SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

OPTICAL AND MICROWAVE ENGINEERING

III YEAR/ VI SEMESTER

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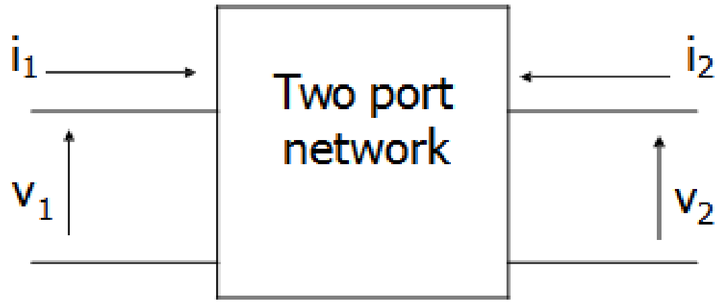
UNIT 1 – MICROWAVE PARAMETERS

TOPIC – ABCD PARAMETERS

Two-Port Network

2-port networks are often described by using z, y, h, or ABCD parameters.

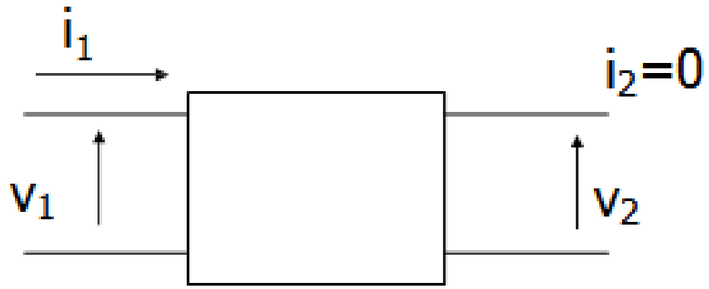


Drawbacks of Y, Z parameters

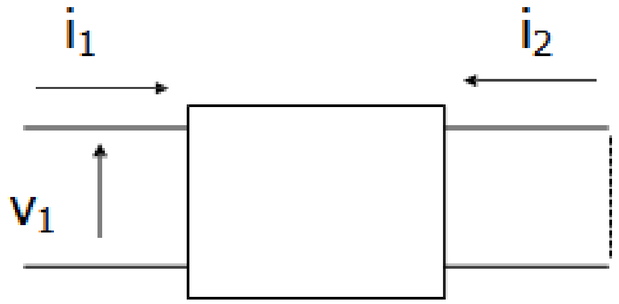
- At microwave frequency, total voltage and current are difficult to measure.
- Ideal open- and short-circuit terminations are difficult to realize.
- Active devices may oscillate under open- or short-circuit conditions.

ABCD-parameters

$$A = \left.\frac{v_1}{v_2}\right|_{-i_2=0}$$



$$C = \left.\frac{i_1}{v_2}\right|_{-i2=0}$$



$$B = -\left.\frac{v_1}{i_2}\right|_{v2=0}$$

$$D = -\left.\frac{i_1}{i_2}\right|_{v_2=0}$$

ABCD-parameters

$$v_1 = Av_2 + B(-i_2)$$

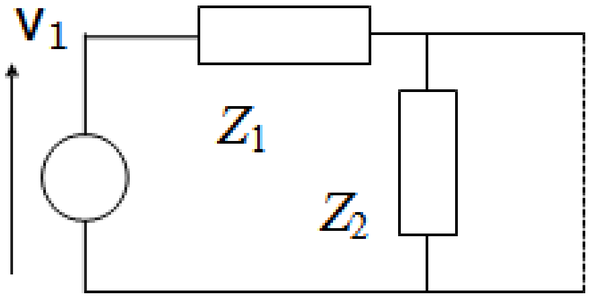
$$i_1 = Cv_2 + D(-i_2)$$

$$\Longrightarrow \quad \begin{bmatrix} v_1 \\ i_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} v_2 \\ -i_2 \end{bmatrix}$$

where $A = \left.\frac{v_1}{v_2}\right|_{-i_2=0}$ $\qquad B = -\left.\frac{v_1}{i_2}\right|_{v_2=0}$

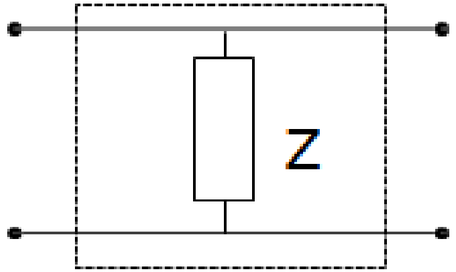
$C = \left.\frac{i_1}{v_2}\right|_{-i2=0}$ $\qquad D = -\left.\frac{i_1}{i_2}\right|_{v_2=0}$

Example (ABCD-parameters)

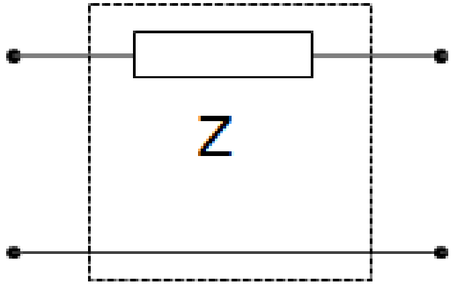


$$D = -\left.\frac{i_1}{i_2}\right|_{v_2=0} \longrightarrow \begin{matrix} i_2 = -i_1 \\ D = 1 \end{matrix}$$

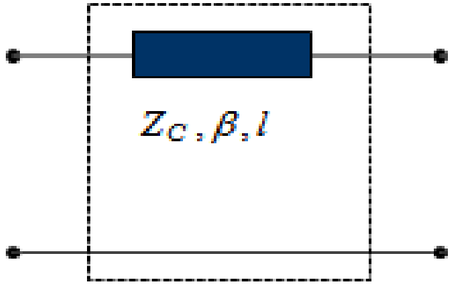
ABCD-(circuit examples)



$$\begin{bmatrix} 1 & 0 \\ 1/Z & 1 \end{bmatrix}$$

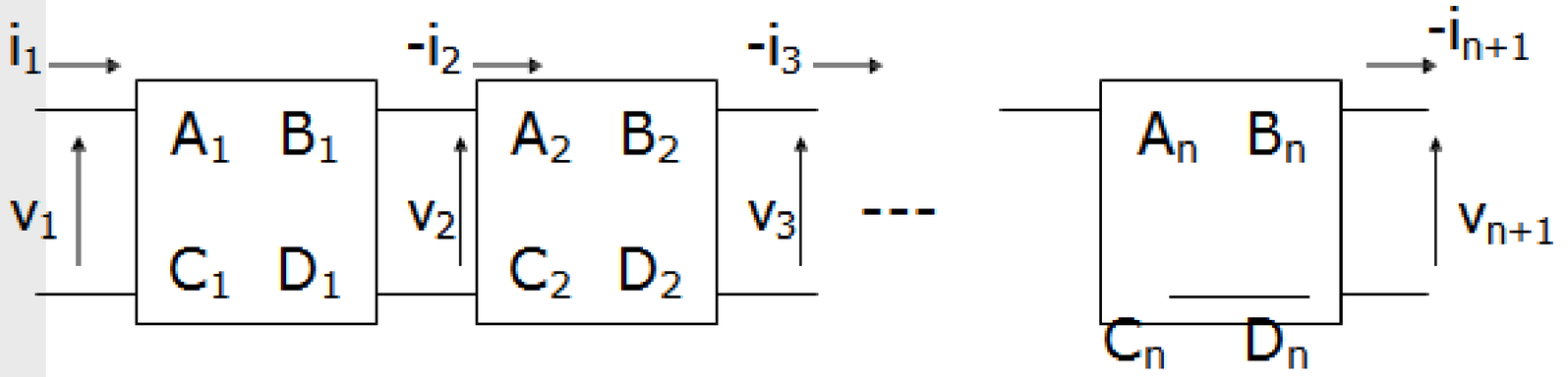


$$\begin{bmatrix} 1 & Z \\ 0 & 1 \end{bmatrix}$$



$$\begin{bmatrix} \cos \beta l & jZ_C \sin \beta l \\ \frac{j \sin \beta l}{Z_C} & \cos \beta l \end{bmatrix}$$

ABCD-(Cascaded circuit)



$$\begin{bmatrix} v_1 \\ i_1 \end{bmatrix} = \begin{bmatrix} A_T & B_T \\ C_T & D_T \end{bmatrix} \begin{bmatrix} v_{n+1} \\ -i_{n+1} \end{bmatrix}$$

$$\begin{bmatrix} A_T & B_T \\ C_T & D_T \end{bmatrix} = \begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix} \cdots \begin{bmatrix} A_n & B_n \\ C_n & D_n \end{bmatrix}$$

THANK YOU