# Lab4 Problem 10: Quantitative Circuit Analysis

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**Abstract**

**The circuit structure designed for experiment was determined. The supplied voltage of battery could be measured through DMM. The resistances of three resistors used in experiment were predetermined before experiment by DMM. The relationship equation about voltage, resistance and corresponding current flowing through the resistor in theory was initially calculated out. The experiment result under specific circuit design and variant supplied voltage was reasonably close to the result calculated out by the equation in theory.**

**Introduction**

**To calculate the current through resistors accurately, it is essential to derive a general equation for calculation under specific circuit structure and variant relative parameters.**

**Before making use of this equation for calculation, we should firstly check the precision of this equation. The corresponding circuit structure is built, and batteries and resistors were provided with measures voltage and resistance. By measuring and recording current flowing through resistor under such circuit structure and comparing the result to the predicted result , the accuracy of the equation could be proved and the aim of experiment is achieved**

**Prediction**

**Mathematically the current flowing through each resistors could be calculated following the Ohm’s law and Kirchhoff’s law. Under these two physics laws, we could derive three equations towards the experiment circuit:**

**From these three equations, the function of voltages of batteries and resistances to calculate the current through each resistors could be determined:**

**Procedure**

**Following the given circuit structure, we connected three batteries and three resistors. The resistances of three resistors are 43.5, 116.8 and 22.1 respectively, which is denoted as . Two of three batteries have stable voltage which are 6.43V and 6.52V. These two batteries are denoted as . The voltage of could be changed within a range. After the circuit has been built , we uniformly change the voltage of and use DMM to measure current under different . The was modified from 8V to 12V . After a set of data have been recorded, we compare them to the theoretical result calculated by the equation below to derive the experiment conclusion.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Theoretical** | **Theoretical** | **Theoretical** | **Experiment** | **Experiment** | **Experiment** |
|  | **6.43** | **8** | **0.02409** | **-0.00448** | **-0.01959** | **0.023** | **-0.0047** | **-0.019** |
|  | **6.52** | **9** | **0.040177** | **-0.00704** | **-0.03314** | **0.036** | **-0.008** | **-0.0285** |
|  | **43.5** | **10** | **0.056284** | **-0.0096** | **-0.04668** | **0.051** | **-0.011** | **-0.042** |
|  | **116.8** | **11** | **0.072391** | **-0.01217** | **-0.06023** | **0.066** | **-0.0139** | **-0.0544** |
|  | **22.1** | **12** | **0.088499** | **-0.01473** | **-0.07377** | **0.081** | **-0.0165** | **-0.0673** |

**Table1:**

**This table is built with 9 sets. The first two sets present 5 stable value of this experiment. The other 7 sets present the theoretical value and experimental value of the under different values of .**

**Analysis**

**Figure1: The comparison of experimental current and theoretical current**

**From figure 1, we could tell that the difference between theoretical current and experimental current reasonably close. The difference could be resulted from the error of measurement or the instability of the circuit component. To further prove the correctness of correctness of the equation**

**Conclusion:**