**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

**ET 110 – Introduction to Circuit Analysis Laboratory**

**Lab#8**

Series-Parallel Circuits and In-circuit resistance measurement

**Inspector: Prof. Wu**

**Date 10/7/16**

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**Objective**

* Understanding the series-parallel circuits
* Know how to calculate the total resistance
* Realize the currents and voltages distribute in the series-parallel circuits
* Measure the current, voltage and resistance in the series-parallel circuits
* Provide KCL and KVL in the series-parallel circuits

**Components’ list**

* Power supply
* DMM
* Jumper wires
* Resistors: 100Ω; 330Ω; 680Ω; 150Ω; 220Ω; 470Ω

**Experimental**

* **Part 1: Resistance Measurement in a Series-Parallel Circuit**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **% difference** |
|  | 322.18Ω | 335.02Ω | 3.99% |
| Table 8.1- Total Resistance analysis in a Series-Parallel Circuit, Circuit 8.1 | | | |

* **Part 2: Current analysis in a Series-Parallel Circuit**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Current through current source** | **Current Through** | **Current Through** | **Current Through** | **Does KCL Hole?** |
| **Measured Value** | 27.54mA | 27.53mA | 18.62mA | 9.05mA | Yes |
| **Calculated Value** | 27.93mA | 27.93mA | 18.82mA | 9.13mA | Yes |
| **% Difference** | -1.4% | -1.43% | -1.06% | -0.09% |  |
| Table 8.2-Current analysis in a Series-parallel Circuit, Circuit 8.1 | | | | | |

* **Part 3: Voltage analysis in a Series-Parallel Circuit**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Voltage through current source** | **Voltage Through** | **Voltage Through** | **Voltage Through** | **Does KVL Hole?** |
| **Measured Value** | 8.97V | 2.78V | 6.19V | 6.18V | Yes |
| **Calculated Value** | 9V | 2.79V | 6.21V | 6.21V | Yes |
| **% Difference** | -0.33% | -0.36% | -0.32% | -0.48% |  |
| Table 8.3-Voltage analysis in a Series-parallel Circuit, Circuit 8.1 | | | | | |

* **Part 4: Resistance, Voltage, and Current analysis in a Series-Parallel Circuit**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **% difference** |
|  | 307.02Ω | 313.36Ω | 2.07% |
| Table 8.4- Total Resistance analysis in a Series-Parallel Circuit, Circuit 8.3 | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Current through current source** | **Current Through** | **Current Through** | **Current Through** | **Current Through** |
| **Measured Value** | 28.80mA | 28.79mA | 16.29mA | 16.29mA | 12.80mA |
| **Calculated Value** | 29.31mA | 29.31mA | 16.41mA | 16.41mA | 12.91mA |
| **% Difference** | -1.74% | -1.77% | -0.73% | -0.73mA | -0.85% |
| Table 8.5-Current analysis in a Series-parallel Circuit, Circuit 8.3 | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Voltage through current source** | **Voltage Through** | **Voltage Through** | **Voltage Through** | **Voltage Through** |
| **Measured Value** | 8.96V | 2.93V | 2.44V | 3.59V | 6.02V |
| **Calculated Value** | 9V | 2.93V | 2.46V | 3.61V | 6.07V |
| **% Difference** | -0.44% | 0% | -0.81% | -0.55% | -0.82% |
| Table 8.6-Voltage analysis in a Series-parallel Circuit, Circuit 8.3 | | | | | |

**Questions**

1. When we have the measurements of the voltage source and current source, we can use ohm’s law to calculate the total resistance.
2. First of all, we need to analysis the elements connection. Then if they are a series connection, we need the sum of the resistance. However, if they are a parallel connection, we need to use the reciprocal of conduction to get the resistance.
3. To obtain the resistance measurement by using an ohmmeter, we need to connect the both legs of the resistor and make sure the circuit are not energized. However, when we only connected one side of the resistor, it looks like we are measuring the resistance as an open circuit, so the resistance will be enormous.

**Conclusion**

In this lab, we are starting to realize the series-parallel circuits. There is serval of the difference between series-parallel circuits and others. First of all, the total resistance is not easy to find as like the series circuits and the parallel circuits. In other words, we cannot obtain the total resistance by the just sum of all the resistance or use the reciprocal of conduction to analysis the resistors. Likewise, we need to look the way of the circuit structure and understand the connection between the branches in the network. Meanwhile, if we can realize the elements connected by the series, let means they share the voltage source and have the same current through them. Otherwise, if they connected to the parallel circuit, then they will share the current source and have the same voltage. As we know the above, we are able to use the KCL or KVL in the series-parallel circuit to calculate the unknown value. The same way, we can use VDR or CDR to calculate the voltage and current. As a result, we have a series-parallel circuit, the most important thing is to figure out which part is the series and the parallel. After that, we are able to obtain the unknown value by using the rules in the series circuit or parallel circuit.