

# ENGR 201 Questions, Homework 3

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For this and all homework assignments, you should show enough work that the assignment is self supporting. Write out the problem, explain any researched information needed to solve the problem, and show your work in an organized manner. I encourage you as students to post questions onto Canvas concerning this assignment.

## **Nodal Analysis (4 points)**

Calculate the voltages of each node on the circuit, with reference to ground. Use the following procedure for each circuit.

1. Draw circuit
2. Label nodes
3. List KCL Equations
4. Perform Ohm's Law substitutions
5. Identify an equation per unknown voltage
6. Solve system of equations
7. Summarize final voltages for each node
8. Validate answers with LTSpice simulation

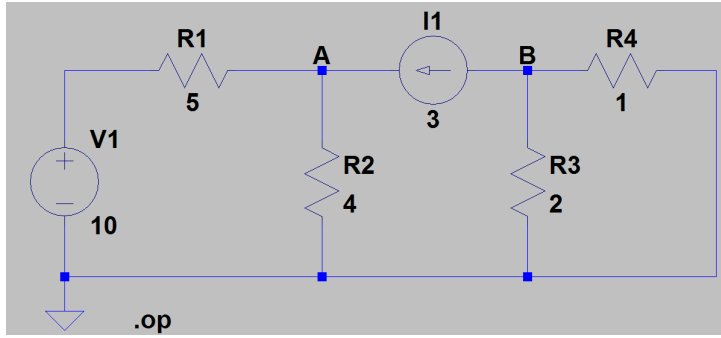


Figure 1: First circuit for nodal analysis

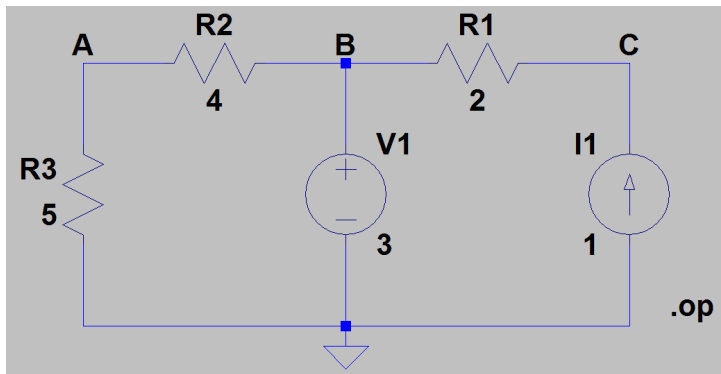


Figure 2: Second circuit for nodal analysis

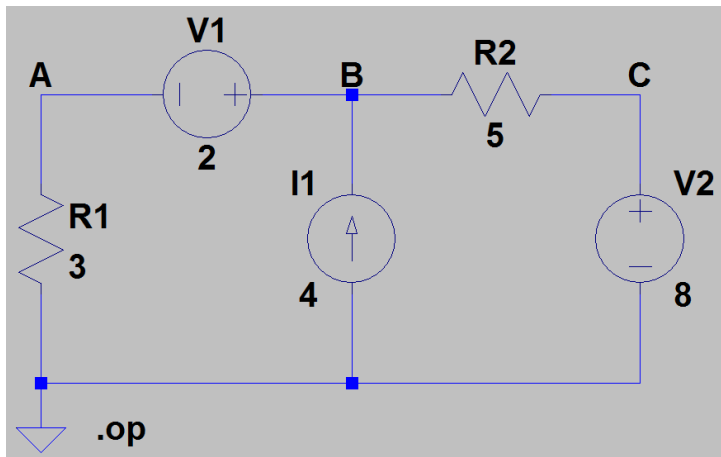


Figure 3: Third circuit for nodal analysis

## Mesh Analysis (4 points)

Calculate the mesh currents of each mesh on the circuit. Use the following procedure for each circuit.

1. Draw circuit
2. Label meshes
3. List KVL Equations
4. Perform Ohm's Law substitutions
5. Identify an equation per unknown mesh current
6. Solve system of equations
7. Summarize final mesh currents for each mesh
8. Validate answers with LTSpice simulation

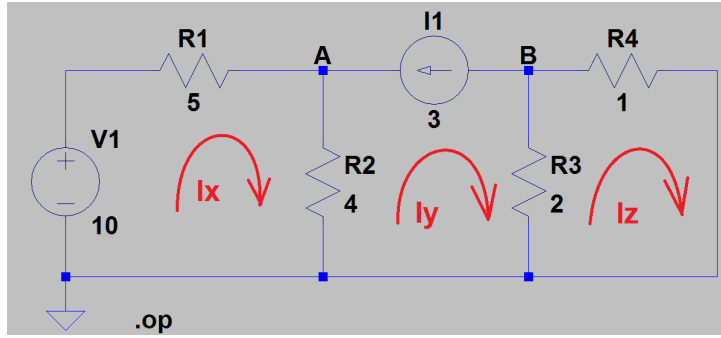


Figure 4: First circuit for mesh analysis

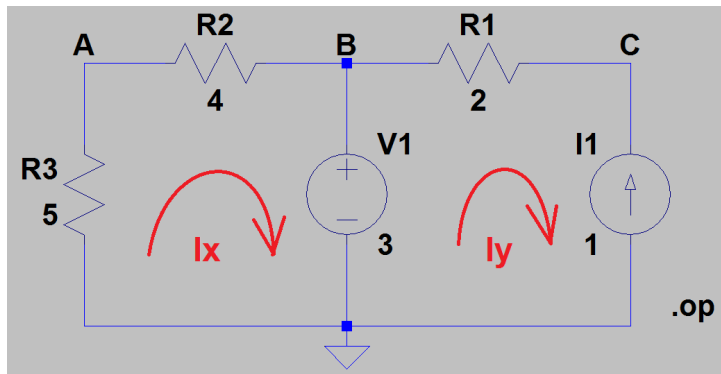


Figure 5: Second circuit for mesh analysis

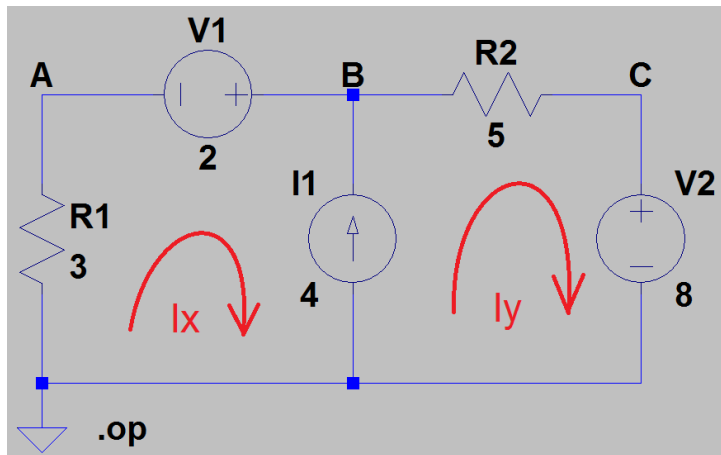


Figure 6: Third circuit for mesh analysis

## DC Sweep Analysis (4 points)

Calculate the voltages of each node on the circuit, with reference to ground. Use the following procedure for each circuit. Note that F1 is a current controlled current source (CCCS). It is 100 times the current going through V2, using passive sign convention. The details of F2 are shown to the right of the circuit.

1. Draw circuit, with V1 being 2 volts
2. Label nodes
3. Solve equations
4. Summarize final voltages for each node, with V1 being 2 volts
5. Validate answers with LTSpice simulation
6. Note the DC sweep option shown in the lower left hand corner of Figure 7[1] [2]. This sweeps V1 from 0 volts to 10 volts in .1 volt increments. Use this option to identify the range of inputs in V1 that meets the following criteria.

$I_{V2} > 0$  (Current going through V2 is positive) and  $V_C > .2$  (Voltage of node C is higher than .2 volts above ground).

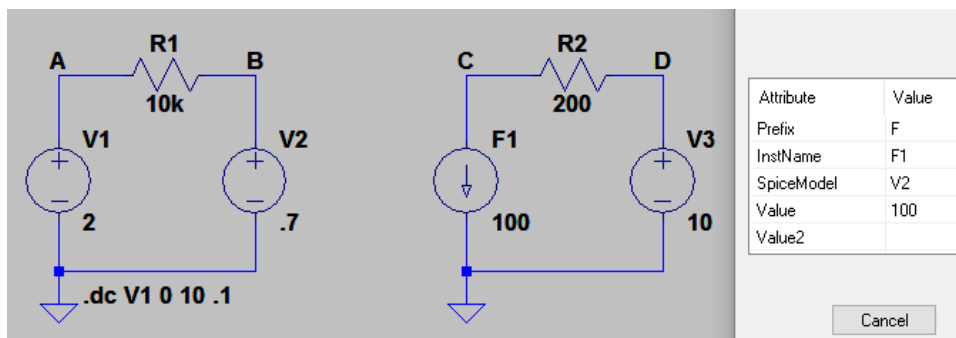


Figure 7: Circuit for DC Sweep Analysis

## References

- [1] EECSatOSU, "How to simulate a variable resistor in ltspice." [http://eecs.oregonstate.edu/education/docs/tutorials/LT%20Spice\\_VarResistor.pdf](http://eecs.oregonstate.edu/education/docs/tutorials/LT%20Spice_VarResistor.pdf).
- [2] ElectronicsBeliever, "How to sweep voltage in ltspice step by step tutorials." <http://electronicsbeliever.com/how-to-sweep-voltage-in-ltspice/>.