

ELEC ENG 2EI5

Lab 1

Lab 1 will be the guided exploration that was recommended at the beginning of Content Module 1. For the lab, you are required to do this both in hardware and in simulation.

Objectives

1. Learn about the Analog Discovery module and become comfortable using it.
2. Learn about a circuit simulator and become comfortable using it.
3. Learn about iv-characteristics.

Safety

The 10mF capacitor in your parts kit is a polarized capacitor. It MUST be connected in the correct polarity whenever you use it. Do NOT use it if the polarity across it is going to change. Do NOT connect it the wrong way around.

Other than the capacitor you should be sure to check the ratings of any device before using it. Supplying current or applying voltage in excess of device ratings could destroy the device and/or cause minor burns if you touch a device that is “running hot.”

Lab Requirements

A. The Minimum (30 points)

You need to accomplish all the tasks in this section to get a non-zero mark for the lab.

1. Construct the circuit shown in Figure 1, using your AD2 wave function generator to implement the source E and the oscilloscope channels to implement V1 and V2. Use 1k for R1 and any resistor from your parts kit for R2.

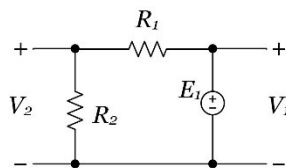


Figure 1. Simple iv-characteristics measurement circuit.

2. Take a photograph of your setup. Ensure that your circuit setup is neat and easy to understand from the photo. Include in the photo a label with you name and the date the photo was taken. A sample satisfactory photograph is shown in Figure 2.
3. Set the function generator to produce a sinewave of frequency 10Hz and amplitude 5V.
4. Use the AD2 scope functionality to generate a plot with V2 on the horizontal axis and $(V_1 - V_2)$ on the vertical axis.
5. From the generated plot, determine the value of the resistor R2. Compare this value with nominal value indicated by the color coding of the resistor.

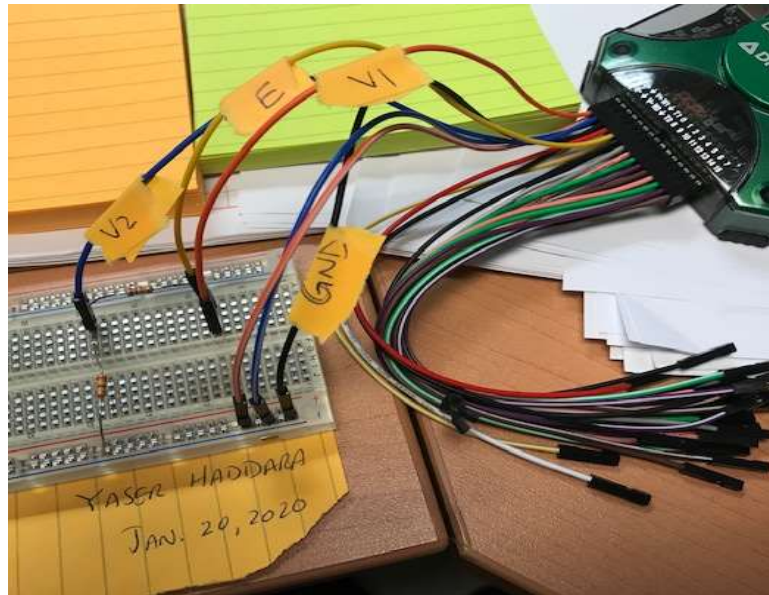


Figure 2. Circuit setup.

B. The Bulk (60 points)

Do as many of these steps as you wish to get points. Points for each step are specified.

1. (10 points) Simulate the circuit in Figure 1.
2. (10 points) Compare the results of experiment and simulation and comment on possible sources of error.
3. (15 points) Replace R2 with other devices and report the iv-characteristics measured. Choose any three of the following:
 - a. Two other resistors of different values
 - b. A short circuit and an open circuit
 - c. Any capacitor
 - d. The 1N4148
 - e. The 1N5225B
 - f. Any LED
4. (20 points) Simulate two of the measurements that you did for step 3 above (this cannot include option a).

C. The Max (10 points)

Discuss at least one problem in measurement that would arise from R1 being too small and at least one problem that would arise from R1 being too large.

D. The Bonus (10 points)

Use your AD2 to produce a DC current source and modify the circuit above to measure the iv-characteristics of the current source. *Hint: this cannot be an ideal current source.*

Report Requirements

Your report should be submitted in the Avenue Dropbox for Lab 1. Your submission has to be a single pdf file containing:

1. The photograph of your hardware setup.
2. Tabulated or graphed data for part A step 4 (15 points).
3. The value of R_2 calculated in part A step 5 (15 points).
4. Results for part B as follows:
 - a. Step 1: simulation result as a graph
 - b. Step 2: give your answer clearly and concisely – no marks given for handwaving!
 - c. Step 3: for each device measured, a picture of the graph of the iv-characteristics produced by the AD2
 - d. Step 4: for each device simulated give the graph of the iv-characteristics produced by the simulator
5. Answers for part C should be given as two clear and concise statements.
6. For part D:
 - a. describe the circuit built (4 points)
 - b. explain how and why the test circuit is modified (4 points)
 - c. report the measurement result (2 points)

Deadline

All deadlines are listed on the course schedule and in the “Labs and Projects” page in the Handbook.