

Lab 5: Verification of Superposition Theorem.

Objective:

- To verify Superposition Theorem.

Theory: If a circuit has two or more independent sources, one way to determine the value of a specific variable (voltage or current) is to use nodal or mesh analysis. Another way is to determine the contribution of each independent source to the variable and then add them up. The latter approach is known as the *superposition*. The superposition principle states that the voltage across (or current through) an element in a linear circuit is the algebraic sum of the voltages across (or currents through) that element due to each independent source acting alone.

The principle of superposition helps us to analyze a linear circuit with more than one independent source by calculating the contribution of each independent source separately. However, to apply the superposition principle, we must keep two things in mind:

1. We consider one independent source at a time while all other independent sources are turned off. This implies that we replace every voltage source by 0 V (or a short circuit), and every current source by 0 A (or an open circuit). This way we obtain a simpler and more manageable circuit.
2. Dependent sources are left intact because they are controlled by circuit variables.

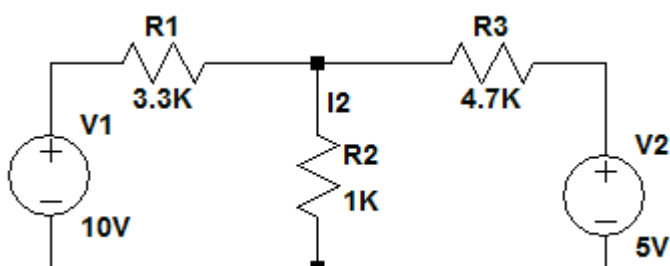
Steps to apply superposition principle:

1. Turn off all independent sources except one source. Find the output (voltage or current) due to that active source using nodal or mesh analysis.
2. Repeat step 1 for each of the other independent sources.
3. Find the total contribution by adding algebraically all the contributions due to the independent sources.

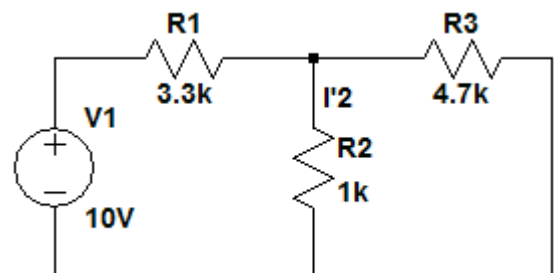
List of Equipment

- Trainer Board
- DMM
- 1 x 3.3k Ω resistor
- 1 x 4.7k Ω resistor
- 1 x 1K Ω resistor

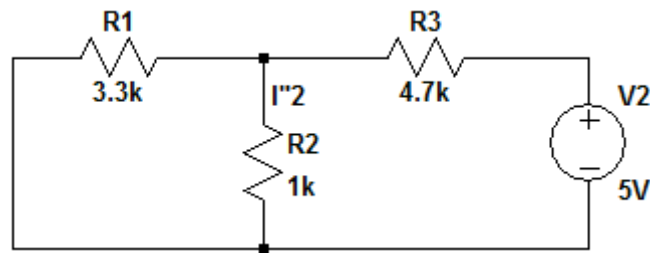
Circuit Diagram



Circuit 1



Circuit 2



Circuit 3

Procedure:

1. Set up Circuit 1.
2. Mark the polarities of each resistor.
3. With both the voltage source connected to the circuit, measure I_2 , V_{R1} , V_{R2} , V_{R3} and record the values in appropriate tables.
4. Setup Circuit 2. Measure and record I'_2 , V'_{R1} , V'_{R2} , V'_{R3} .
5. Setup Circuit 3. Measure and record I''_2 , V''_{R1} , V''_{R2} , V''_{R3} .

NORTH SOUTH UNIVERSITY

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING



EEE141L/ETE141L

Data Collection for Lab 5:

Group No. _____

Table 1:

| I_2 | I_2' | I_2'' | $I_2' + I_2''$ |
|-------|--------|---------|----------------|
| | | | |

Table 2:

| V_{R1} | V_{R1}' | V_{R1}'' | $V_{R1}' + V_{R1}''$ |
|----------|-----------|------------|----------------------|
| | | | |

Table 3:

| V_{R2} | V_{R2}' | V_{R2}'' | $V_{R2}' + V_{R2}''$ |
|----------|-----------|------------|----------------------|
| | | | |

Table 4:

| V_{R3} | V_{R3}' | V_{R3}'' | $V_{R3}' + V_{R3}''$ |
|----------|-----------|------------|----------------------|
| | | | |

Questions:

1. What is Superposition Theorem?
2. Theoretically calculate all values of Table 1 to Table 4. **Show all the steps in details.**
3. Using measured data show that your circuit followed superposition theorem.
4. Find the % Error between your theoretical and experimental values.