

3.2.2: Nodal Analysis

Overview:

In this lab, we will analyze, build, and test a circuit containing multiple sources. Except in special cases, multiple sources preclude the use of analysis techniques based entirely on circuit reduction approaches. In this assignment, we will use nodal analysis to predict the circuit behavior prior to building and testing the circuit. We will then compare the measured circuit response with our expectations based on our analysis.

It should be noted that analysis techniques other than nodal analysis can be used to predict the circuit's response. The approach used to analyze the circuit does not, however, affect the actual circuit's behavior. Other lab assignments will use this same circuit, in conjunction with other analysis techniques. Please keep in mind that the circuit's physical behavior is not affected by the analysis technique used; the same measurement on the same circuit should provide the same result, regardless of the approach used to predict the response.

Before beginning this lab, you should be able to:

- Predict node voltages in a circuit using nodal analysis techniques
- Use node voltages to predict physical voltages and currents in an electric circuit
- Use a digital multimeter to measure resistance, voltage, and current
- Use the Analog Discovery module to apply and measure constant voltages





After completing this lab, you should be able to:

- Compare measured voltages and currents in an electrical circuit with predictions based on nodal analysis techniques

This lab exercise requires:

- Analog Discovery module
- Digilent Analog Parts Kit
- Digital multimeter

Symbol Key:

-  Demonstrate circuit operation to teaching assistant; teaching assistant should initial lab notebook and grade sheet, indicating that circuit operation is acceptable.
-  Analysis; include principle results of analysis in laboratory report.
-  Numerical simulation (using PSPICE or MATLAB as indicated); include results of MATLAB numerical analysis and/or simulation in laboratory report.
-  Record data in your lab notebook.

General Discussion:

This lab assignment concerns the circuit shown in Figure 1 below. We want to determine the voltage difference V_1 and the current I_1 .

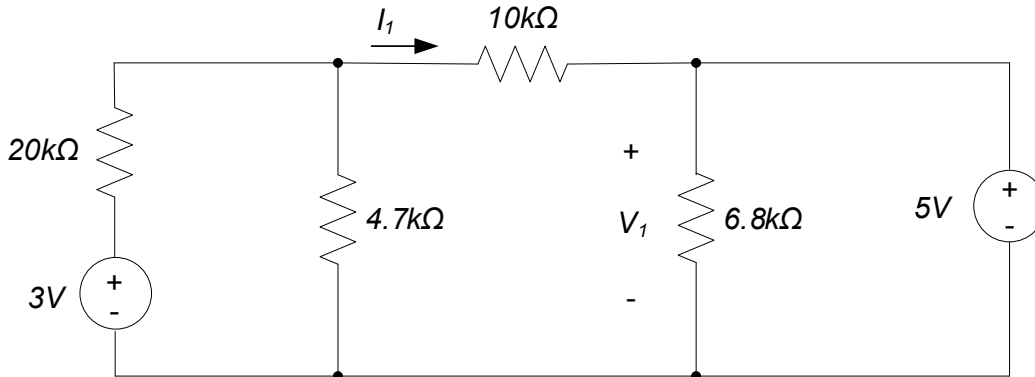


Figure 1. Circuit schematic.

Pre-lab:

ANALYSIS Use nodal analysis techniques to predict the voltage V_1 and the current I_1 in the circuit of Figure 1.

Lab Procedures:

- DATA** 1. Construct the circuit of Figure 1; measure and record all actual resistance values. Use whichever voltage supplies you want to implement the voltage sources in the circuit. Measure the voltage V_1 and the current I_1 in the circuit. Calculate a percent error between the measured values and your predictions from the pre-lab.
ANALYSIS
- DEMO** 2. Demonstrate operation of your circuit to the Teaching Assistant. Have the TA initial the appropriate page(s) of your lab notebook and the lab checklist.