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MIT WORLD PEACE UNIVERSITY | PUNE
TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

S. Y. B. Tech. (Electrical and Computer Engineering)

Semester: IV **Subject: Electrical Circuit Analysis**

Name: Shreerang Mhatre **Class:**

Roll No: 29 **Batch:** A2

Experiment No: 07

Name of the Experiment: Verification of Superposition Theorem using MATLAB Simulink.

Performed on: 11/10/2022

Submitted on: 3/11/2022

Marks	Teacher's Signature with Date
	Mw 3-11-22

Aim: To verify the Superposition Theorem using MATLAB Simulink.

Prerequisite: Knowledge of network theorem and MATLAB Simulink.

Theory:

The Superposition Theorem is used to solve complex networks with a number of energy sources. It is an important concept to determine voltage and current across the elements by calculating the effect of each source individually. And combine the effect of all sources to get the actual voltage and current of the circuit element. The theorem states that, *"In any linear bilateral network having a greater number of sources, the response (voltage and current) in any element is equal to the summation of all responses caused by individual source acting alone. While other sources are eliminated from the circuit."*

In other words, we will consider only one independent source acting at a time. So, we need to remove other sources. The voltage sources are short-circuited and the current sources are open-circuited for ideal sources. If the internal resistance of sources is given, you need to consider the circuit.
The superposition theorem is only applied to the circuit which follows Ohm's law.

Applications of Superposition theorem:

- Superposition theorem can be used for AC and DC networks.
- When the number of independent sources is more, it is easy to find a response of the network.
- It helps to calculate current passes and the voltage across the element by calculating the effect of each energy source individually. And after we can determine the combined effect on elements from all sources.

Limitations of Superposition Theorem:

- Superposition theorem cannot apply to the circuit having only a dependent source. It needed at least two independent sources.
- This theorem only applicable to the network which consists of linear elements. It cannot apply to the non-linear elements like a diode, transistor, etc.
- We cannot calculate power by this theorem. As the power is proportional to the square of voltage and current as it becomes non-linear.
- This theorem is not applicable in a condition where the resistance varies with voltage and current. For all energy sources, the value of resistance must remain constant.
- This theorem only applicable to the bilateral elements. If the response of the network depends on the direction of the current, this theorem is not applicable.

Procedure:

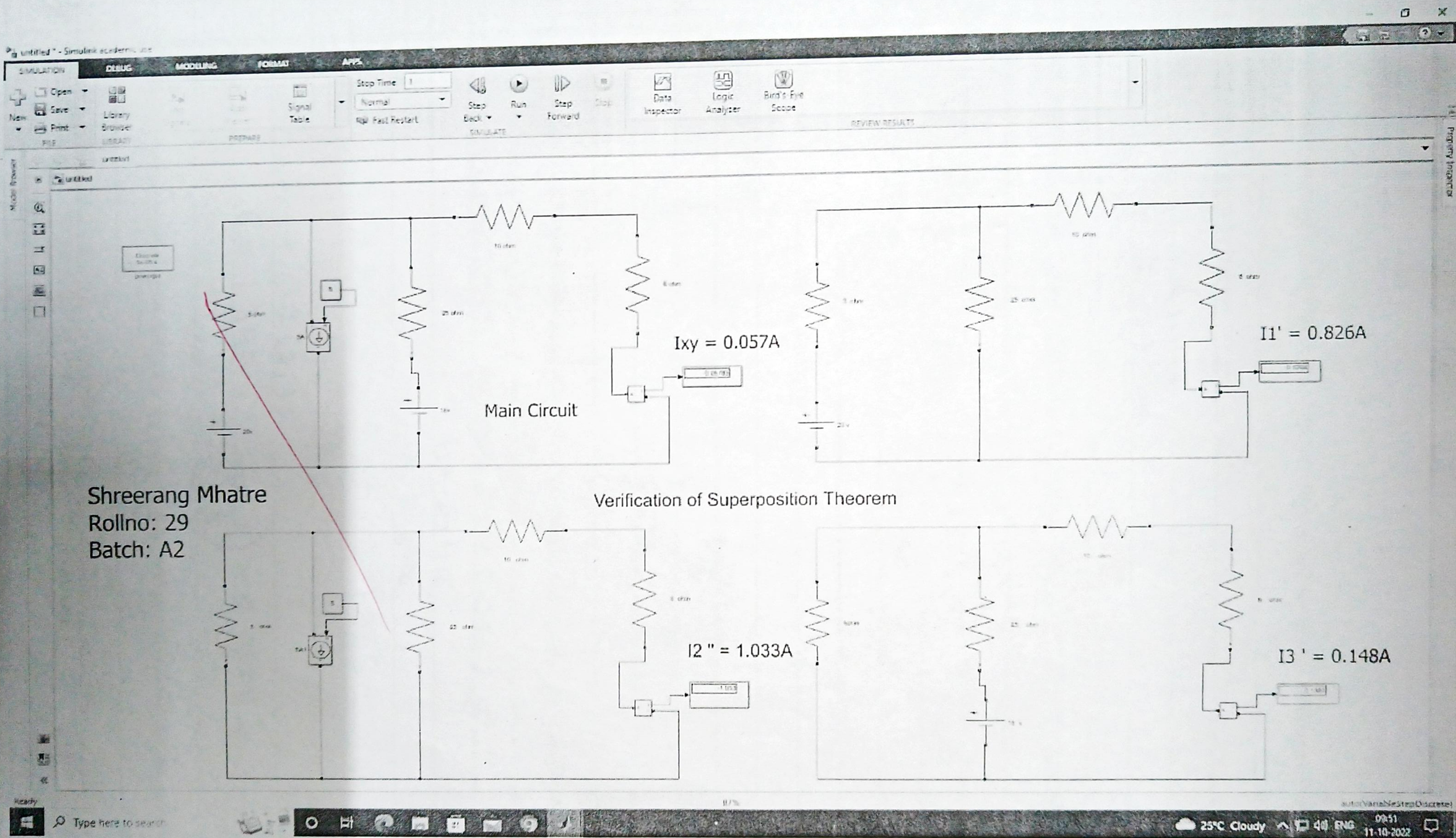
1. Start MATLAB.
2. Start Simulink, open the blank model.
3. Build the circuit as given in the class and measure current in required branch.
4. Build new circuit with only one source and removing other sources. Measure current in required branch.
5. Repeat step 4 for all other sources individually.
6. Verify that sum of all the individual currents is equal to current measured in step 3.

Activity:

Attach screenshots of above activity.

Post Lab Questions:

1. Show the detailed solution of the above problem.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SIMULATION
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Stop Time
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
Data Inspector
Logic Analyzer
Bird's Eye Scope
REVIEW RESULTS
Property Inspector
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Main Circuit
Ixy = 0.057A
I1' = 0.826A
Verification of Superposition Theorem
Shreerang Mhatre
Rollno: 29
Batch: A2
I2 " = 1.033A
I3 ' = 0.148A
Ready
Type here to search
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11-10-2022

* Calculations-

* Post Lab Questions -

Q 1) show the detailed solution of the above problem

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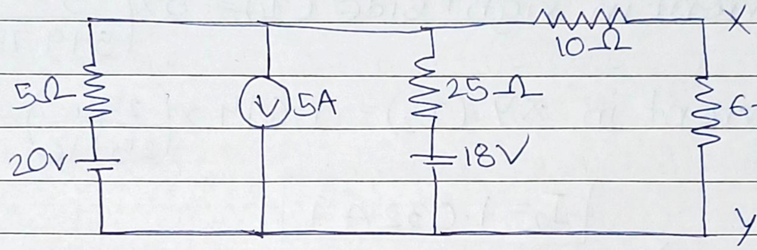
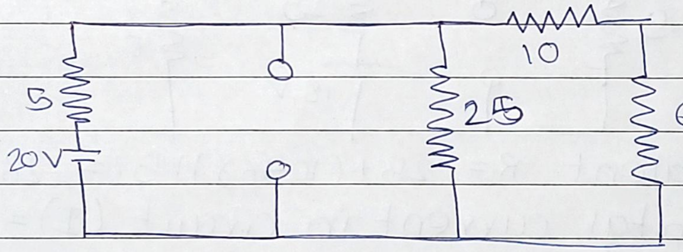


step I)



Equivalent $R = 5 + 25 \parallel (10+6)$

$= 5 + 25 \parallel 16$

$= 14.756\,\Omega$

$\therefore I = \frac{V}{R} \Rightarrow I = \frac{20}{14.756} = 1.355\,A$

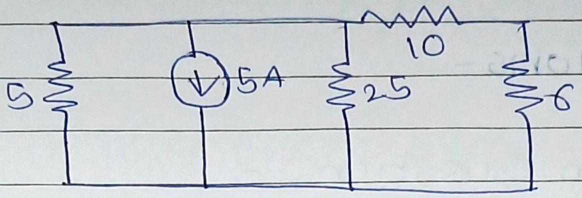
Current $6\,\Omega$ (I_1):

$I_1 = 1.355 \times \left(\frac{25}{25+16}\right) = 0.826\,A \downarrow$

$\boxed{I_1 = 0.826\,A\downarrow}$

FOR EDUCATIONAL USE

step II)



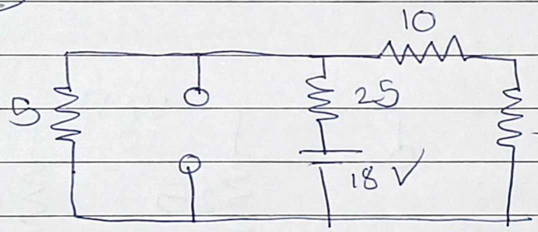
equivalent R on right side $= 25 \parallel (10+6) = 9.756\,\Omega$

current in right side $(I) = 5 \times \left(\frac{5}{5+9.756}\right) = 1.694A$

current in XY $(I_2) = 1.694 \times \left(\frac{25}{25+16}\right)$

$\boxed{I_2 = 1.032A\uparrow}$

step III)



Equivalent $R = 25 + (10+6) \parallel 5 = 28.809\,\Omega$

$\therefore$ Total current in circuit $(I) = \frac{18}{28.809}$

$I = 0.624A$

$\therefore$ current in XY $(I_3) = 0.624 \times \left(\frac{5}{16+5}\right)$

$\therefore \boxed{I_3 = 0.148A\downarrow}$

$\therefore$ Total current in XY $(I_{XY}) = I_1 + I_2 + I_3$

$= 0.826 - 1.032 + 0.148$

$= -0.058A$

$\therefore \boxed{I_{XY} = 0.058A\uparrow}$

3-11-22