**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

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

**Lab#10**

Superposition analysis

**Inspector: Prof. Wu**

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**Student Name: XIN SHEN**

* **Objective**
* Understanding the Superposition Theorem and use it to solve superposition circuit.
* Measured voltages and currents in superposition circuit.
* Active each source of power individually and measure the voltages and currents through each element in the circuit.
* Analysis the current flow and voltage polarities for each element.
* Combine the results to get final voltages and currents through each element.
* Compare the results with the measurements in the superposition circuit.
* To analyzing the power works in superposition circuit.
* **Components’ list**
* Power supply
* DMM
* Protoboard
* Jump wires
* Resistors: 100Ω, 330Ω, and 220Ω
* **Experimental**
* **Tables**

|  |  |
| --- | --- |
| **Table 10.1- Resistance Measurement** | |
| **Resistor** | **Measured value** |
|  | 115.10Ω |
|  | 342.80Ω |
|  | 234.50Ω |

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| --- | --- |
| **Table 10.2- Voltage Measurement** | |
| **Voltage** | **Measured value** |
|  | +1.55V- |
|  | +7.40V- |
|  | -1.55V+ |

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| --- | --- |
| **Table 10.3- Current Measurement** | |
| **Current** | **Measured value** |
|  | 15.09mA→ |
|  | 22.22mA↓ |
|  | 6.93mA← |

|  |  |
| --- | --- |
| **Table 10.4- Voltage Measurement with VT1 active** | |
| **Voltage** | **Measured value** |
|  | +3.85- |
|  | +5.09- |
|  | +5.09- |

|  |  |
| --- | --- |
| **Table 10.5- Current Measurement with VT1 active** | |
| **Current** | **Measured value** |
|  | 38.12mA→ |
|  | 15.40mA↓ |
|  | 22.59mA→ |

|  |  |
| --- | --- |
| **Table 10.6- Voltage Measurement with VT2 active** | |
| **Voltage** | **Measured value** |
|  | -2.31+ |
|  | +2.31- |
|  | -6.63+ |

|  |  |
| --- | --- |
| **Table 10.7- Current Measurement with VT2 active** | |
| **Current** | **Measured value** |
|  | 22.47mA← |
|  | 7.36mA↓ |
|  | 29.83mA← |

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| **Table 10.8 – Voltage Measurement and Analysis** | | | | | |
| **Voltage** | **Measured voltage from Table 10.4** | **Measured voltage from Table 10.6** | **Voltage across each resistor (step 20)** | **Measured voltage from Table 10.2** | **% difference** |
|  | +3.85- | -2.31+ | +1.54V- | +1.55V- | -0.65% |
|  | +5.09- | +2.31- | +7.40V- | +7.40V- | 0% |
|  | +5.09- | -6.63+ | -1.54V+ | -1.55V+ | -0.65% |

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| --- | --- | --- | --- | --- | --- |
| **Table 10.9 – Current Measurement and Analysis** | | | | | |
| **Current** | **Measured Current from Table 10.5** | **Measured Current from Table 10.7** | **Current through each resistor (step 24)** | **Measured current from Table 10.3** | **% difference** |
|  | 38.12mA→ | 22.47mA← | 15.65mA→ | 15.09mA→ | 3.71% |
|  | 15.40mA↓ | 7.36mA↓ | 22.76mA↓ | 22.22mA↓ | 2.43% |
|  | 22.59mA→ | 29.83mA← | 6.88mA← | 6.93mA← | -0.72% |

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| **Table 10.10 – Power Analysis in a Superposition Circuit** | | | | | | | | | |
|  | (Table 10.4 & 10.5) | | | (Table 10.6 & 10.7) | | | Step (20 & 24) | | |
|  |  |  |  |  |  |  |  |  |
| Power dissipation | 146.47mW | 78.39mW | 116.82mW | 51.91mW | 17mW | 197.77mW | 24.10mW | 168.42mW | 10.60mW |

* **Question**

1. The measured data proves the superposition theorem. The reason is the Superposition Theorem states that a circuit can be analyzed with only one source of power at a time, the corresponding component voltages and currents algebraically added to find out what they’ll do with all power sources in effect.
2. Superposition Theorem only works where the underlying equations are linear (no mathematical powers or roots). The requisite of linearity means that Superposition Theorem is only applicable for determining voltage and current. Hence, Power dissipations, being nonlinear functions, do not algebraically add to an accurate total when only one source is considered at a time. As a result, the power does not superimpose.

* **Conclusion**

In this lab, we measured the voltages across (and/or currents) each element in the superposition circuit. And we use that results to prove the superposition theorem. That allows us to use the theorem to solve the circuit which has more the one power source. The strategy used in the Superposition Theorem is to eliminate all but one source of power within a network at a time, using series/parallel analysis to determine voltage drops (and/or currents) within the modified network for each power source separately. Then, once voltage drops and/or currents have been determined for each power source working separately, the values are all “superimposed” on top of each other (added algebraically) to find the actual voltage drops/currents with all sources active. In addition, we find the power cannot use the superposition theorem the solve, the reason is the power does not superimpose. Moreover, we need to know when we use superposition theorem to figure out the voltages and currents, we have to identify the voltage polarity and the current flow for each time we active one power source. Otherwise, we are not able to get correct answer in the later.