

University of engineering & technology Peshawar



Circuit & system-1

Lab report # 10

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Submitted to:

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ASSESSMENT RUBRICS LAB # 10

Mesh Current Analysis using PSPICE

LAB REPORT ASSESSMENT				
Criteria	Excellent	Average	Nil	Marks Obtained
1. Objectives of Lab	All objectives of lab are properly covered [Marks 0.5]	Objectives of lab are partially covered [Marks 0.25]	Objectives of lab are not shown [Marks 0]	
2. Mesh Current Analysis (Theory, Circuit Diagram)	Brief introduction about Mesh Current Analysis (what is Mesh current analysis, What are meshes, How to apply KVL equations in each mesh) is shown along with properly labeled circuit diagram [Marks 1]	Some of the points about Mesh Current Analysis are missing and circuit diagram is not properly labeled [Marks 0.5]	Introduction about Mesh Current Analysis and circuit diagram is not shown [Marks 0]	
3. PSPICE Simulator	Brief introduction of PSPICE simulator [Marks 1]	Brief introduction of PSPICE simulator Is not shown [Marks 0]		
4. Procedure	All experimental steps are shown in detail along with how to verify Mesh Current Analysis. [Marks 1]	Some of the experimental steps are missing [Marks 1]	Experimental steps are missing [Marks 0]	
5. Observations & Calculations	Mathematical calculations are shown and comparison with PSPICE results. [Marks 5]	Mathematical calculations are shown but no comparison with PSPICE results [Marks 2.5]	No mathematical calculations are shown [Marks 0]	
6. Conclusion	Conclusion about experiment is shown [Marks 1]	Conclusion about experiment is partially shown [Marks 0.5]	Conclusion about experiment is not shown [Marks 0]	
Total Marks Obtained: _____				
Instructor Signature: _____				

MESH CURRENT ANALYSIS USING PSPICE

INTRODUCTION:

In this lab we will apply KCL to a circuit and will calculate current entering and leaving the circuit.

OBJECTIVES OF LAB:

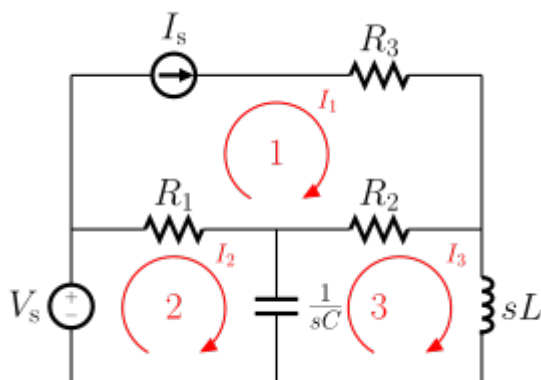
There are several benefits of Kirchhoff's current Law are given below:

1. To Know about the Kirchhoff current Law.
2. Application of Kirchhoff current law in circuits.
3. To analyze the circuit and circuit elements.
4. To know about loop currents.

MESH CURRENT ANALYSIS

DEFINITION:

- **Mesh analysis** (or the **mesh current method**) is a method that is used to solve planar circuits for the current (and indirectly the voltage) at any place in the electrical circuit.
- Planar circuits are circuits that can be drawn on a plane surface with no wires crossing each other.
- A more general technique, called **loop analysis** (with the corresponding network variables called **loop currents**) can be applied to any circuit, planar or not.
- Mesh analysis and loop analysis both make use of kirchoff voltage law to arrive at a set of equations guaranteed to be solvable if the circuit has a solution.^[1]
- Mesh analysis is usually easier to use when the circuit is planar, compared to loop analysis.^[2]



STEPS:

- Identify the meshes, (the open windows of the circuit).
- Assign a current variable to each mesh, using a consistent direction (clockwise or counterclockwise).
- Write Kirchhoff's Voltage Law equations around each mesh.
- Solve the resulting system of equations for all mesh currents.
- Solve for other element currents and voltages you want using Ohm's Law.

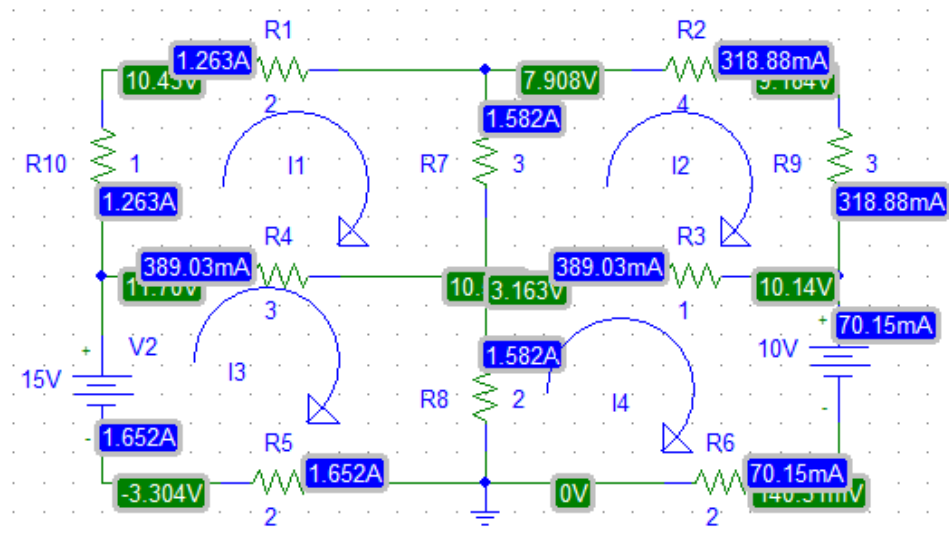
EXPLANATION:

- Mesh analysis works by arbitrarily assigning mesh currents in the essential meshes (also referred to as independent meshes).
- An essential mesh is a loop in the circuit that does not contain any other loop.
- A mesh current is a current that loops around the essential mesh and the equations are set solved in terms of them.
- A mesh current may not correspond to any physically flowing current, but the physical currents are easily found from them.^[2] It is usual practice to have all the mesh currents loop in the same direction.
- This helps prevent errors when writing out the equations.
- The convention is to have all the mesh currents looping in a clockwise direction.

Solving for mesh currents instead of directly applying Kirchhoff's current law and Kirchhoff's voltage law can greatly reduce the amount of calculation required. This is because there are fewer mesh currents than there are physical branch currents.

In figure BELOW for example, there are six branch currents but only three mesh currents.

CIRCUIT DIAGRAM:



MESH:

“A mesh is a closed path in a circuit with no other paths inside it. In other words, a loop with no other loops inside it.”

PSPICE SIMULATOR:

SPICE (Simulation Program with Integrated Circuit Emphasis) is a general-purpose, open source analog electronic circuit simulator. It is a program used in integrated circuit and board-level design to check the integrity of circuit designs and to predict circuit behavior.

PSPICE is a computer-aided simulation program that enables you to design a circuit and then simulate the design on a computer. As this is one of its main purposes, it is used extensively by electronic design engineers for building a circuit and then testing out how that circuit will simulate.

PSPICE stands for Program Simulation with Integrated Circuit Emphasis. The Electronics Research Laboratory of the University of California developed it and made it available to the public in 1975. PSPICE is largely popular because of its user-friendly interface, extensions that support modeling of digital circuits, and its no-cost basic version.

PSPICE is a general purpose program designed for a wide range of circuit simulation including the simulation of nonlinear circuits, transmission lines, noise and distortion, digital circuits, mixed digital and analog circuits. It can perform dc analysis, steady-state sinusoidal (AC) analysis, transient analysis, and Fourier series analysis.

PROCEDURE:

Procedure to analyze complex circuit using PSPICE as follows.

- First of all open the simulation software (PSPICE).
- Open the workspace.
- Then open the schematic diagram.
- Name your workspace and give it a location.
- Click on “draw” and then click on “Get New Part” from a drop off menu.
- Write the name of component you want to use.
- Click “place” and place the component where you want.
- Click on part value to change its value.
- Write VDC for DC voltage supply.
- Write gnd for ground.
- Write R for resistance.
- Click on “Draw wire” to draw wire.
- In the above figures we can see that we have found the node voltages and mesh current, so put the different components in the schematic.

EXPERIMENTAL STEPS:

1. Draw your circuit in PSPICE.
2. Simulate the circuit.
3. Click on I to get current.
4. Note down on the resistor for corresponding mesh that does not appear in any other mesh.

OBSERVATIONS AND CALCULATIONS:

I_1	I_2	I_3	I_4
1.263A	318.88mA	1.65A	70.15mA

CONCLUSION:

Mesh analysis (or the mesh current method) is a method that is used to solve planar circuits for the currents (and indirectly the voltages) at any place in the electrical circuit. ... Mesh analysis is usually easier to use when the circuit is planar, compared to loop analysis.

After attending this lab, I am able to solve the circuits using mesh current analysis and clearly understood the concept of mesh, loop and mesh current.

.....T H E E N D.....