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EXPERIMENT NO.-6

Calculation of two -port network parameters

Objective :

- To understand the analysis of a two-port network
- To understand the behavior of a two-port network using parametric analysis.
- To learn the measurement conditions and procedure for two-port analysis.

Software Used : NI Multisim

Theory :

The electrical network with two pairs of terminals is a two-port network . The network inside the box can contain resistors, inductors, capacitors, transformers, transistors and in general any linear circuit device, including depending devices but no independent sources are allowed. The behavior of a linear two-port network is described by impedance (Z), admittance (Y), transmission (ABCD), or hybrid (h) parameter .

Z - parameters :

$$V_1 = Z_{11}I_1 + Z_{12}I_2$$

$$V_2 = Z_{21}I_1 + Z_{22}I_2$$

Parameter	Condition	Name
$Z_{11} = V_1/I_1$	$I_2 = 0$	Input Impedance
$Z_{21} = V_2/I_1$	$I_2 = 0$	Transfer Impedance
$Z_{12} = V_1/I_2$	$I_1 = 0$	Transfer Impedance
$Z_{22} = V_2/I_2$	$I_1 = 0$	Output Impedance

Y-parameters :

$$I_1 = Y_{11}V_1 + Y_{12}V_2$$

$$I_2 = Y_{21}V_1 + Y_{22}V_2$$

Parameter	Condition	Name
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$Y_{11} = I_1/V_1$	$V_2 = 0$	Input admittance
$Y_{21} = I_2/V_1$	$V_2 = 0$	Transfer admittance
$Y_{12} = I_1/V_2$	$V_1 = 0$	Transfer admittance
$Y_{22} = I_2/V_2$	$V_1 = 0$	Output admittance

H-parameters :

$$V_1 = h_{11}I_1 + h_{12}V_2$$

$$I_2 = h_{21}I_1 + h_{22}V_2$$

Parameter	Condition	Name
$h_{11} = V_1/I_1$	$V_2 = 0$	SS input admittance
$h_{21} = I_2/I_1$	$V_2 = 0$	SS forward current gain
$h_{12} = V_1/V_2$	$I_1 = 0$	OS reverse voltage gain
$h_{22} = I_2/V_2$	$I_1 = 0$	OS output admittance

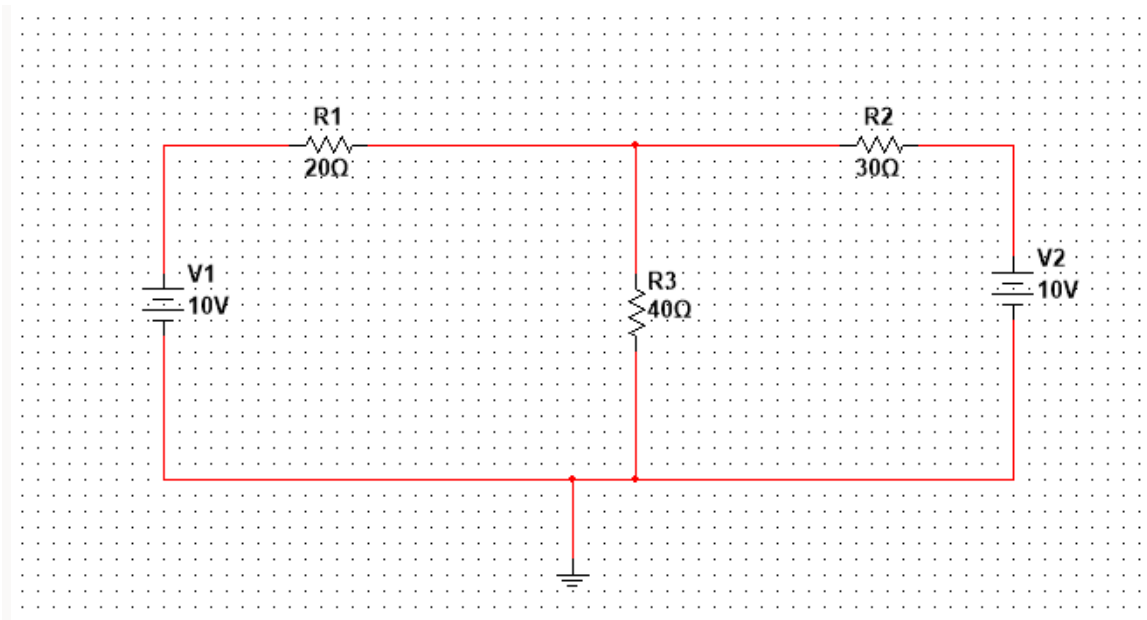
ABCD-parameters :

$$V_1 = AV_2 - BI_2$$

$$I_1 = CV_2 - DI_2$$

Parameter	Condition	Name
$A = V_1/V_2$	$I_2 = 0$	OC voltage ratio
$B = V_1/-I_2$	$V_2 = 0$	OC transfer admittance
$C = I_1/V_2$	$I_2 = 0$	-SC transfer impedance
$D = I_1/-I_2$	$V_2 = 0$	-SC current ratio

Circuit Diagram :



RESULTS & OBSERVATIONS :

Parameter	Calculated Value	Measured value
Z_{11}	60	59.998
Z_{21}	40	40.001
Z_{12}	40	39.998
Z_{22}	70	70
Y_{11}	0.0269	0.0269
Y_{21}	0.0153	0.01538
Y_{12}	0.0153	0.01538
Y_{22}	0.023	0.023
h_{11}	37.142	37.14
h_{21}	0.571	0.57
h_{12}	0.571	0.571
h_{22}	0.0142	0.0142
A	1.5	1.499
B	-65	-65
C	0.025	0.0249
D	-1.75	-1.75