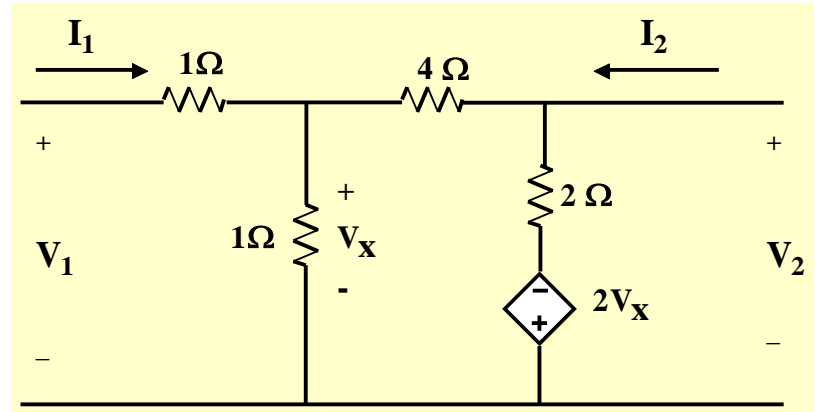# NETWORK ANALYSIS AND SYNTHESIS

Two Port Networks

$$z_{11} = \dfrac{V_1}{I_1} \bigg|_{I_2 = 0}$$

$$I_1 = \frac{V_x}{1} + \frac{V_x + 2V_x}{6} = \frac{6V_x + V_x + 2V_x}{6}$$

$$I_1 = \frac{3V_x}{2} \quad ; \quad \text{but } V_x = V_1 - I_1$$

Substituting gives;

$$I_1 = \frac{3(V_1 - I_1)}{2} \quad \text{or} \quad \frac{V_1}{I_1} = z_{11} = \frac{5}{3} \ \Omega$$

Other Answers

$$Z_{21} = -0.667 \ \Omega$$

$$Z_{12} = 0.222 \ \Omega$$

$$Z_{22} = 1.111 \ \Omega$$

Two Port Networks

Transmission parameters (A,B,C,D):

The defining equations are:

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix}$$

$$A = \frac{V_1}{V_2} \bigg|_{I_2 = 0}$$

$$B = \frac{V_1}{-I_2} \bigg|_{V_2 = 0}$$

$$C = \frac{I_1}{V_2} \bigg|_{I_2 = 0}$$

$$D = \frac{I_1}{-I_2} \bigg|_{V_2 = 0}$$

Two Port Networks

Example   Given the network below with assumed voltage polarities and
Current directions compatible with the A,B,C,D parameters.
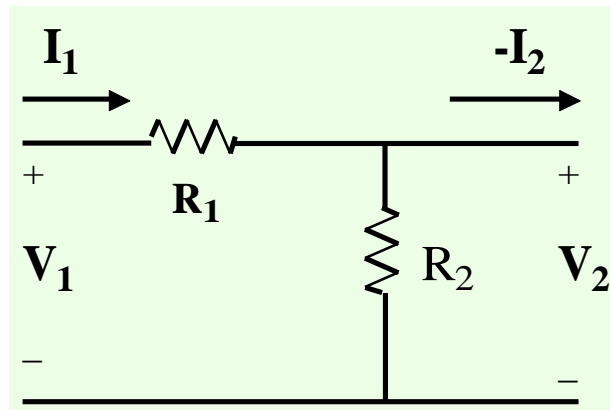
We can write the following equations.

$$V_1 = (R_1 + R_2)I_1 + R_2 I_2$$

$$V_2 = R_2 I_1 + R_2 I_2$$

It is not always possible to write 2 equations in terms of the V's and I's
Of the parameter set.

Two Port Networks

Example (cont.)

$$V_1 = (R_1 + R_2)I_1 + R_2I_2$$

$$V_2 = R_2I_1 + R_2I_2$$

From these equations we can directly evaluate the A,B,C,D parameters.

$$A = \frac{V_1}{V_2}\bigg|_{I_2 = 0} = \boxed{}$$

$$B = \frac{V_1}{-I_2}\bigg|_{V_2 = 0} = \boxed{}$$

$$C = \frac{I_1}{V_2}\bigg|_{I_2 = 0} = \boxed{}$$

$$D = \frac{I_1}{-I_2}\bigg|_{V_2 = 0} = \boxed{}$$

Later we will see how to interconnect two of these networks together for a final answer

* notes

Two Port Networks

Hybrid Parameters:

The equations for the hybrid parameters are:

$$\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix}$$

$$h_{11} = \left. \frac{V_1}{I_1} \right|_{V_2 = 0}$$

$$h_{12} = \left. \frac{V_1}{V_2} \right|_{I_1 = 0}$$

$$h_{21} = \left. \frac{I_2}{I_1} \right|_{V_2 = 0}$$

$$h_{22} = \left. \frac{I_2}{V_2} \right|_{I_1 = 0}$$

* notes

THANKS….

Queries Please…