Laboratory #2

Electrical and Computer Engineering

**The Reality of Node Voltage and Circuit Reduction**

Rahul Manay And Borja Rojo

Objectives

The objectives of this lab are to test the theory of Node Voltage Analysis and Resistor Circuit Reduction in a real setting.

Procedures

1. Node Voltage Analysis

This section of the lab had us calculate theoretical values for the node V­­a, Vb, Vc, and Vd in a circuit and then compare those values to real measurements of voltage at those nodes.



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| --- | --- | --- |
| Quantity | Predicted Value | Measured Value |
| VA | 10V \* (1044.77Ω/1144.77Ω) = **9.12V** | **9.18V** |
| VB | 9.12V \* (166.66Ω/1266.66Ω) = **1.302V** | **1.302V** |
| VC | 1.302V \* (100Ω/200Ω) = **.651V** | **.653V** |
| VD | **10V** | **10.04V** |

|  |  |  |
| --- | --- | --- |
| Quantity | Predicted Value | Measured Value |
| VA | 5V \* (1044.77Ω/1144.77Ω) = **4.56V** | **4.64V** |
| VB | 4.56V \* (166.66Ω/1266.66Ω) = **.651V** | **.657V** |
| VC | .651V \* (100Ω/200Ω) = **.325V** | **.330V** |
| VD | **5V** | **5.01V** |

The theoretical and the measured values are incredibly close. They all are within 5% of each other. This experimental data shows that Node Voltage Analysis is an accurate and useful was of analyzing theoretical circuits.

2. Circuit Reduction

This part of the lab had us reconfigure a given circuit and create an equivalent circuit in the perspective of a node above a give RL. We did this by measuring the voltage at that node when RL was not there, by calculating the Short Circuit current between ground and the RL node, and using these values to try and create a circuit that matches.



Measurements:

Voc = 5.05V

Isc = 34.06 mA

VRL = 4.49 V

The reduction of the circuit to one Practical Voltage Source and one Load Resistor only needs 10V (assuming that we keep the same voltage) and two 146Ω resistors to have the node after the PVS and the Load Resistor. Practically, we would use two 150Ω resistors.

We were then asked to create a real version of our reduction and measure the values of the current and voltage when removing the Load Resistor and the voltage across the Load Resistor when it was in the circuit.

Measurements:

Voc = 10.12V

Isc = 67.5 mA

VRL = 4.94V

These values are consistent. This shows that the voltage across the load resistor is about half of the source voltage, which is perfect because the full circuit consists of two equally valued resistors. The current measurement is also consistent because when measuring the current, only one resistor was in, so there was half as much resistance. This created twice the amount of current that would usually flow through the node.