



Department of Computer Science and Engineering

Course Title: Electrical Circuits

Course Number: 209

Semester: 4th

Experiment No.: 05

Experiment Title: Verification of Superposition Theorem

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Objectives of the Experiment:

To verify the superposition theorem theoretically, experimentally and using PSpice simulation.

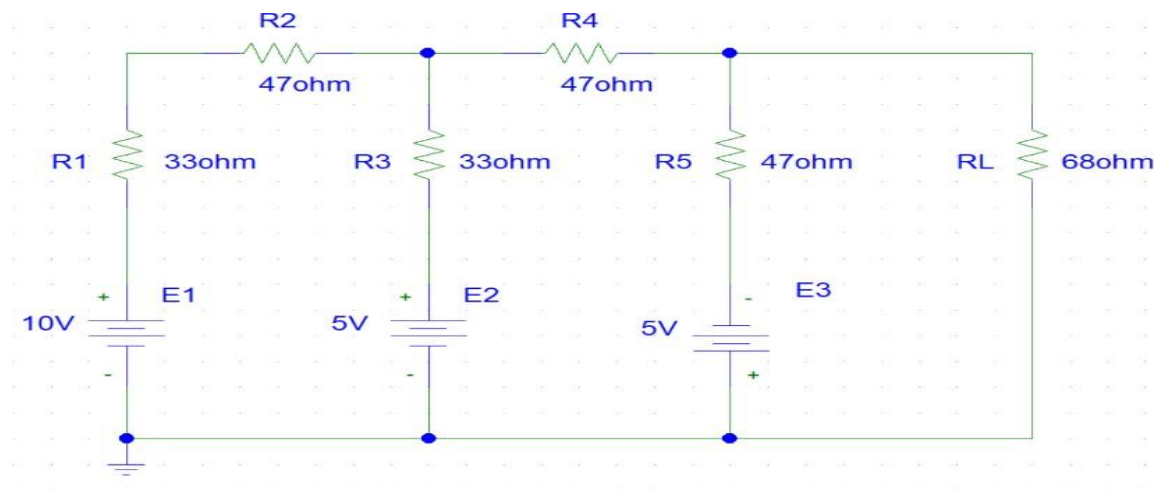
Circuit Diagram:

Figure - 1: Circuit with all sources active.

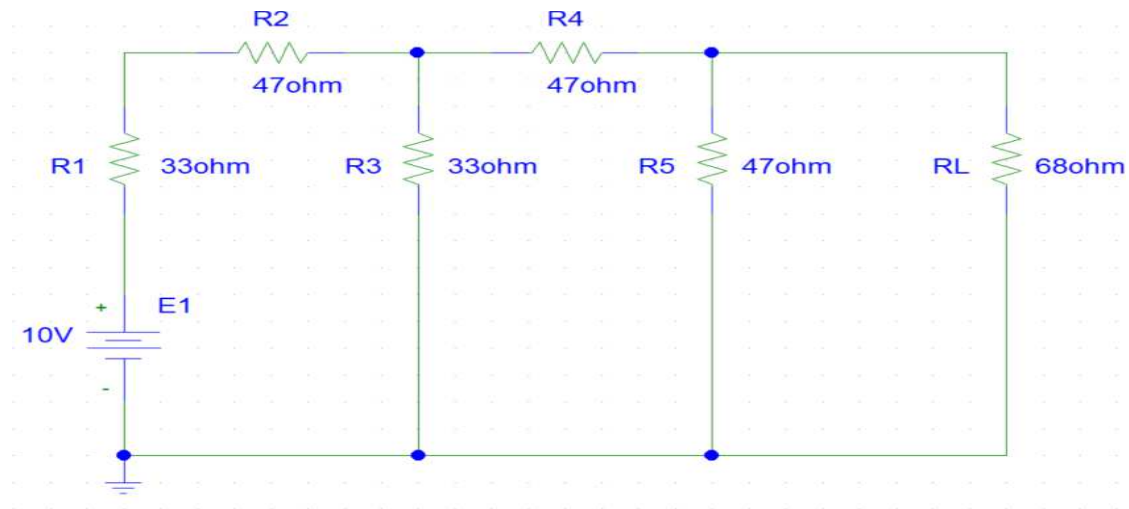


Figure - 2: Circuit with E_1 source active

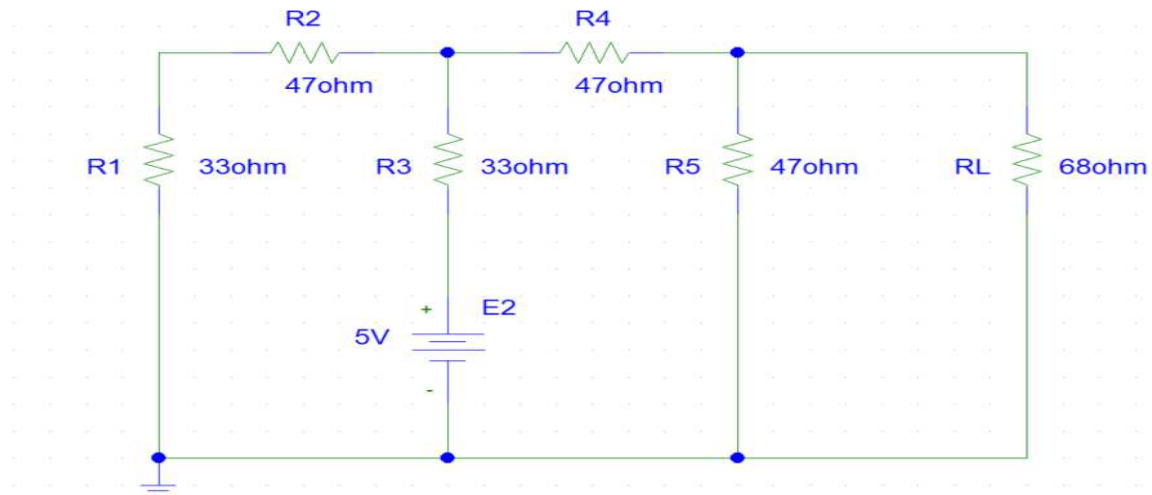


Figure - 3: Circuit with E_2 source active

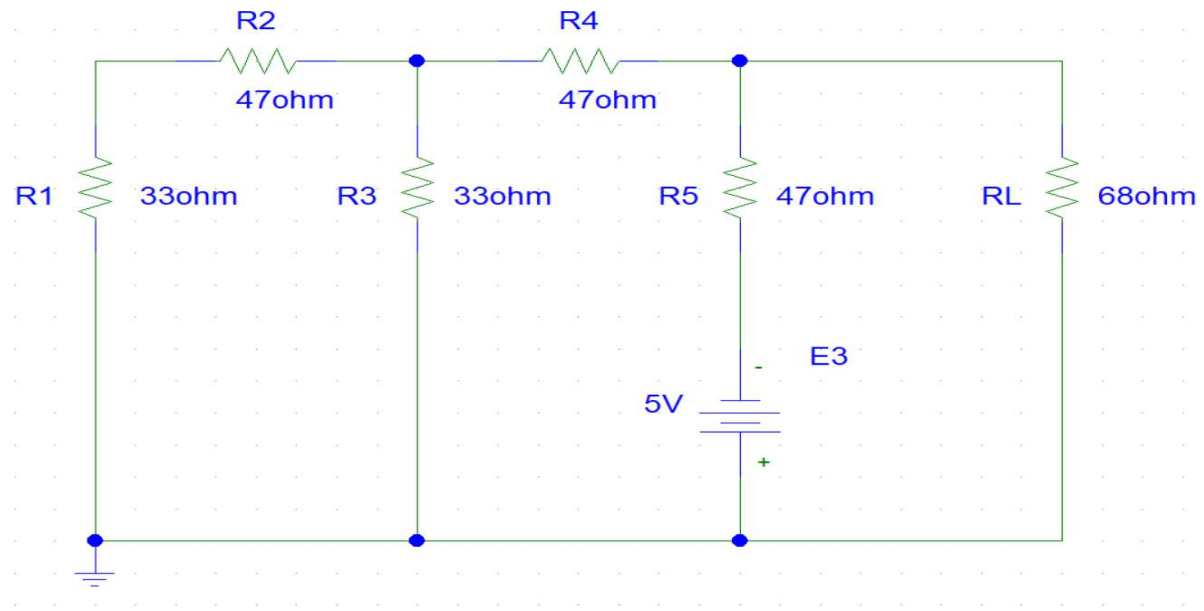


Figure - 4: Circuit with E_3 source active.

Table 01.Experimental-datasheet:

Measured Value of E_1 (V)	Measured Value of E_2 (V)	Measured Value of E_3 (V)	Measured Value of I_L with all sources active	Measured Value of I_{L1} with E_1 source active	Measured Value of I_{L2} with E_2 source active	Measured Value of I_{L3} with E_3 source active	Measured Values of Resistors (ohm)
10	5	5	- 4.269	12.16	14.74	- 31.17	$R_1 = 33,$ $R_2 = 47,$ $R_3 = 33,$ $R_4 = 47,$ $R_5 = 47,$ $R_L = 68$

Answer to the question of post lab report 01:

From figure - 1:

Applying KVL on mesh - 1,

$$33i_1 + 47i_1 + 33(i_1 - i_2) = 5$$

$$33i_1 + 47i_1 + 33i_1 - 33i_2 = 5$$

$$113i_1 - 33i_2 = 5 \dots \dots (1)$$

Applying KVL on mesh - 2,

$$33(i_2 - i_1) + 47i_2 + 47(i_2 - i_3) = 10$$

$$33i_2 - 33i_1 + 47i_2 + 47i_2 - 47i_3 = 10$$

$$- 33i_1 + 127i_2 - 47i_3 = 10 \dots \dots (2)$$

Applying KVL on mesh

$$- 3, 47(i_3 - i_2) +$$

$$68i_3 = - 5$$

$$47i_3 - 47i_2 + 68i_3 = - 5$$

$$- 47i_2 + 115i_3 = - 5 \dots \dots (3)$$

Solving (1), (2) & (3) -

$$i_1 = 72.27$$

$$\text{mA } i_2 =$$

$$95.94 \text{ mA}$$

$$i_3 = - 4.269 \text{ mA} = I_L$$

From figure - 2:

Applying KVL on mesh - 1,

$$33i_1 + 47i_1 + 33(i_1 - i_2) = 10$$

$$33i_1 + 47i_1 + 33i_1 - 33i_2 = 10$$

$$113i_1 - 33i_2 = 10 \dots \dots (1)$$

Applying KVL on mesh - 2,

$$33(i_2 - i_1) + 47i_2 + 47(i_2 - i_3) = 0$$

$$33i_2 - 33i_1 + 47i_2 + 47i_2 - 47i_3 = 0$$

$$-33i_1 + 127i_2 - 47i_3 = 0 \dots \dots (2)$$

Applying KVL on mesh

$$-3, 47(i_3 - i_2) +$$

$$68i_3 = 0$$

$$47i_3 - 47i_2 + 68i_3 = 0$$

$$-47i_2 + 115i_3 = 0 \dots \dots (3)$$

Solving (1), (2) & (3) -

$$i_1 = 97.1\text{mA}$$

$$i_2 = 29.7\text{mA}$$

$$i_3 = 12.16\text{ mA} = I_L$$

From figure - 3:

Applying KVL on mesh - 1,

$$33i_1 + 47i_1 + 33(i_1 - i_2) = -5$$

$$33i_1 + 47i_1 + 33i_1 - 33i_2 = -5$$

$$113i_1 - 33i_2 = -5 \dots \dots (1)$$

Applying KVL on mesh - 2,

$$33(i_2 - i_1) + 47i_2 + 47(i_2 - i_3) = 5$$

$$33i_2 - 33i_1 + 47i_2 + 47i_2 - 47i_3 = 5$$

$$-33i_1 + 127i_2 - 47i_3 = 5 \dots \dots \dots (2)$$

Applying KVL on mesh

$$-3, 47(i_3 - i_2) +$$

$$68i_3 = 0$$

$$47i_3 - 47i_2 + 68i_3 = 0$$

$$-47i_2 + 115i_3 = 0 \dots \dots \dots (3)$$

Solving (1), (2) & (3) -

$$i_1 = -33.7\text{mA}$$

$$i_2 = 36.0\text{mA}$$

$$i_3 = 14.74\text{ mA} = I_L$$

From figure - 4:

Applying KVL on mesh - 1,

$$33i_1 + 47i_1 + 33(i_1 - i_2) = 0$$

$$33i_1 + 47i_1 + 33i_1 - 33i_2 = 0$$

$$113i_1 - 33i_2 = 0 \dots \dots \dots (1)$$

Applying KVL on mesh - 2,

$$33(i_2 - i_1) + 47i_2 + 47(i_2 - i_3) = 5$$

$$33i_2 - 33i_1 + 47i_2 + 47i_2 - 47i_3 = 5$$

$$-33i_1 + 127i_2 - 47i_3 = 5 \dots \dots \dots (2)$$

Applying KVL on mesh

$$-3, 47(i_3 - i_2) +$$

$$68i_3 = -5$$

$$47i_3 - 47i_2 + 68i_3 = -5$$

$$-47i_2 + 115i_3 = -5 \dots \dots \dots (3)$$

Solving (1), (2) & (3) -

$$i_1 = 8.79\text{mA}$$

$$i_2 = 30.1\text{mA}$$

$$i_3 = -31.17 \text{ mA} = I_L$$

$$\text{Now, } I_L = I_{L1} + I_{L2} + I_{L3} = 12.16 + 14.74 - 31.17 = -4.269 \text{ mA}$$

There is no discrepancy in PSpice.

Answer to the question of post lab report 02:

The theoretical solution of the circuit and solution obtained from PSpice is the same.

Conclusion:

In this experiment we verified the 'Superposition' theorem. Then, compared the theoretical values with experimental values & found no discrepancy

