Lab2: Superposition theorem

A. Objective

The objective of this experiment aims to analyze electric circuit using Superposition theorem. At the end of this experiment, the student will be able to construct and know how to analyze electric circuit.

B. Instruments and Materials

- Adjustable DC power supply (1)
- Breadboard (1)
- DMM (Digital Multimeter) (1)
- ½ watt resistors (1)

C. Theory

• **Superposition**: According to this theorem, if there are two or more sources of EMFs acting simultaneously in a linear bilateral network, the current flowing through any section is the algebraic sum of all the currents that should flow in that section if each source of emf were considered separately and all other sources are replaced, for the time being, by their internal resistances.

D. Circuit testing

a. Nodal and loop analysis

$R_1 = 560\Omega$; $R_2 = 220\Omega$
$R_3 = 470\Omega$; $R_4 = 200\Omega$
$R_5 = 680\Omega$

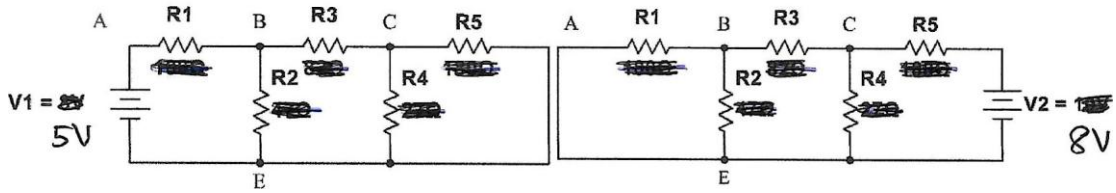
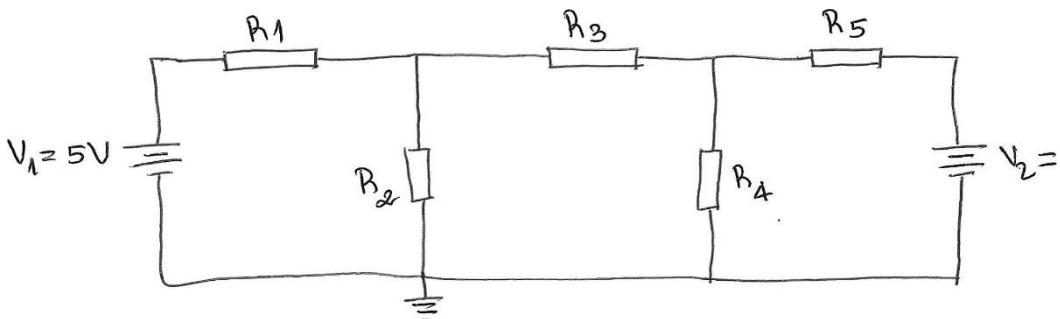


Fig 1: Given network with V2 source removed

Fig 2: Given network with VI source removed

E. Nodal and Loop Analysis

1. Connect the circuit in Fig 1 with the given values;
2. Turn on the DC power supply and use DMM to measure the applied voltage (V1) 11V and (V2) 9V note the voltmeter readings;
3. Turn off the power supply and connect the circuit in Fig 1 with the DC power supply;



4. Turn on the power supply and measure the voltage on a node by using DMM. Record the results in Table 1;
5. Measure the value of current by using the ammeter. Note the readings of Ammeters and record the results in Table 1;

Table1:

Voltage(V)	V1 alone Present(Fig.1)		
	Theoretical	Multisim	Experiment
v_{R_1}	3.586V		3.87V
v_{R_2}	1.414V		1.13V
v_{R_3}	1.064V		0.85V
v_{R_4}	0.35V		0.28V
v_{R_5}	0.35V		0.3V
I_{R1}	0.88 mA		0.0069A
I_{R2}	2.03 mA		0.0051A
I_{R3}	2.91 mA		0.0018A
I_{R4}	8.85 mA		0.0013A
I_{R5}	11.76 mA		0.00044A

Voltage(V)	V2 alone Present(Fig.2)		
	Theoretical	Multisim	Experiment
v_{R_1}	0.447		0.87V
v_{R_2}	0.447		0.37V
v_{R_3}	1.323		0.73V
v_{R_4}	1.77		1.47V
v_{R_5}	6.23		6.46V
I_{R1}	8.9 mA		0.0015A
I_{R2}	6.42 mA		0.0016A
I_{R3}	2.48 mA		0.0015A
I_{R4}	1.75 mA		0.0072A
I_{R5}	1.75 mA		0.0096A

Voltage(V)	V3 alone Present(Fig.3)		
	Theoretical	Multisim	Experiment
v_{R_1}	2.93		5.83V
v_{R_2}	2.07		2.03V
v_{R_3}	0.19		0.74V
v_{R_4}	2.26		1.38V
v_{R_5}	5.74		3.55V
I_{R1}	5.2 mA		0.01051A
I_{R2}	9.4 mA		0.00922A
I_{R3}	0.4 mA		0.0016A
I_{R4}	11.3 mA		0.00684A
I_{R5}	8.44 mA		0.00531A

6. Verify the principle of superposition with the measured current. Will the principle of superposition apply to currents through each of the resistors?
7. Make the report using (Theoretical Vs Multisim Vs Experiment) results. Discuss the results of nodal and loop analysis with superposition.

Discuss the result: The experiment aimed to validate circuit analysis techniques, specifically nodal and loop analysis with the principle of superposition. While the tables present data for different voltage source configurations (V1, V2, and V3 alone, and presumably the combined case), a comprehensive conclusion requires comparing these individual contributions to the results when all sources are active.