NETWORK THEORY

LECTURE 2

SECTION C

TOPIC COVERED :TRANSMISSION PARAMETERS, HYBRID PARAMETERS, RELATIONSHIPS BETWEEN PARAMETER SETS,INTER-CONNECTION OF TWO PORT NETWORKS.

Calculation of h-parameters. The h-parameters are as follows :

$$h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2=0} \quad \text{(short circuit input impedance)}$$

$$h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0} \quad \text{(short circuit reverse voltage gain)}$$

$$h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2=0} \quad \text{(short circuit forward current gain)}$$

$$h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0} \quad \text{(open circuit output impedance)}$$

TRANSMISSION PARAMETERS

The transmission parameter A, B, C and D express the required source variables V_1 and I_1 in terms of the existing destination variables V_2 and I_2. They are called $ABCD$ or T-parameters and are defined by

$$\left.\begin{aligned} V_1 &= AV_2 - BI_2 \\ I_1 &= CV_2 - DI_2 \end{aligned}\right\} \text{ or } \begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix} \quad \ldots(5.4)$$

T-parameters are used in the analysis of power transmission line.

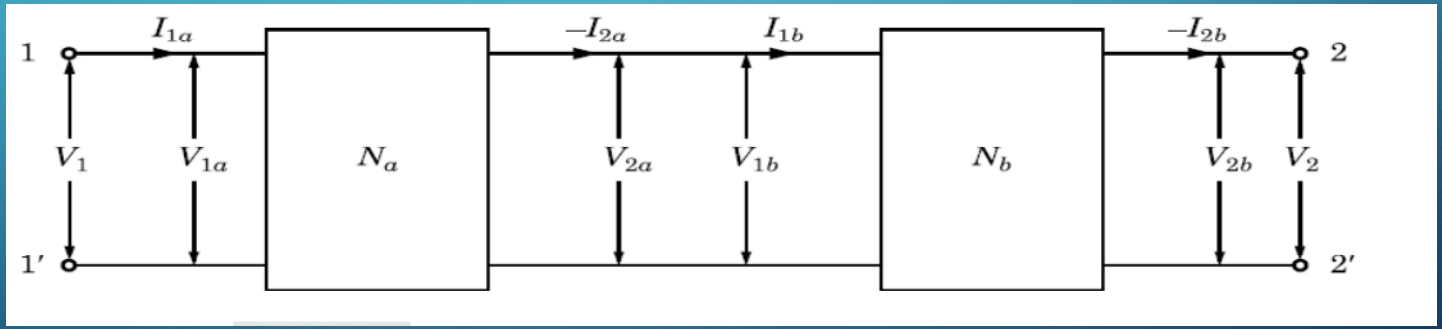
Calculation of [T] parameters. In case of two port network, we assume that both the currents I_1 and I_2 enter into the port. In equation 5.4 the negative sign is for I_2 and not for 'B' and 'D'. This negative sign indicates that the current I_2 is leaving an output port.

INTERCONNECTION OF TWO PORT NETWORKS

- A two port network can be designed by combining simple two port structure as building blocks.
- It is much easier to design a simple block and to interconnect them to design a complex network in one pce.

CASCADE CONNECTION

- The simplest possible interconnection of two-port networks is cascade or tandem connection. Two port network are said to be connected in cascade if the output of the first becomes the input port of the second, which is shown in Figure.



for the network Na, the transmission parameter equation are as follows:

$$\begin{bmatrix} V_{1a} \\ I_{1a} \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} V_{2a} \\ -I_{2a} \end{bmatrix}$$

Similarly, for the Network N_b,

$$\begin{bmatrix} V_{1b} \\ I_{1b} \end{bmatrix} = \begin{bmatrix} A_a & B_b \\ C_b & D_b \end{bmatrix} \begin{bmatrix} V_{2b} \\ -I_{2b} \end{bmatrix}$$

Then their cascade connection requires that

$$I_1 = I_{1a}, \; -I_{2a} = I_{1b}, \; I_2 = I_{2b}$$
$$V_1 = V_{1a}, \; V_{2a} = V_{1b}, \quad V_2 = V_{2b}$$

so the overall trannmission parameter of the combined networts N_a and B_n can be written in the metrix form as follows :

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} V_{1a} \\ I_{1a} \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} V_{2a} \\ -I_{2a} \end{bmatrix}$$

$$= \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} V_{1b} \\ I_{1b} \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} A_b & B_b \\ C_b & D_b \end{bmatrix} \begin{bmatrix} V_{2b} \\ -I_{2b} \end{bmatrix}$$

$$= \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} A_b & B_b \\ C_b & D_b \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix}$$

so $$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} A_b & B_b \\ C_b & D_b \end{bmatrix}$$

or in the matrix form $[T] = [T_a] . [T_b]$

SERIES CONNECTION

Series connection for network N_a and N_b is shown in Fig. 5.61.

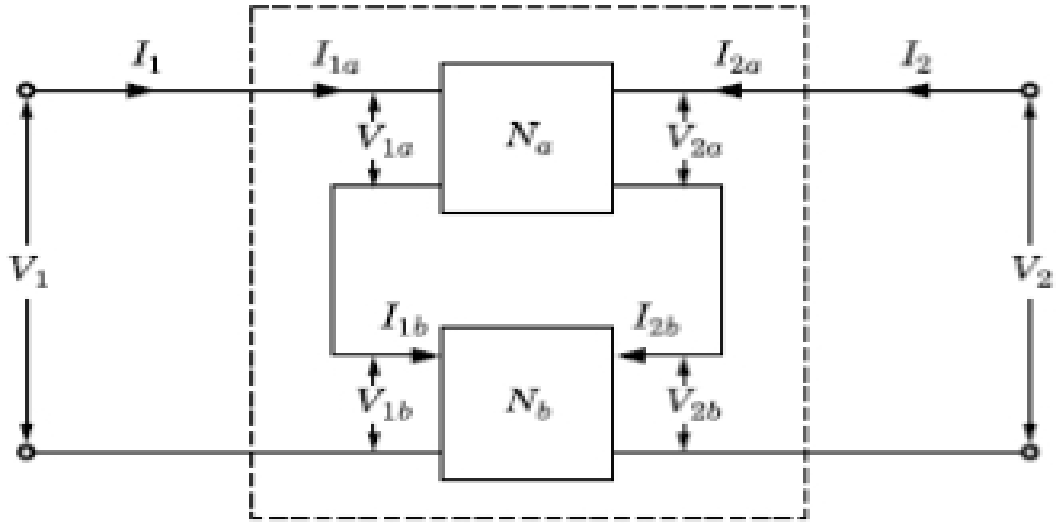


Fig. 5.61 Series connection of two-port network