Lab07

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1 Introduction

In this lab we furthered our understanding of Op-amps. We focused in on using Negative feedback to control current flows and the further verifying the I-V characteristics of a diode.

2 Verification of Capacitor behaviour

In order to verify the I-V characteristics of a capacitor we used the the circuit in Figure 1. The circuit take advantage of op-amp design such that voltage can be measured directly and current can be measured indirectly.

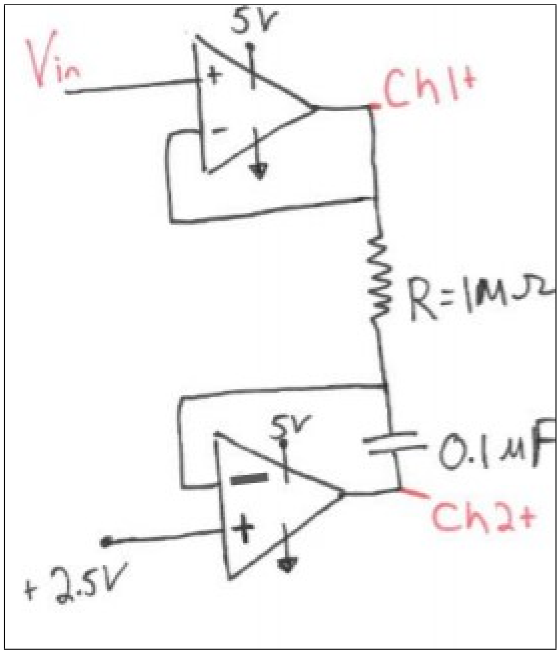

Figure 1: Capacitor Verification Circuit
This circuit takes advantage of the fact that an Op-amp is designed to take no current in through V_+ orV_-. As such there is only one path for the current to flow in this circuit. With this restriction we can directly measure the voltage across the capacitor and indirectly infer the current flowing through the resistor because we know the value of the resistor

The output reading of this circuit is recorded in Figure 2.

Vin	dv/dt
2.5	21.27
2	17.27
1.5	12.5
1	7.933
0.5	3.954

Figure 2: Capacitor Verification Data
The first column is V_{in} which is the amplitude of the voltage applied across the circuit. The second column is the measured ${}^{dv}/_{dt}$.

The data was then plotted in MatLab to produce Figure 3.

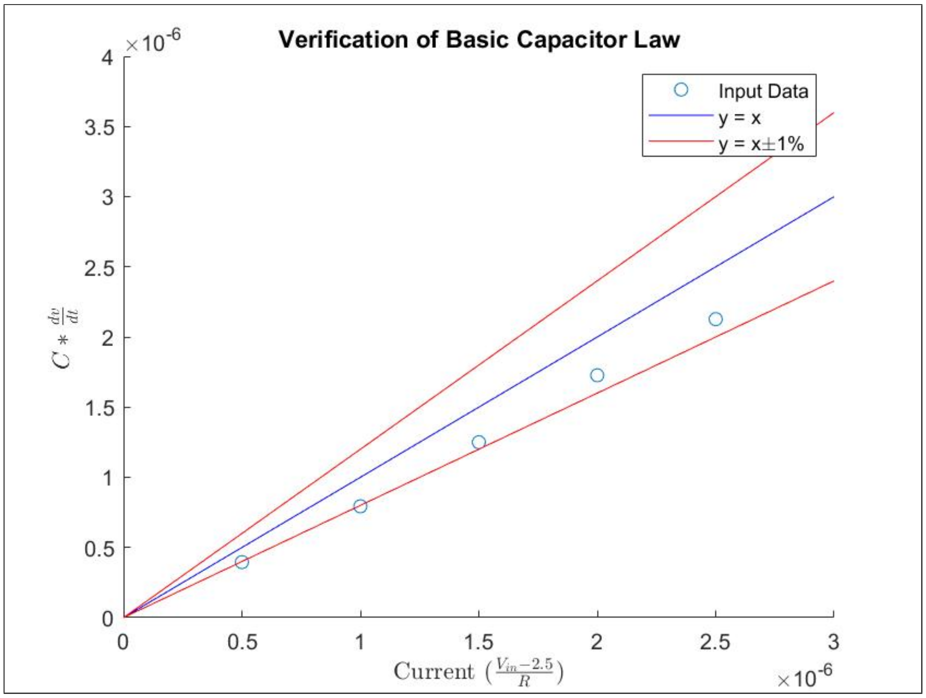

Figure 3: Capacitor Verification Figure
This plot attempts to verify the basic capcitor law $I = C^{dv}/_{dt}$. The x-axis is the current which was calculated using Ohm's Law ($V = IR$). The y-axis is $C^{dv}/_{dt}$. Next I plotted blue line $y = x$ to test to see how close the two data sets were to each other. I was not satisfied by the vicinity of the data so I tried to consider the range of the capacitor's factory issues. The red lines represent capacitor values $\pm 1\%$. With this addition, we can conclude that the capacitor is functioning within the appropriate range.

3 Verification of Diode behavior

The verification of the Diode behavior follows a very similar process as that of the verification of the capacitors behavior. Using nearly identical circuit as before which is shown in Figure 4.

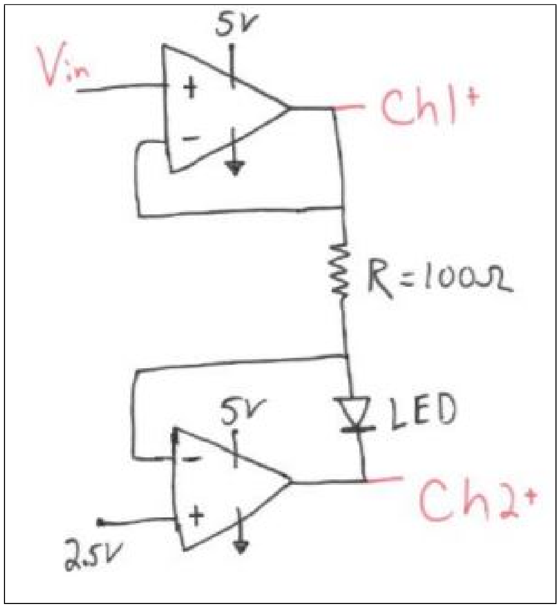

Figure 4: Diode Verification Circuit
This circuit takes advantage of the fact that an Op-amp is designed to take no current in through V_+ orV_-. As such there is only one path for the current to flow in this circuit. With this restriction we can directly measure the voltage across the diode and indirectly infer the current flowing through the resistor because we know the value of the resistor

Figure 5 shows what the ideal I-V characteristic of a diode is. In Figure 6, we can see the results of this circuit. I plotted the $Ch2$ output on the x- axis and the $Ch1$ output was converted to Current by using Ohm's Law.

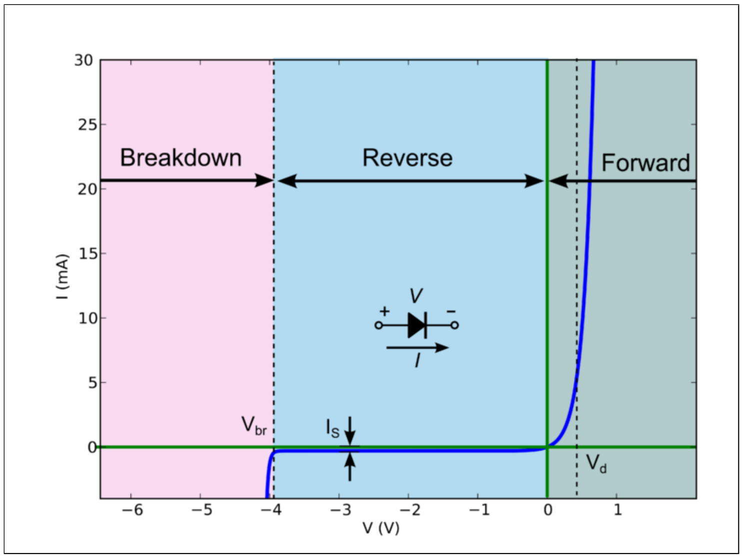

Figure 5: Idealized I-V curve given in lab

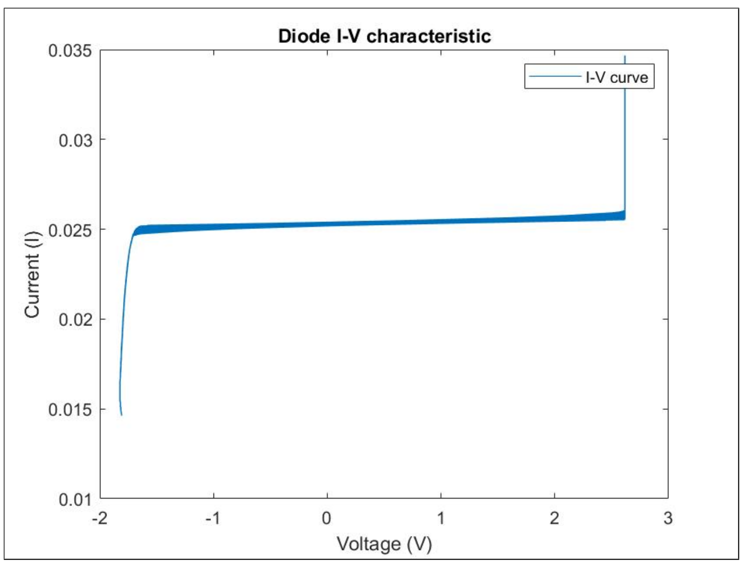

Figure 6: Diode Verification Figure
This figure shows that when low voltage is applied nearly no current flows through and the after the voltage threshold is crossed, infinite current begins to flow through the diode. Furthermore the behavior seems to follow the behavior shown by Figure 5 the idealized I-V behavior.