Name:

NetID:

Usual bench partner:

Section AB/BB:

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Unit 1 Report: Circuits, Laws, and Equipment

Due Tuesday February 27th at 9am.

Reflections

Review your lab 1 procedure. You should find that in addition to gaining experience with the multi-meter and the power supply, you modeled the motor as a resistor and witnessed that the NiMH battery is definitely not an ideal voltage source.

Review your lab 2 prelab and procedure. You gained an introduction to the use of MATLAB as a tool for analysis (one aspect of scientific computing). You learned to connect switches and to use resistors as current-limiting devices to slow your motor. Out of necessity, you learned to utilize networks of resistors to accomplish this goal. Each of your two resistor networks had an equivalent resistance designed to achieve the proper wheel speed and also a power rating high enough that they would not result in circuit failure. As an engineer-in-training, you learned to validate your design through measurements taken using your benchtop hardware.

Review your lab 3 prelab and procedure. As you learned about Kirchhoff's laws, you also found that smaller "tweaks" in your resistor network could lead to better speed control. You also found that in a controlled system, time-varying signals cannot be purely analyzed using DC analysis tools. In this introduction to the oscilloscope, you found that the oscilloscope provides a window into the time-varying behavior of your circuits. You also continued your engineer-in-training practice by validating Kirchhoff's laws on your own car.

Review your lab 4 prelab and procedure. The extension of Kirchhoff's laws to voltage-divider circuits allowed us to design a cloud-detector. We gained valuable practice in reading datasheets for electronic components and we learned to connect a DIP-packaged IC to our breadboard, supplying it with "power and ground". While the prelab consisted of "blind, hobbyist-style" work, the laboratory environment allowed us to gain insight into the time-varying behavior of the cloud-detector circuit via the oscilloscope. We learned more about the *triggering* operation of the oscilloscope which is central to our understanding of the information it provides us. We move away from current-limiting resistors. Instead, we use a MOSFET transistor as a motor switch that is controlled by a voltage-divider circuit. A single resistive device, the potentiometer, provides a great way to quickly adjust wheel speed while the MOSFET itself provides a large increase in power efficiency.

Notes:

Unit 1 Report

You are asked to now provide a report for the unit of this lab that includes **laboratory exercises 1 through 4**. Your report has no minimum or maximum length, but you are expected to give a well-formatted report containing thoughtful evaluations as well as measured data and plots in support of your report. In particular, your report should touch upon these aspects:

- The efficiency of the current-limiting design for motor-speed control (reference Experiment #3, Figure 10).
- The efficiency of the MOSFET-based design for motor-speed control (reference Experiment #4, Figure 6).
- Compare the “zeroth-order” resistive model of the motor to the larger set of data collected (Experiment #1, Question 9 vs. Experiment #1, Question 11).
- The agreement (or disagreement) of actual measurements taken to confirm Kirchhoff’s laws.
- The use of the equipment: Ohmmeter, voltmeter, ammeter, power supply, battery, oscilloscope.
- The modules you completed and their learning objectives.

Just do your best and feel free to discuss these topics with classmates, but **do not just copy answers** or you will be penalized for plagiarism.