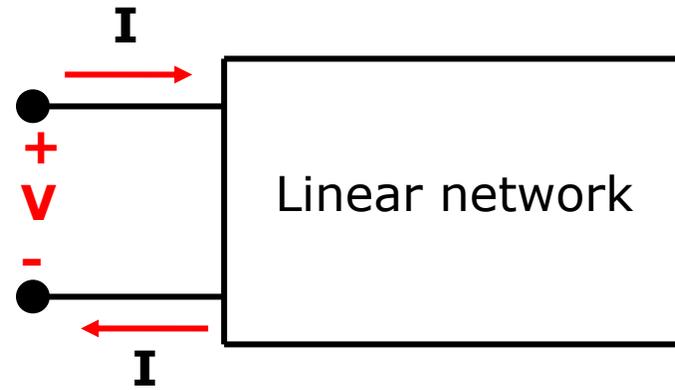
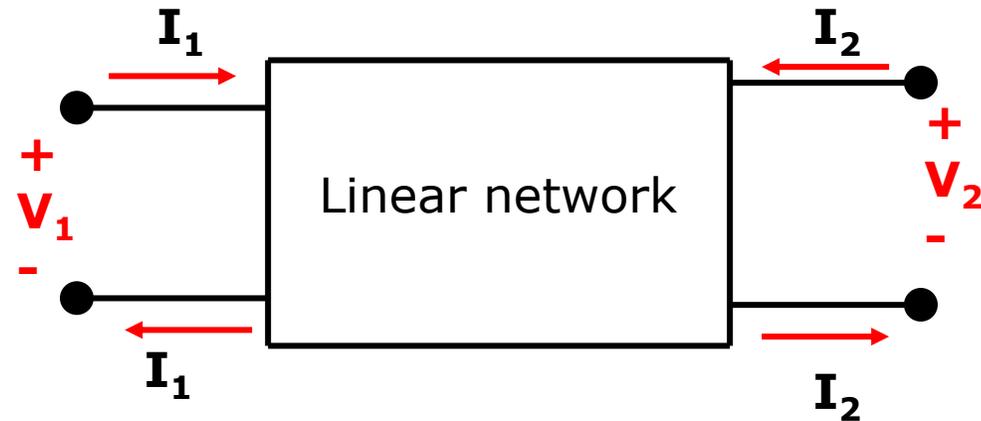


- A two – port network is an electrical network with two separate ports for input and output.
- It has two terminal pairs acting as access points. The current entering one terminal of a pair leaves the other terminal in the pair.



One – port network



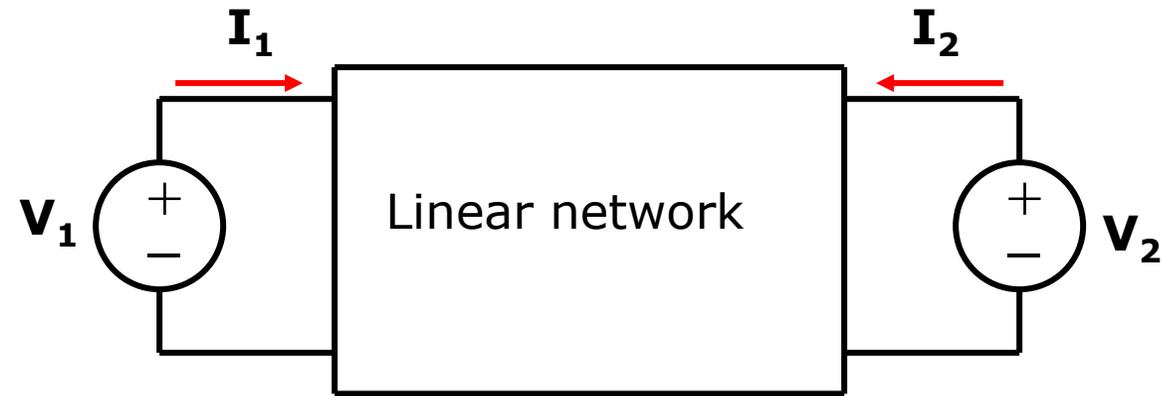
Two – port network

- From the network, we can observe that there are 4 variables that is I_1 , I_2 , V_1 and V_2 , which two are independent.
- The various term that relate these voltages and currents are called *parameters*.

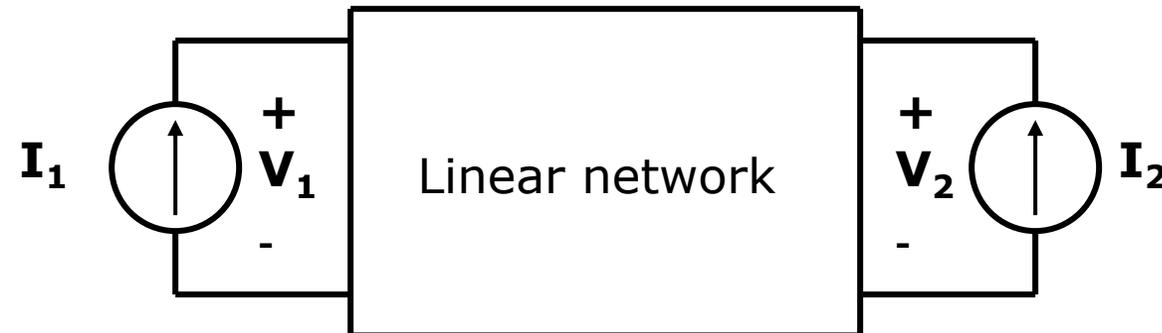
Z – PARAMETER

- Z – parameter also called as impedance parameter and the units is ohm (Ω)
- Impedance parameters is commonly used in the synthesis of filters and also useful in the design and analysis of impedance matching networks and power distribution networks.
- The two – port network may be voltage – driven or current – driven.

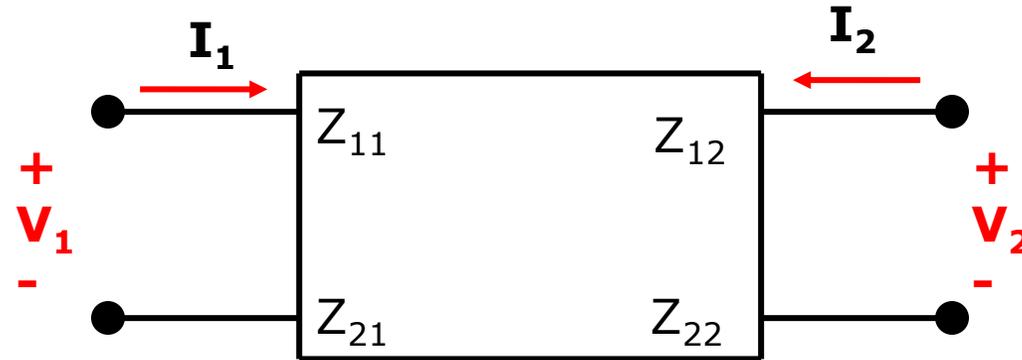
- Two – port network driven by voltage source.



- Two – port network driven by current sources.



- The “black box” is replaced with Z-parameter as shown below.



- The terminal voltage can be related to the terminal current as:

$$V_1 = z_{11}I_1 + z_{12}I_2 \quad \text{————— (1)}$$

$$V_2 = z_{21}I_1 + z_{22}I_2 \quad \text{————— (2)}$$

- In matrix form as:

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

- The Z-parameter that we want to determine are z_{11} , z_{12} , z_{21} , z_{22} .
- The value of the parameters can be evaluated by setting:
 1. $I_1 = 0$ (input port open – circuited)
 2. $I_2 = 0$ (output port open – circuited)

- Thus,

$$z_{11} = \left. \frac{V_1}{I_1} \right|_{I_2=0}$$

$$z_{12} = \left. \frac{V_1}{I_2} \right|_{I_1=0}$$

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

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

- Where;

z_{11} = open – circuit input impedance.

z_{12} = open – circuit transfer impedance from port 1
to port 2.

z_{21} = open – circuit transfer impedance from port 2
to port 1.

z_{22} = open – circuit output impedance.

Example 1

Find the Z – parameter of the circuit below.

