**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

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

**Lab#7**

Parallel Circuits, Kirchhoff’s Current law, and Current Divider Rule

**Inspector: Prof. Wu**

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**Objective**

* Understanding KCL
* Find currents, voltages, resistance and conductance in the parallel circuits
* Use the CDR to find each current through the parallel circuits
* Applications of parallel circuit

**Components’ list**

* DMM
* Power supply
* Jumper wires
* Resistors 1kΩ, 4.7kΩ, 3.3kΩ, 5.6kΩ and 1.5kΩ
* Cooling fan

**Experimental**

**Part 1: Two Resistors Connected In Parallel**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Measured Value** | **Calculated Value** | **% of difference** |
|  | 813.50Ω | 824.56Ω | -1.34% |
|  | 11.07mA | 10.91mA | 1.47% |
|  | 9.13mA | 9mA | 1.44% |
|  | 1.94mA | 1.91mA | 1.57% |
|  | 9.04V | 9V | 0.4% |
|  | 9.04V | 9V | 0.4% |
|  | 9.04V | 9V | 0.4% |
| Table 7.1-2 Resistors Circuit: Total resistance, Voltage and Current Measurements | | | |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Measured value** | 11.07mA | 9.13mA | 1.94mA |
| **Calculated value** | 11.07mA | 9.01mA | 1.92mA |
| **% of difference** | 0% | 1.33% | 1.04% |
| Table 7.2 – Current divider ruler in a 2 resistors circuit | | | |

**Part 2 – 3 Resistors Connected in Parallel Configuration**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Measured Value** | **Calculated Value** | **% of difference** |
|  | 666.59Ω | 674.95Ω | -1.24% |
|  | 13.54mA | 13.33mA | 1.58% |
|  | 9.14mA | 9mA | 1.56% |
|  | 2.74mA | 2.73mA | 0.36% |
|  | 1.63mA | 1.61mA | 1.24% |
|  | 9.04V | 9V | 0.4% |
|  | 9.04V | 9V | 0.4% |
|  | 9.04V | 9V | 0.4% |
|  | 9.04V | 9V | 0.4% |
| Table 7.3 - 3 Resistors Circuit: Total resistance, Voltage and Current Measurements | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **Measured value** | 13.54mA | 9.14mA | 2.74mA | 1.63mA |
| **Calculated value** | 13.51mA | 9.01mA | 2.73mA | 1.61mA |
| **% of difference** | 0.2% | 1.44% | 0.36% | 1.24% |
| Table 7.4 – Current divider ruler in a 3 resistors circuit | | | | |

**Part 3: Non-Resistive Components in Parallel**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | **Does KCL Hold?** |
| **Measured** | 67.18mA | 6.14mA | 60.24mA | Yes |
| Table 7.5 – Non-Resistive Components and KCL in parallel circuit | | | | |

**Question**

1. KCL in a parallel circuit was always the total current is equal sum all the currents through each element in table 7.3, 7.4 and 7.5
2. CDR is a way to find the individual current through the branch if you already know the total current, the resistance of the branch and the total resistance in the network. The formula will be
3. When the hair dryer plugs in the circuit, the hair dryer, air conditioner, television and light bulb are in a parallel circuit. In other words, they have the same amount of voltages across each one and different currents through individually. In addition, the total resistance in this network will be increased, even so with the same voltage source, the total current will be different also.

**Conclusion**

In this lab, we were learning how to work on the parallel circuit. First of all, we need to understand in a parallel circuit, the voltages across each element will be the same if the elements are connecting in the same node. Moreover, the way to calculate total resistance will not be same as in the way in a series circuit. In other words, to calculate total resistance in a 2- resistors parallel circuit, we can just use the formula . However, when we are working on a 3 or more resistors parallel circuit, we need to use conductance to help us. The reason is the conductance is the reciprocal of resistance, so that lead us to find the total resistance in a 3 or more resistors parallel circuit will be used the formula . In addition, we measure the total resistance in parallel circuit, we connect the leads from beginning of the network to the end of it. Furthermore, when we know the voltages and resistance, based on the ohm’s law, we can get the currents through each element and the total current in the network. We look at table 7.1 and 7.3, it is interesting each individual currents add together, we will have the same magnitude of the total current. As a results, that providing the currents in the parallel circuit is following the KCL. In the sample words, we can use KCL to get unknown current if we have enough information. Additional, we also can use CDR to get unknown current if we have others sources such as individual resistance, total resistance and total current in the parallel circuit.