Deep Learning, Learning Objectives, EGR 220 Lab Memos

Lab Memo Assessment

- Progress you make each week → a combination of course and personal objectives.
  - Note that I can only assess these if you make your objectives clear throughout the semester, and state them in your weekly lab memos.
- Evidence of learning, which includes framing questions as well as making progress on them
- Evidence of performing your lab experiment.
  - Circuit, elements selected, expected behavior
  - Results – data, figures, graphs you make
- Organization and neatness.
- Completeness (you did significant work each week)

Lab Memo: What to Hand In

- **Your memo must be a stand-alone document**
  - ***One Memo Per Team***
- Your memo should be **one page** (of text)
- Your memo will have the following elements
  - Your names
  - Informative title (*not* "Lab 1")
  - Objective: *in your own words* including your learning objective(s)
  - Results from the laboratory experiments
  - Concise discussion of what you discovered and how you made progress on your learning goal
  - One concise and elegant statement of *what you learned* and *how your understanding is improving, has improved...*

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One Page Lab Memo Guidelines

- * Include **one statement** demonstrating your growing understanding, that **goes beyond** what is requested directly in the lab handout. *
- Focus on *your* **Q**uestion **O**f **U**nderstanding
  - This is for you to demonstrate you are processing and reflecting on the course material and on your quest to better understand circuit theory.
  - New & improved questions often demonstrate your on-going learning, and can be used as part of this statement.
- * Note that this statement *must* demonstrate some *independent thinking and learning*. *

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Questions of Understanding

1) How are voltage and current inter-related?
   - What do I understand about the theoretical and practical connections between voltage and current?
2) What is voltage?
   - What do I understand about the concept of voltage?
3) How do conservation laws apply to circuit theory?
   - What is my understanding of how conservation laws are used in circuit analysis and design?
4) What does "equivalent" mean for electrical circuits?
   - What is my understanding of how "equivalence" is used to design and analyze circuits?

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Examples for pushing your understanding

1) How are voltage and current inter-related?
   - What is my theory to explain these connections?
2) What is voltage?
   - What am I unsure about, for the concept of voltage?
3) How do conservation laws apply to circuit theory?
   - How can I experiment with conservation laws?
4) What does "equivalent" mean for electrical circuits?
   - Can I design and test two circuits to explore my theory of equivalence?

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Introduction to Laboratory Equipment

January 29, 2013

1. Objective: The objective of this lab was to become acquainted with laboratory equipment and explore Kirchoff's and Ohm's Laws through simple measurements.

2. Results: In the first activity, we created a voltage wave function with an amplitude of 1 Volt and a frequency of 1000 Hz using the function generator and measured it on the oscilloscope, finding the period of the sinusoid to be 1.00 ms. The relationship between the period and the frequency is: T = 1/f. When acquainting ourselves with the power supply, we found that the "Output On/Off" button turns off the flow of power to the circuit, so that we could safely alter our circuit while saving the settings we had already inputted. We also found that the function generator generated an alternating current, creating a sinusoidal function, and the power supply generated a direct current.

In part two of the lab, we used a 5.1 kΩ resistor and a breadboard to create a circuit. We measured the actual resistance of the resistor using the multimeter and found that it was equal to 5.01 kΩ. This was a 1.8% difference from the nominal value, which is within the 5% tolerance indicated by the gold band on the resistor. We attached the multimeter to the circuit in parallel in order to measure the voltage, which we found to be 5.002 V. When we attached it to the oscilloscope it was 5.00 V. The values found by the oscilloscope and the multimeter were reasonable. The oscilloscope appears to be more accurate in this situation because we were able to adjust the scale on the oscilloscope display in order to accurately measure the voltage. In other situations, the multimeter might be more accurate, it is unclear at this point. We set up the ammeter in series with the resistor in the circuit to measure a current of 0.9978 mA. We had predicted a current of 1.000 mA, yielding us a 0.22% error. This seems completely reasonable. Ohm's Law states that

V = I*R

I*R = (0.9978 mA)*(5.01 kΩ) = 4.999V

4.999 V is essentially equivalent to 5.0 V, so Ohm's Law was satisfied.

KCL states that the sum of currents entering a node must be equal to the sum of currents exiting a node. We measured the current flowing from the power supply to the resistor to be equal to the current from the resistor to the power supply, so KCL is satisfied. KVL states that the sum of voltages in a loop must be equal to 0. We knew that the voltage was -5.0 V across the power supply, and we measured it to be 5.0 V across the resistor. These values add up to equal 0, so KVL is satisfied.

3. In this lab, we reinforced our understanding of Ohm's Law, KCL, and KVL by experimentally proving them, as well as analyzing the concept of alternating and direct currents by viewing the functions on the oscilloscope. A question that arose is "Why did the oscilloscope and the multimeter not read the exact same values that the function generator indicated were being supplied?" This led us to think about the resistance inherent in all material, including the wires connecting the different machines and the wires within the actual machines that are reading the values. We now wonder whether in the future, when we are practicing engineers, we will always be using tools with inevitable inaccuracy because of the resistances of wires. If so, how will we be able to compensate for this inaccuracy in order to ensure our experiments are successful and our values are valid?

good

good

10/10

1/29/13

Memo Circuit Lab1: Using four circuit measurement machines

Objective: The objective of this activity is to become more familiar with standard circuits lab equipment and measurement machines.

Summary: In lab, we first tested all the machines by comparing voltage, current and resistance measurements with known (voltage, current and resistance) inputs. We then built a circuit on a breadboard (Figure 1). Using this circuit, we experimentally found voltage, current and resistance values for this circuit and proved Ohms law, KCL and KVL with these measurements.

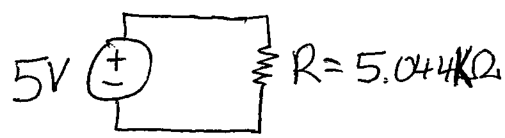

Figure 1. The circuit that was constructed and experimented with.

Results:

For the KCL law, the current was measured at two locations in the circuit- once before and once after the resistor, which produced the values 0.9908 mA and 0.9909 mA, respectively. Because of the similarity in values, KCL is confirmed because the current entering and leaving this element was the same.

To prove KVL, we measured the voltage across the resistor, which was 5.004V. Given that the voltage output was 5.002V and the resistor was the only other element in the circuit, the voltage being outputted from the SRC and that going across the resistor was the same, which agrees with KVL. Ohm's law was confirmed because the current measured through the resistor was 0.9909mA, and the predicted value of current by Ohm's law was 0.9912mA(5V/5044 Ohms). These values match. We also answer Q1 by measuring T(period) 0.001second and f(frequency) 1000 Hz. The relationship between T and f is T=1/f.

Learned: One valuable lesson from the hands-on activity we learned was trouble shooting using multiple meters. In lab, we had some unexpected readings when measuring the resistor and, after checking all of our connections and the instructions, we also used two different multi-meters to confirm the value range the Agilent multimeter was outputting. It is a little bit annoying to find out our resistor is 50 k ohms instead of 5 k ohms but it provided more practice with different resistors and using the meters.