

Junior Design

ECE 3090 - Spring 2018

Measuring the Internal Resistance of a Battery: Experiment

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Objective

The purpose of this experiment is to find the average internal resistance of a 7.2 V rechargeable battery.

Required Equipment

- Battery (7.2 V)
- Multimeter to measure the current through the circuit
- Function Generator (1 V peak) to act as the AC source
- 20 Ω Resistor to be the load of the circuit
- 1.3k Ω to ensure that the battery doesn't burn down the resistor before its current decreases to 0
- 470 μ F Capacitor to block the current coming through the battery
- Breadboard

Preliminary Calculations

There are no preliminary calculations necessary.

Procedure

1. Measure the load resistor using the multimeter
2. Set up the circuit from Figure 1 (second time replacing RL with a 1.3k Ω resistor) [2]
3. Set the function generator to “High Z” and set the AC voltage to 1 Vp (2 Vpk-pk) at a frequency of 1 kHz
4. Replace the 1.3k Ω with a 20 Ω resistor after 3 seconds of setting the circuit

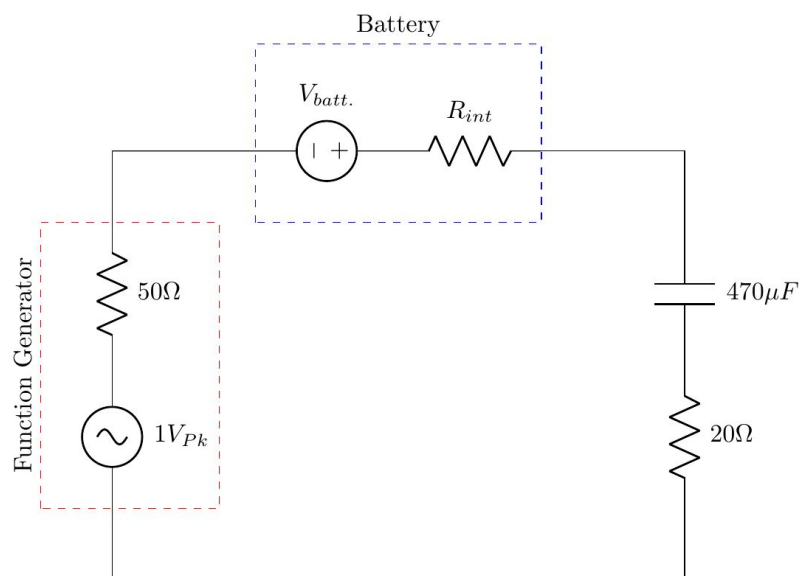


Figure 1 shows the circuit diagram used to find the internal resistance of the given battery assuming an internal resistance of 50 Ohms for the function generator

4. Use a multimeter to measure the voltage across RL
5. Use a multimeter to measure the current through the circuit
6. Measure the RMS voltage of the AC voltage source
7. Use the measured current and voltages difference to find the internal resistance of the battery
8. Increase the frequency of the AC source by 1 kHz [1] with each trial and repeat 5 more times

Data Analysis

To find the precision of the data, use both trials and calculate the variance of the measured internal resistance at each frequency. The mean can be found by averaging the trials, however the accuracy cannot be measured due to the inability to reference a nominal value.

Conclusion Questions

1. How does the internal resistance of a battery affect the behavior of most real world circuits? In which cases does this resistance have a significant effect on the circuit?
2. What is the percent error for the voltage compared to a theoretical circuit with no internal resistance? What is the minimum circuit resistance for a 1% error?

References

1. <https://www.sciencedirect.com/science/article/pii/S1388248109005980>
2. <https://patentimages.storage.googleapis.com/1f/dc/29/7eb23147dc4239/US20070194791A1.pdf>
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