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
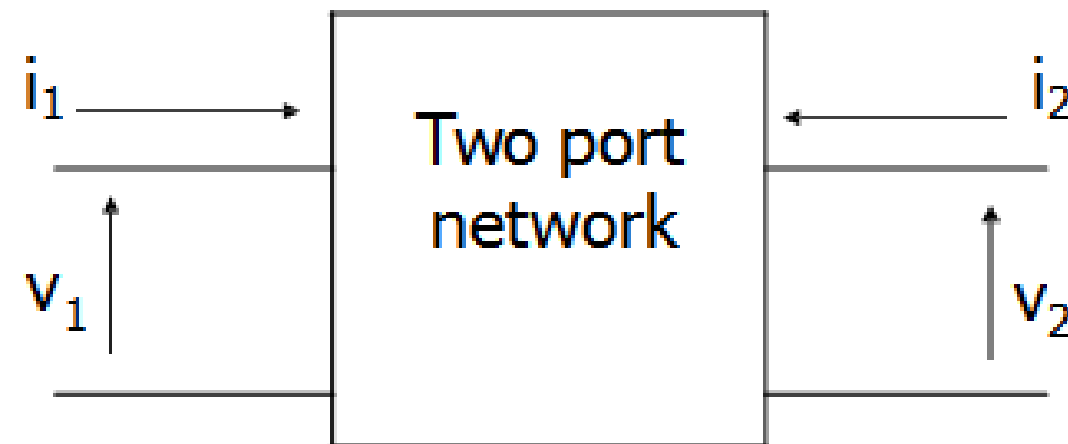
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UNIT 1 – MICROWAVE PARAMETERS

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.

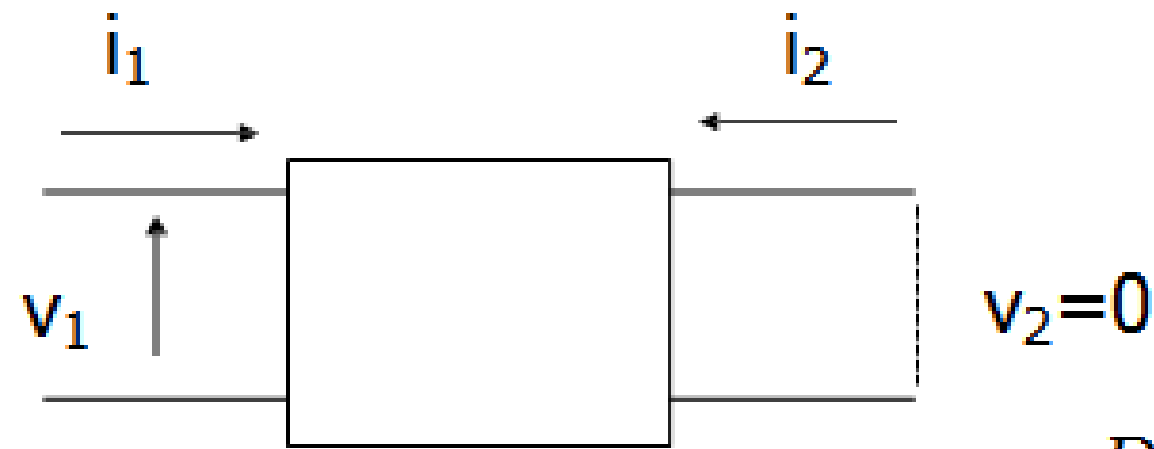- Active devices may oscillate under open- or short-circuit conditions.

ABCD-parameters

$$A = \frac{v_1}{v_2}\bigg|_{-i_2=0}$$

i_1

$i_2 = 0$

v_1 v_2

$$C = \frac{i_1}{v_2}\bigg|_{-i_2=0}$$

i_1 i_2

v_1
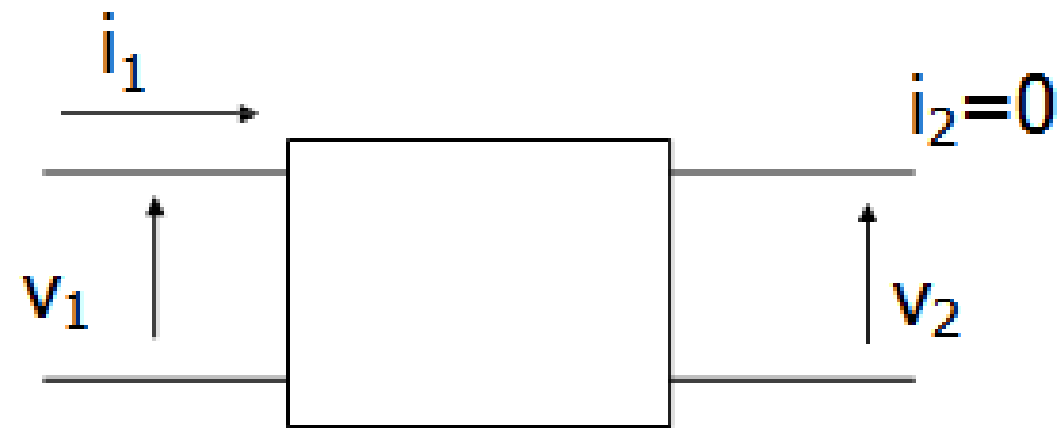
$v_2 = 0$

$$B = -\frac{v_1}{i_2}\bigg|_{v_2=0}$$

$$D = -\frac{i_1}{i_2}\bigg|_{v_2=0}$$

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

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

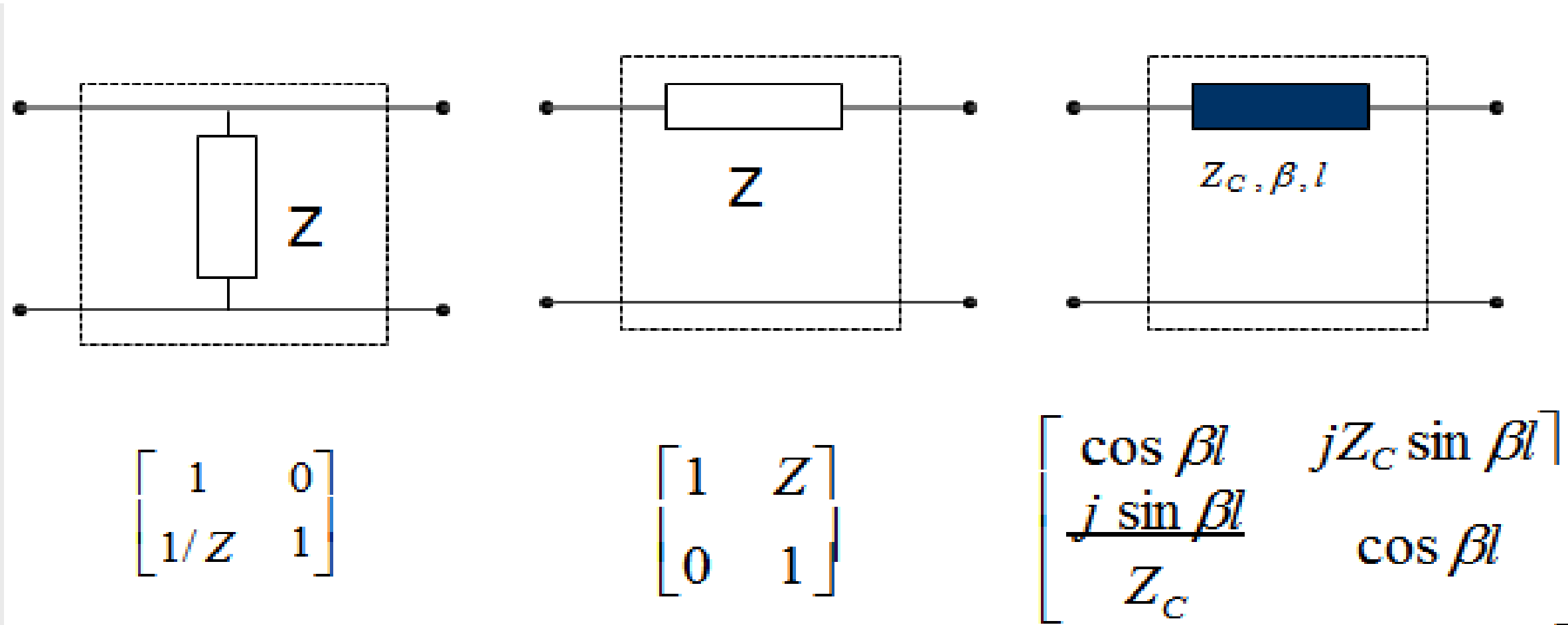$$C = \left.\frac{i_1}{v_2}\right|_{-i_2=0} \qquad\qquad D = \left.-\frac{i_1}{i_2}\right|_{v_2=0}$$

Example (ABCD-parameters)

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

ABCD-(circuit examples)

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

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

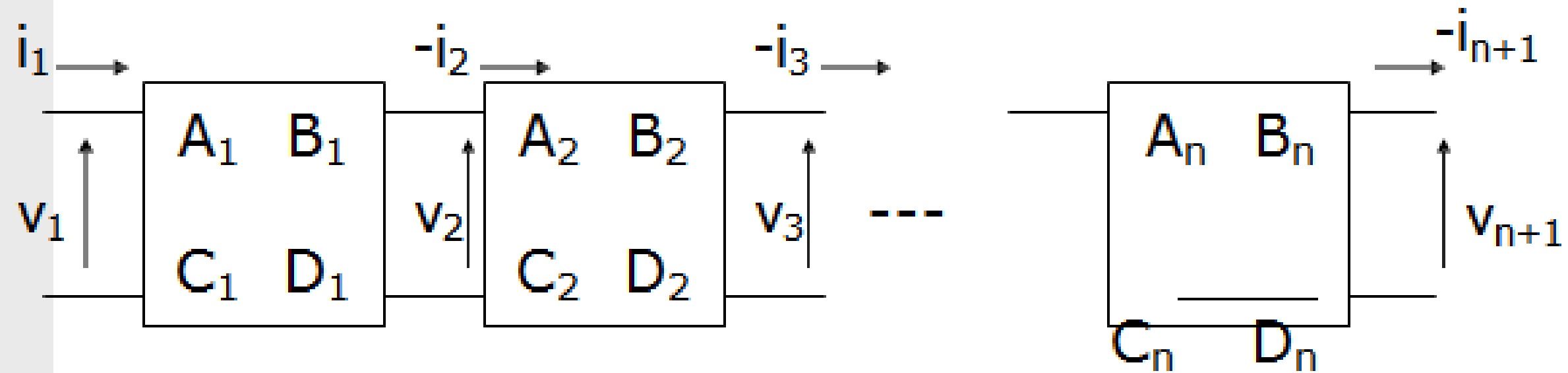$$\begin{bmatrix} \cos \beta l & jZ_C \sin \beta l \\ \dfrac{j \sin \beta l}{Z_C} & \cos \beta l \end{bmatrix}$$
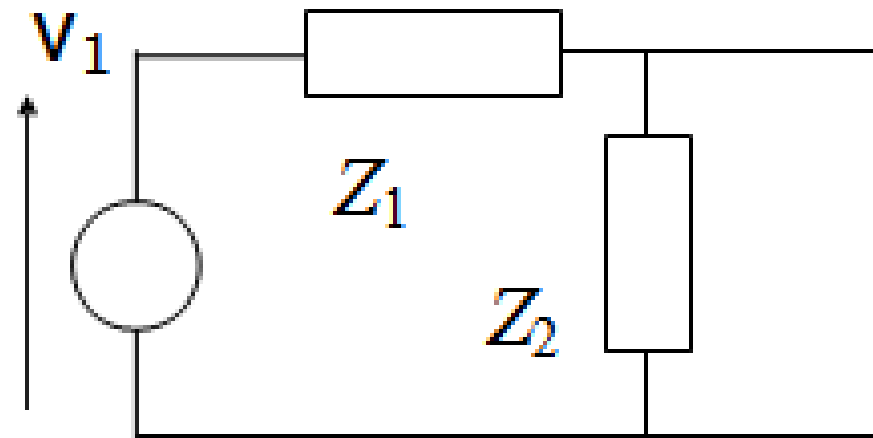
ABCD-(Cascaded circuit)

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

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

THANK YOU