Lab Work: Experiment-3: Verification of Superposition Theorem

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Verification of Superposition Theorem

3.1 Purpose/Objective:

The aim of this experiment is-

- To be familiar with the Superposition theorem and also to verify it.
- To know about its applicability.

3.2 Theory:

This theorem may be stated as follows:

- In a linear bilateral network containing more than one generator (source of emf), the current which flows at any point is the sum of all the currents which would follow at that point if each generator where considered separately and all the other generators replaced for the time being by resistances equal to their internal resistances.
- Consider the circuit given below. We apply Superposition Theorem to it:

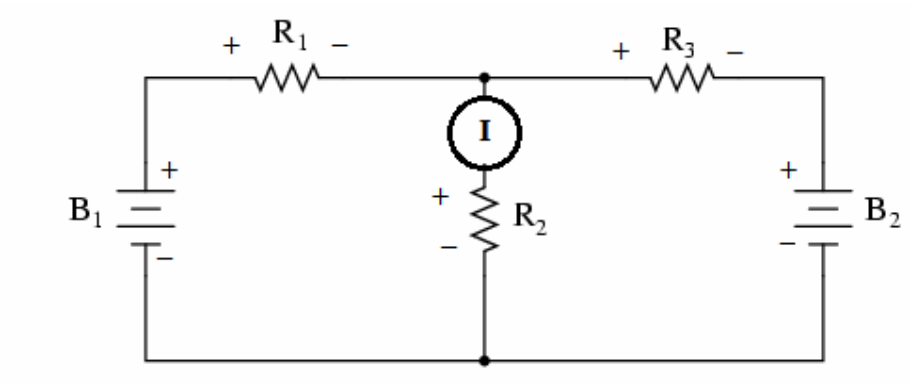

Figure: The original circuit under test

In the above circuit, I represent the values of current through R_2 resistor which are due to the simultaneous action of the two sources of emf in the network. We want to find this current using Superposition theorem.

- Since we have two sources of power in this circuit, we will have to calculate two sets of values for currents through R_2 resistor:
  - When B_1 source is acting (shown in the figure below), let us assume that current through R_2 is I^*.

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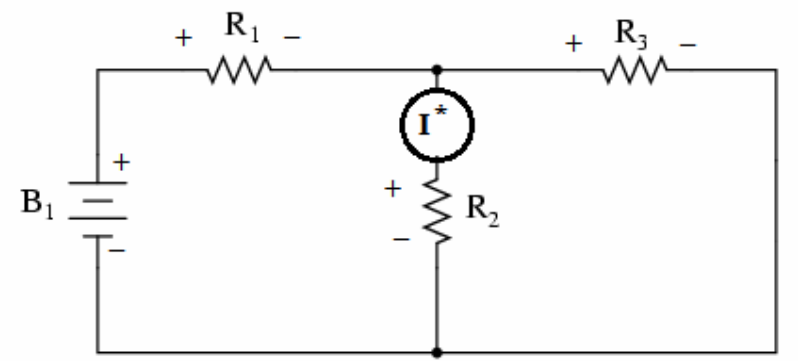

Figure-2: Circuit after deactivating source B_2

- When B_2 source is acting (shown in the figure below), let us assume that current through R_2 is I^{**}.

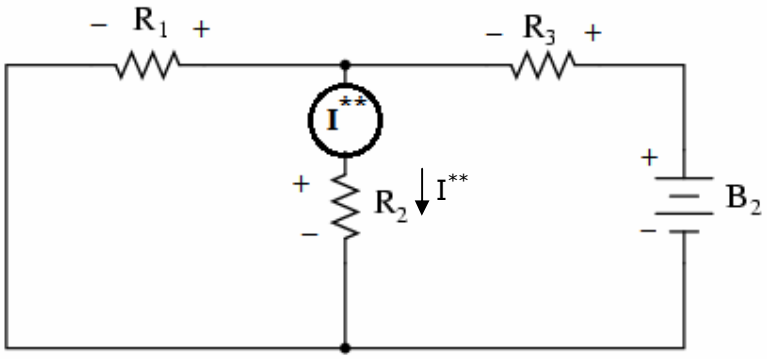

Figure-3: Circuit after deactivating source B_1

Hence in order to verify Superposition theorem, it requires to prove that I is equal to the algebraic sum of I^* and I^{**}, i.e.

$$I = I^* + I^{**}$$

3.3 Equipment/ Apparatus:

a) Two regulated variable Power Supply (0-30 V)

b) One Digital Multimeter

c) Circuit Experiment Board (Breadboard)

d) Three resistors

e) Connecting wires

f) Cutting tools etc.

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3.4 Cautions:

1. All connections should be tight and correct.
2. Switch off the supply when not in use.
3. Reading should be taken carefully.

3.5 Circuit Diagram:

The circuit diagrams to verify Superposition theorem are shown below:

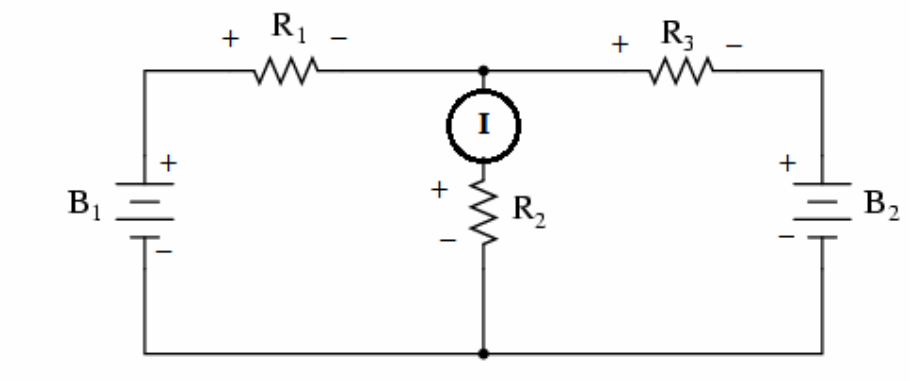

Figure: The original circuit under test

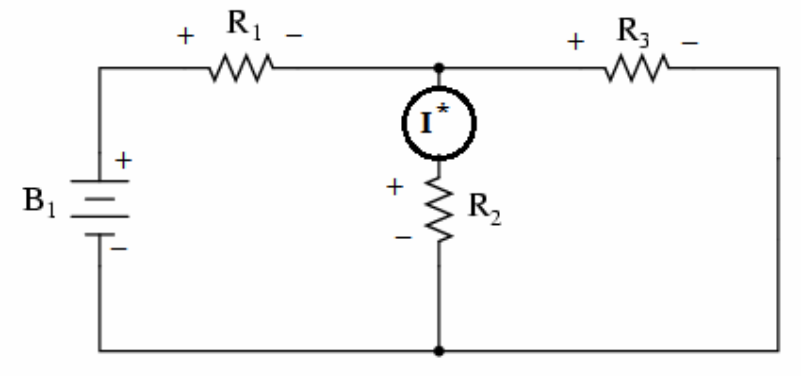

Figure-2: Circuit after deactivating source B_2

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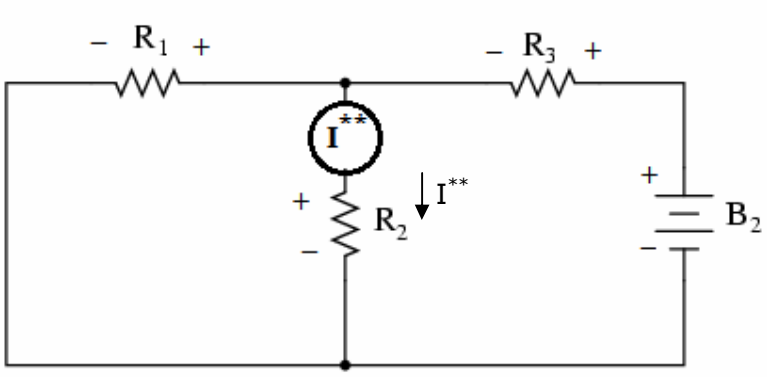

Figure-3: Circuit after deactivating source B_1

3.6 Procedure:

1. Construct the circuit on the breadboard, as shown in figure-1 and observe the voltage of the two sources B_1 and B_2.
2. Now take the ammeter reading I.
3. Now remove the source B_2 by shorting the terminals across this source as shown in figure-2. Now take the ammeter reading I^*.
4. This time remove the source B_1 by shorting the terminals across this source as shown in figure-3. Now take the ammeter reading I^{**}.
5. Check $I=I^*+I^{**}$.
6. Repeat steps 1 to 5 by changing the value of R_2.

3.7 Data Table:

For each reading, fill up the following table:

Reading No.	I **(mA)**	I^* **(mA)**	I^{**} **(mA)**	I **(mA)**	$I= I^*+ I^{**}$ **(mA)**
1.					
2.					
3.					

3.8 Result:

Superposition Theorem has been verified.

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