Experiment : 1.

Date 24-08-2020
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EXPERIMENT - 1

Aim : To determine and verify 'Z' parameters of the given two port network.

Apparatus Required : Power Supply, 2 port kits, patch cords, connecting leads, Voltmeter, ammeter, etc.

Theory :

Z- Parameter - It is also called as open-circuit impedance parameter and unit is (Ω) ohm. Impedance parameter is commonly used in the synthesis of filter and also useful in design and analysis of impedance matching network and power distribution network.

The two-port network may be voltage-driven / current driven.

The terminal voltage can related to the terminal currents as :

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

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

In 2 parameters of a two port, the input and output currents I_1 and I_2.

V_1 and V_2 → dependant variables

I_1 and I_2 → Independant variables

Z-parameters we need to determine Z_{11}, Z_{12} Z_{21} and Z_{22}

Aim : To calculate and verify Z parameters of a two-port network

CIRCUIT DIAGRAM :

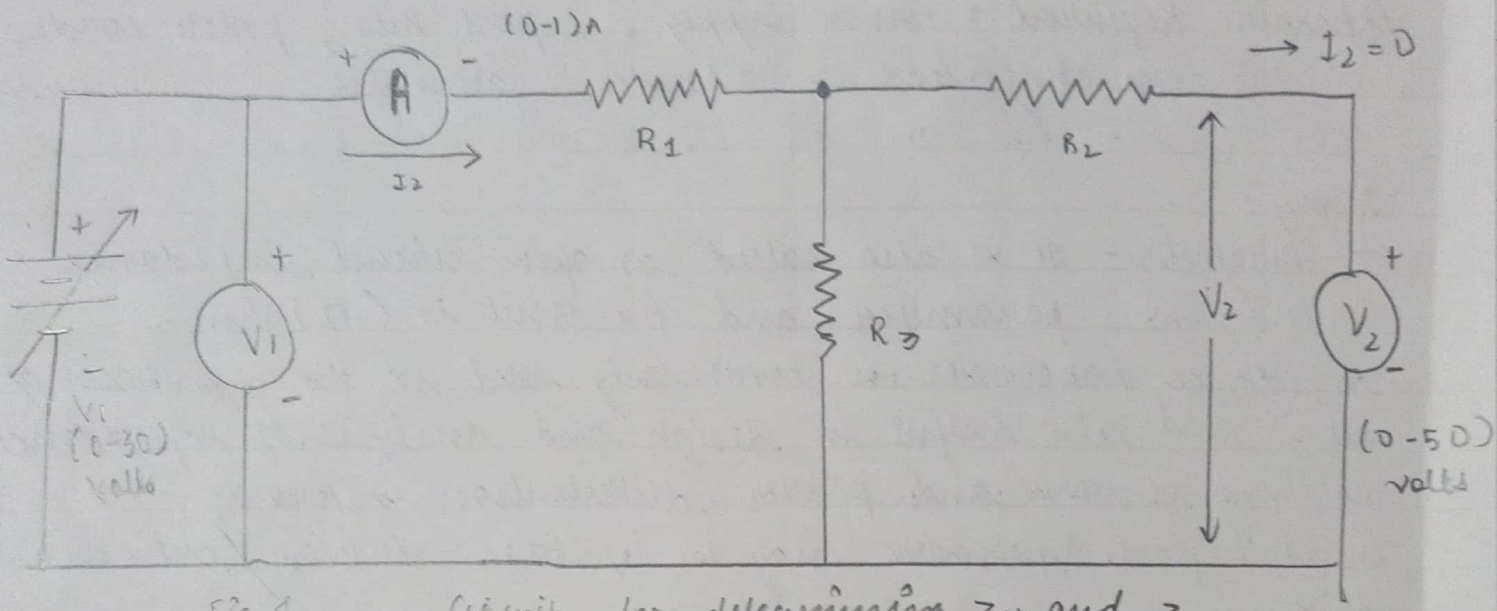


Fig 1. Circuit for determining Z_{11} and Z_{21}

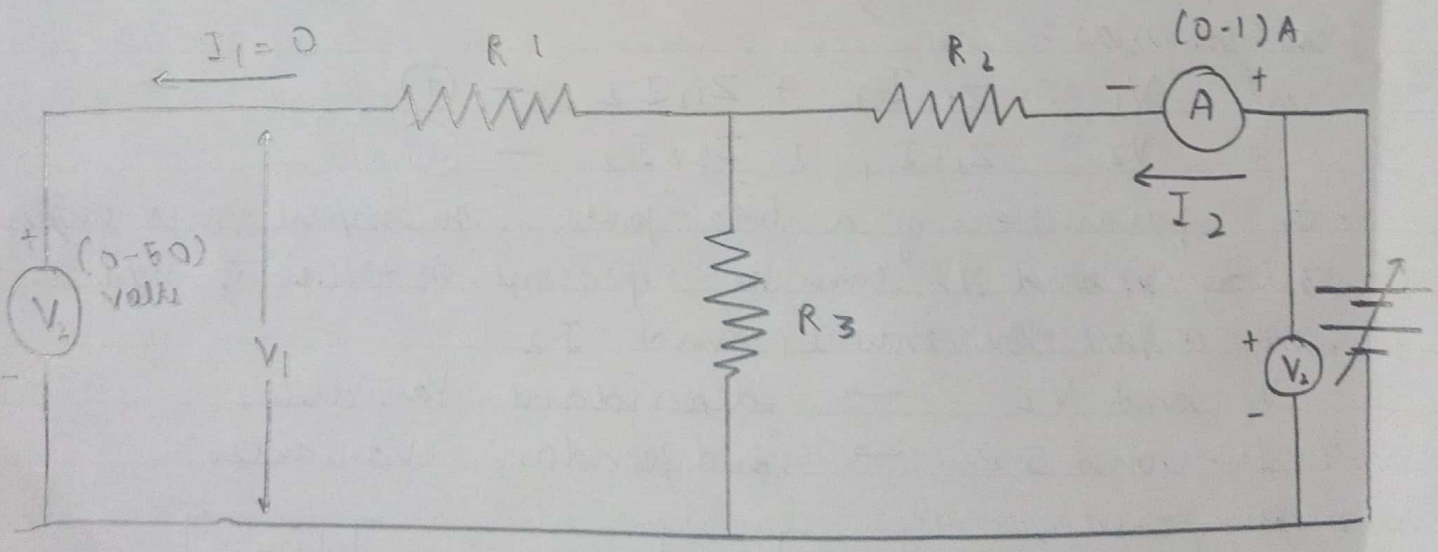
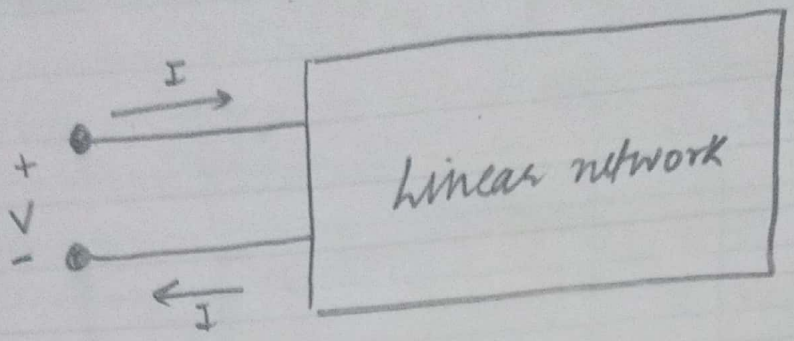
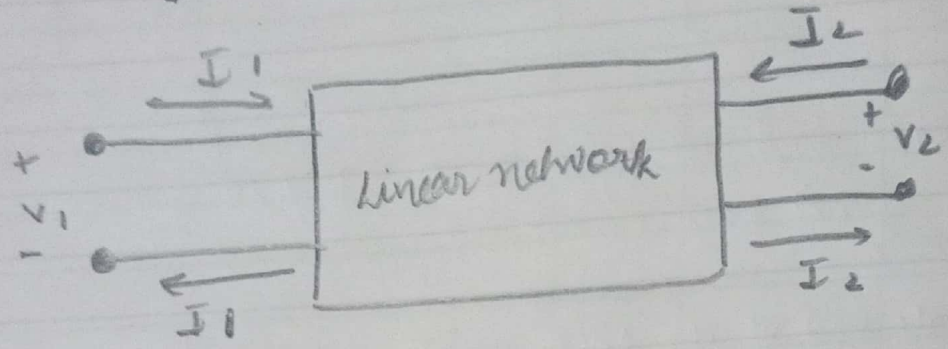


Fig 2. Circuit for determining Z_{12} and Z_{22}

Diagrams

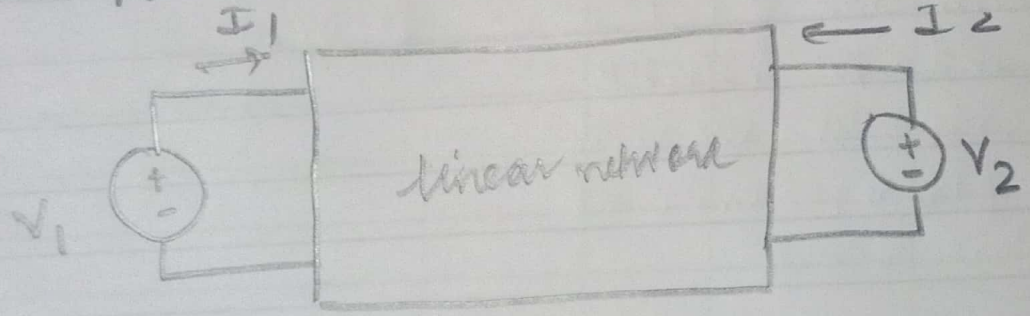


one-port network

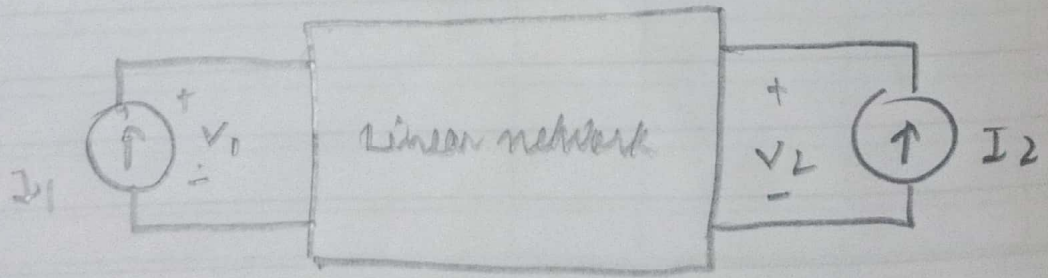


Two-port network

Two port network driven by voltage



Two port network driven by current



Experiment :

Date

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matrix form, $\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$

1) $I_1 = 0$ (input - port open circuited)
2) $I_2 = 0$ (output - port open circuited)

$$Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0} \qquad Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0} \qquad Z_{21} = \frac{V_2}{I_1}\Big|_{I_2=0} \qquad Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0}$$

Z_{11} : Open circuit input impedance
Z_{12} : Open circuit transfer impedance from port 1 to 2
Z_{21} : Open circuit transfer impedance from port 2 to 1
Z_{22} : Open circuit output impedance

Procedure :

1. Connect the circuit as shown in figure and switch 'ON' the experimental board
2. First open the output-terminal and supply 5 V to the input circuit.
3. Secondly, open input terminal and supply 5 V to the output terminal. Measure input voltage and output current using multimeter.
4. Calculate values of z parameters using eq^n (1) and (2)
5. Switch off the supply after taking the reading.

Precautions :

1) Make the connections according to circuit diagram.
2) Power supply should be switched off while taking the reading.

OBSERVATIONS :

	When O/P is Open Circuited $I_2 = 0$					When I/P is open ckt $I_1 = 0$				
S.no.	V_1 (V)	V_2 (V)	I_1 (mA)	$Z_{11} = V_1/I_1$ (Ω)	$Z_{12} = V_2/I_1$ (Ω)	V_1 (V)	V_2 (V)	I_2 (mA)	$Z_{12} = V_1/I_2$ (Ω)	$Z_{22} = V_2/I_2$ (Ω)
1.	11	5	5	$11/5 = 2.2$	$5/5 = 1$	3.5	8	4	$3.5/4 = 0.875$	$8/4 = 2$

CALCULATIONS :

$Z_{11} = 2.2\ \Omega$; $Z_{21} = 1\ \Omega$

$Z_{12} = 0.875\ \Omega$; $Z_{22} = 2\ \Omega$

Error = 0.125

If $Z_{11} = Z_{22}$; the network is called SYMMETRICAL NETWORK

If $Z_{21} = Z_{12}$; the network is called RECIPROCAL NETWORK

RESULT :

The Z parameter of the two port network has been calculated and verified.

3. Connections should be tight
4. Note the readings carefully

Result :
The Z-parameter of two-port network has been calculated and verified

VIVA VOICE

Ques 1. Define Z parameters ?
Ans In Z parameter, the input and output voltages V_1 and V_2 can be expressed in terms of input and output currents I_1 and I_2

Ques 2. List the 4 parameters used in Z-parameter representation
Ans The 4 variables are I_1, I_2, V_1 and V_2

Ques 3. List the 2 dependent variables used in Z-parameter representation
Ans The 2 dependent variables are V_1 and V_2

Ques 4. List 2 independent variables used in Z-parameter.
Ans The 2 independent variables are I_1 and I_2

Ques 5. Define the input driving point impedance.
Ans The input driving point impedance is defined as the ratio of input voltage to the input current.

Ans 6. Define output driving point impedance.
Ans It is defined as ratio of input voltage to output current

Ans 7 Define reverse impedance transfer.
Ans The reverse transfer impedance is defined as ratio of input voltage to output current.

Ans 8. Define forward transfer impedance.
Ans The forward transfer impedance is defined as the ratio of output voltage to input current.

Ans 9. Write condition for reciprocity.
Ans Condition for reciprocity is $Z_{12} = Z_{21}$

Ans 10. Write condition for symmetry.
Ans Condition for symmetry is $Z_{11} = Z_{22}$