

EE301L (Spring 2009)

Laboratory Project 6 -Mesh Analysis

Objective

The objective of Lab 6 is to explore the concepts behind Mesh Analysis. At the end of the lab, the student should have a good understanding of the difference between branch and mesh currents.

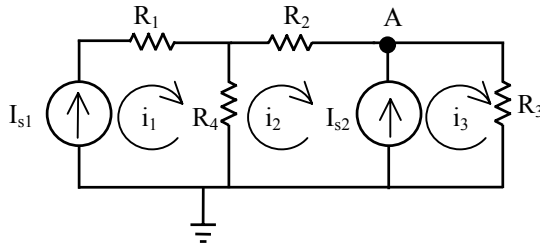


Figure 1: Circuit 1

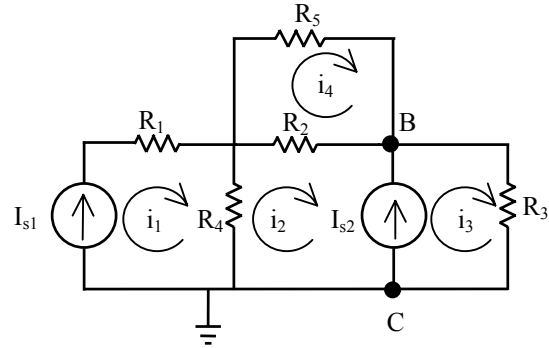


Figure 2: Circuit 2

Given that $R_1=150\Omega$, $R_2=220\Omega$, $R_3=100\Omega$, $R_4=330\Omega$, $R_5=150\Omega$, $I_{s1}=40\text{ mA}$, $I_{s2}=15\text{ mA}$. **Please use the resistor values given. Otherwise the voltages will be high.**

Preliminary: (complete before lab)

- Using Mesh Analysis, find the mesh currents for each circuit.
- Find the current through each resistor using the mesh currents for each circuit.
- Find the voltage drop across each resistor.
- Find the voltage across the source(s) for each circuit.
- Find the amount of power that each source contributes and the amount of power that each resistor dissipates for each circuit.

Table 1: Preliminary Calculations for Circuit 1

Parameter	Calculated Value	Parameter	Calculated Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_{R1}		V_{R4}	
i_{R2}		P_{R1}	
i_{R3}		P_{R2}	
i_{R4}		P_{R3}	
V_{is1}		P_{R4}	
V_{is2}		P_{is1}	
		P_{is2}	

Table 2: Preliminary Calculations for Circuit 2

Parameter	Calculated Value	Parameter	Calculated Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_4		V_{R4}	
i_{R1}		V_{R5}	
i_{R2}		P_{R1}	
i_{R3}		P_{R2}	
i_{R4}		P_{R3}	
i_{R5}		P_{R4}	
V_{is1}		P_{R5}	
V_{is2}		P_{is1}	
		P_{is2}	

Experimental:

Measure the resistors and current sources and enter their values into Table 3. Be sure to measure the current sources after they are in the circuit to ensure that they are not being limited by the voltage.

Table 3: Measured Values for the Resistors and Supplies

Parameter	Calculated Value
R_1	
R_2	
R_3	
R_4	
$R_5(\text{cir. 2 only})$	
I_{S1}	
I_{S2}	

Measure and record the quantities asked for in Tables 4 and 5.

Table 4: Measured Values for Circuit 1

Parameter	Measured Value	Parameter	Measured Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_{R1}		V_{R4}	
i_{R2}		V_{is1}	
i_{R3}			
i_{R4}			

Table 5: Measured Values for Circuit 2

Parameter	Measured Value	Parameter	Measured Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_4		V_{R4}	
i_{R1}		V_{R5}	
i_{R2}		V_{is1}	
i_{R3}		V_{is2}	
i_{R4}			
i_{R5}			

Analysis

- Recalculate the preliminary parameters with the actual resistance and voltage source values and record the results in Tables 6 and 7.

Table 6: Preliminary Calculations for Circuit 1

Parameter	Calculated Value	Parameter	Calculated Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_{R1}		V_{R4}	
i_{R2}		P_{R1}	
i_{R3}		P_{R2}	
i_{R4}		P_{R3}	
V_{is1}		P_{R4}	
		P_{is1}	

Table 7: Preliminary Calculations for Circuit 2

Parameter	Calculated Value	Parameter	Calculated Value
i_1		V_{R1}	
i_2		V_{R2}	
i_3		V_{R3}	
i_4		V_{R4}	
i_{R1}		V_{R5}	
i_{R2}		P_{R1}	
i_{R3}		P_{R2}	
i_{R4}		P_{R3}	
i_{R5}		P_{R4}	
V_{is1}		P_{R5}	
V_{is2}		P_{is1}	
		P_{is2}	

- Calculate the percent difference between the calculated currents through each resistor (Tables 6 and 7) and the experimental values (Tables 4 and 5) for both circuits.

Table 8: Percentage Differences for Circuit 1

Parameter	Percent Difference
i_{R1}	
i_{R2}	
i_{R3}	
i_{R4}	

Table 9: Percentage Differences for Circuit 2

Parameter	Percent Difference
i_{R1}	
i_{R2}	
i_{R3}	
i_{R4}	
i_{R5}	

1. For both circuits, show with a calculation that the power put into the circuit by the source(s) was equal to that dissipated by the resistors.

2. What is the relationship for the current through each resistor in terms of the mesh currents for both circuits – show direction.

An example: $i_{R6} = i_5 - i_6 = 2.4 - 1.4 = 1 \text{ A} \rightarrow$

3. Analyze KCL at Nodes A, B, and C with respect to source currents and both mesh currents and branch currents.

