Lab 2: Non-Ideal Sources

ECEN 214 - 517

TA: Saad Muaddi

Date Performed: September 14, 2020

Due Date: September 16, 2020

Procedure

Tasks 1 & 2

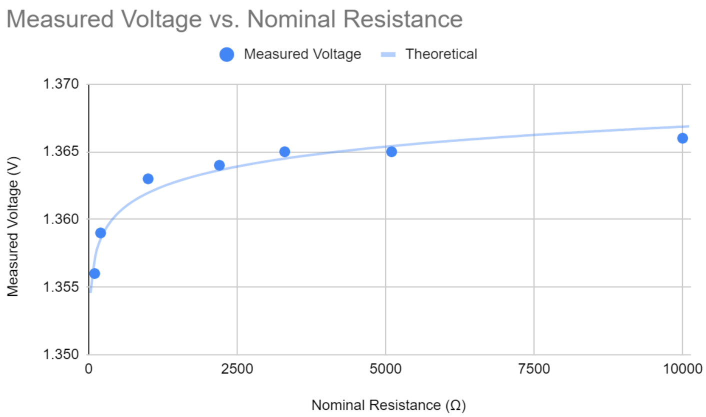
In the first task, the students were asked to take measurements of the load resistance, voltage, and current across the various resistors that range up to 1000 Ω. However, its recommended to not go too low, because they have a power limit, which could be exceeded and cause resistors to burn out, giving us inaccurate results. We utilize the formula $P = V^2/R$, where we notice that the resistance is lower as the power dissipated across the resistor rises. Using the DMM to measure the values, we connect to the voltmeter in parallel to the resistor, keeping in mind that the voltages are the same in parallel. To measure the current we connected the ammeter in series with the resistor because the current will be constant in the series. This part of the task also required to plot the data (V_L vs. R_L), and then find the appropriate curve, which is the "best fit" to the measured data. This will help determine the voltage and internal resistance of the battery.

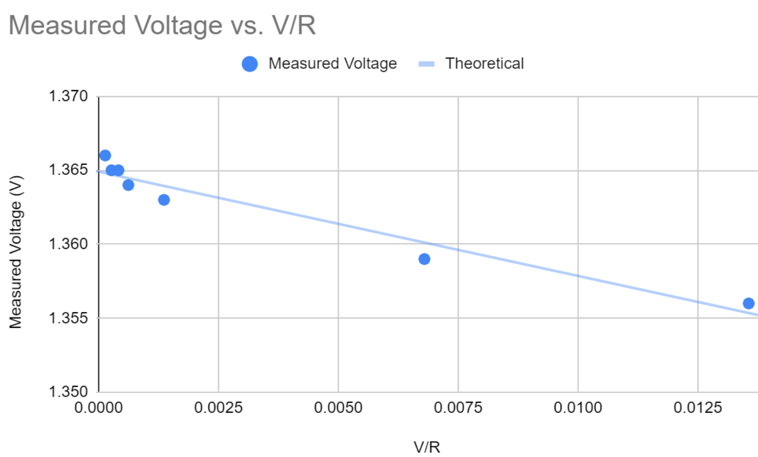
Once we can estimate the value for voltage and internal resistance, we must repeat the steps for the battery in the parts kit. Modeling every battery/holder combo, then we must place the batter in the series to have a 3V source, and measure the actual voltage and internal resistance of the two batteries in a series. And finally, discuss the comparison between your estimate and your result.

Data Tables

______Battery 1:
V_s = 1.368 V

Nominal R_L (Ω)	Measured V_L (V)
2200	1.365
100	1.356
1000	1.363
10000	1.366
5100	1.365
200	1.359
3300	1.364

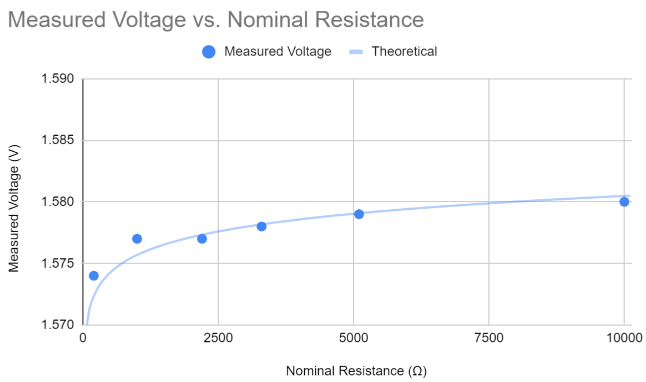


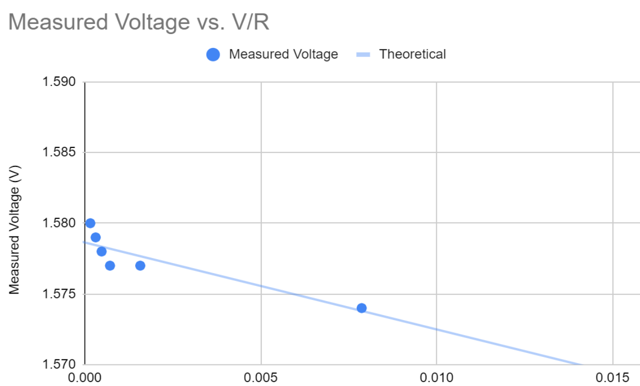


Battery 2:

$V_s = 1.581$ V

Nominal R_L (Ω)	Measured V_L (V)
2200	1.577
100	1.569
1000	1.577
10000	1.580
5100	1.579
200	1.574
3300	1.578



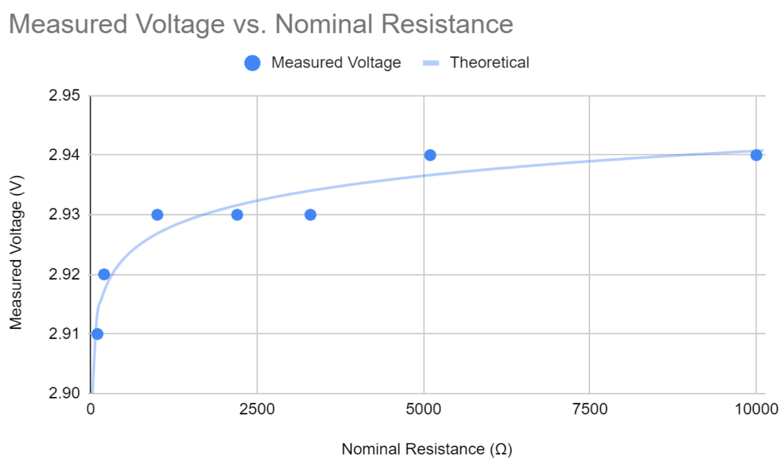


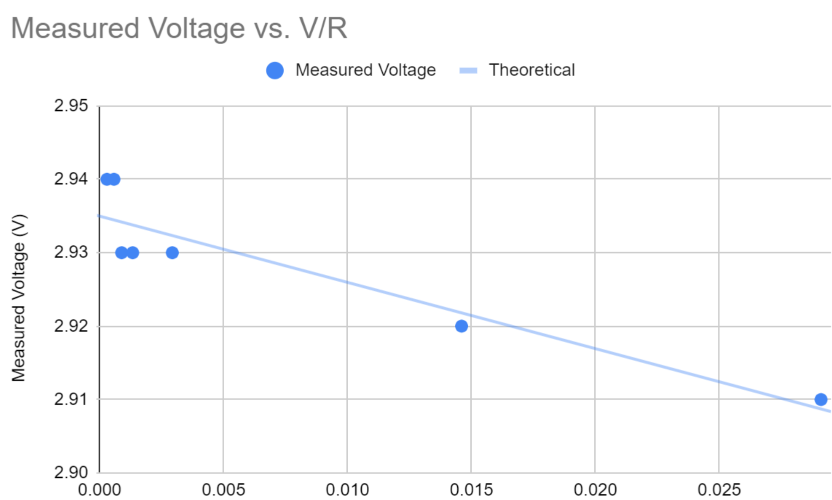
Task 2

Batteries in series:

V_s = 2.94 V

Nominal R_L (Ω)	Measured V_L (V)
2200	2.93
100	2.91
1000	2.93
10000	2.94
5100	2.94
200	2.92
3300	2.93





Sample calculations

The main formula used in calculating the internal resistance R_s of a battery is $V_L = V_s \frac{R_L}{R_L + R_s}$. Additionally, the slope of the trendline in the V_L vs. $\frac{V_L}{R_L}$ graph is indicative of the battery's internal resistance. We find that the internal resistance of battery 1 is 0.704 Ω, the internal resistance of battery 2 is 0.615 Ω, and the resistance of the two batteries in series is 0.902 Ω.

Discussion

This lab required us to take measurement of voltages and currents across various resistors in order to create a model to estimate V_s and R_s and compare that to the actual measured data and find any error while comparing the data and the estimate. Much of the error when measuring with the batteries in series can be attributed to the limitations of the equipment used, in which voltages could only be measured to the hundredths compared to the previous parts of the lab, where the voltages were measured to the thousandths. This lab helped us gain an understanding and build skills in connecting circuits and take measurements from those circuits. We also plotted the data and found the “best fit” curve to determine any trends and find the voltage and source of the internal resistance.