11}V_1 + y_{12}V_2 \quad (1)$$

$$\& I_2 = y_{21}V_1 + y_{22}V_2 \quad (11)$$

$$\leftarrow V_1 = \left[\frac{1}{y_{11}} \right] I_1 + \left[-\frac{y_{12}}{y_{11}} \right] V_2 \quad (11)$$

put V_1 in eqn (11)

$$I_2 = y_{21}V_1 + y_{22}V_2$$

$$= \left(\frac{y_{21}}{y_{11}} \right) I_1 + \left(\frac{y_{22} - y_{12}y_{21}}{y_{11}} \right) V_2 \quad (12)$$

Comparing eq (1) & (12) with standard form of h-parameters

$$h_{11} = \frac{1}{y_{11}}$$

$$h_{12} = -\frac{y_{12}}{y_{11}}$$

$$h_{21} = \frac{y_{21}}{y_{11}}$$

$$h_{22} = \frac{y_{11}y_{22} - y_{12}y_{21}}{y_{11}}$$

12) h-parameters in terms of ABCD-parameters.

From ABCD-parameters

$$I_1 = CV_2 - DI_2$$

$$\Rightarrow I_2 = \left(-\frac{1}{D}\right)I_1 + \left(\frac{C}{D}\right)V_2 \quad \text{--- (I)}$$

$$Q \quad V_1 = AV_2 - BI_2 \quad \text{--- (II)}$$

put value of I_2 in eqn (II)

$$V_1 = AV_2 - B\left[-\frac{1}{D}I_1 + \left(\frac{C}{D}\right)V_2\right]$$

$$= \left(\frac{B}{D}\right)I_1 + \left(\frac{AD - BC}{D}\right)V_2 \quad \text{--- (III)}$$

Comparing (I) & (III) with standard form of h-parameters.

$$h_{11} = \left(\frac{B}{D}\right)$$

$$h_{12} = \left(\frac{AD - BC}{D}\right)$$

$$h_{21} = \left(-\frac{1}{D}\right)$$

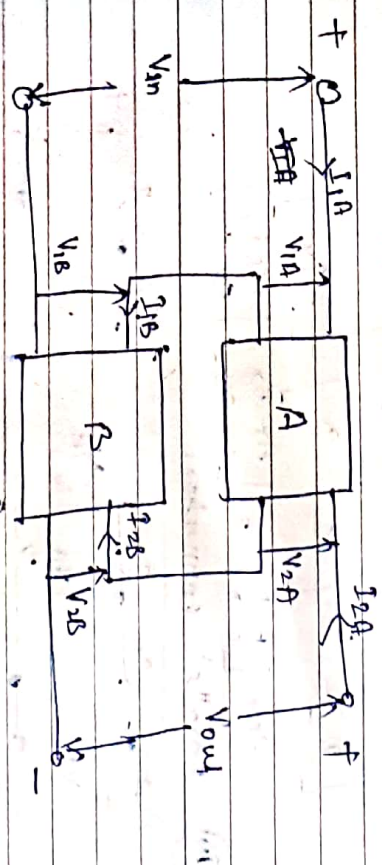
$$h_{22} = \left(\frac{C}{D}\right)$$

Different types of interconnections of two port networks

1) series connection :-

Let network A & B be the two port networks connected in series

voltages shown in fig.



In this form connection.

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} Z_{1A} + Z_{1B} & Z_{1A} + Z_{1B} \\ Z_{2A} + Z_{2B} & Z_{2A} + Z_{2B} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$