

EE301L (Spring 2009)
Laboratory Project 5 - Node Analysis

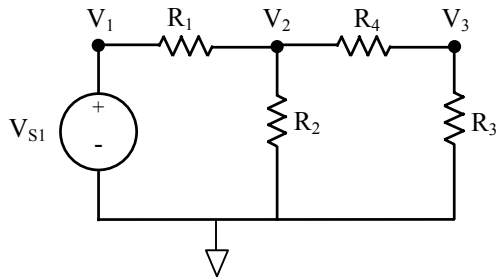


Figure 1: Circuit 1 for Node Analysis

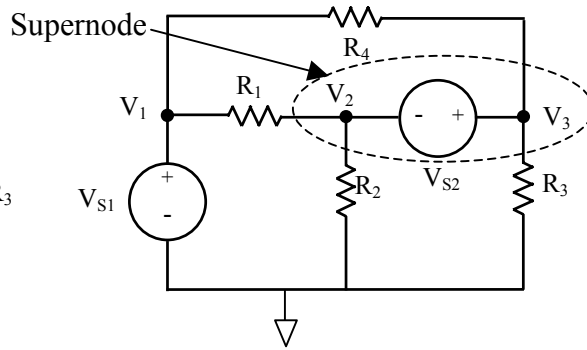


Figure 2: Circuit 2 for Node Analysis

Given that $R_1=3.3 \text{ k}\Omega$, $R_2=2.2 \text{ k}\Omega$, $R_3=1.5 \text{ k}\Omega$, $R_4=680 \text{ }\Omega$, $V_{s1}=30 \text{ volts}$, $V_{s2}=10 \text{ volts}$.

Preliminary: (complete before lab)

- Using Node Analysis, find the voltages at V_1 , V_2 , and V_3 for each circuit.
- Find the current through each resistor for each circuit.
- Find the current through the source(s) for each circuit.
- Find the voltage drop across each resistor using the node voltages.
- 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
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		P_{R1}	
i_3		P_{R2}	
i_4		P_{R3}	
i_{vs1}		P_{R4}	
		P_{vs1}	

Table 2: Preliminary Calculations for Circuit 2

Parameter	Calculated Value	Parameter	Calculated Value
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		P_{R1}	
i_3		P_{R2}	
i_4		P_{R3}	
i_{vs1}		P_{R4}	
i_{vs2}		P_{vs1}	
		P_{vs2}	

Experimental:

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

Table 3: Measured Values for the Resistors and Supplies

Parameter	Measured Value
R_1	
R_2	
R_3	
R_4	
V_{S1}	
V_{S2} (cir. 2 only)	

Table 4: Measured Values for Circuit 1

Parameter	Measured Value	Parameter	Measured Value
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		i_{vs1}	
i_3			
i_4			

Table 5: Measured Values for Circuit 2

Parameter	Measured Value	Parameter	Measured Value
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		i_{vs1}	
i_3		i_{vs2}	
i_4			

Analysis:

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

Table 6: Analysis Calculations for Circuit 1

Parameter	Calculated Value	Parameter	Calculated Value
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		P_{R1}	
i_3		P_{R2}	
i_4		P_{R3}	
i_{vs1}		P_{R4}	
		P_{vs1}	

Table 7: Analysis Calculations for Circuit 2

Parameter	Calculated Value	Parameter	Calculated Value
V_1		V_{R1}	
V_2		V_{R2}	
V_3		V_{R3}	
i_1		V_{R4}	
i_2		P_{R1}	
i_3		P_{R2}	
i_4		P_{R3}	
i_{vs1}		P_{R4}	
i_{vs2}		P_{vs1}	
		P_{vs2}	

- Calculate the percent difference between the calculated node voltages and currents (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
V_1	
V_2	
V_3	
i_1	
i_2	
i_3	
i_4	
i_{vs1}	

Table 9: Percentage Differences for Circuit 2

Parameter	Percent Difference
V_1	
V_2	
V_3	
i_1	
i_2	
i_3	
i_4	
i_{vs1}	
i_{vs2}	

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 voltage across each resistor in terms of the node voltages for both circuits. An example: $V_{R1} = V_1 - V_2 = 20 - 6.6 = 13.4$ volts
3. Using the current measurements, calculate (show work) KCL for all 3 nodes in each circuit?
4. Using the current measurements, calculate KCL for the supernode.

