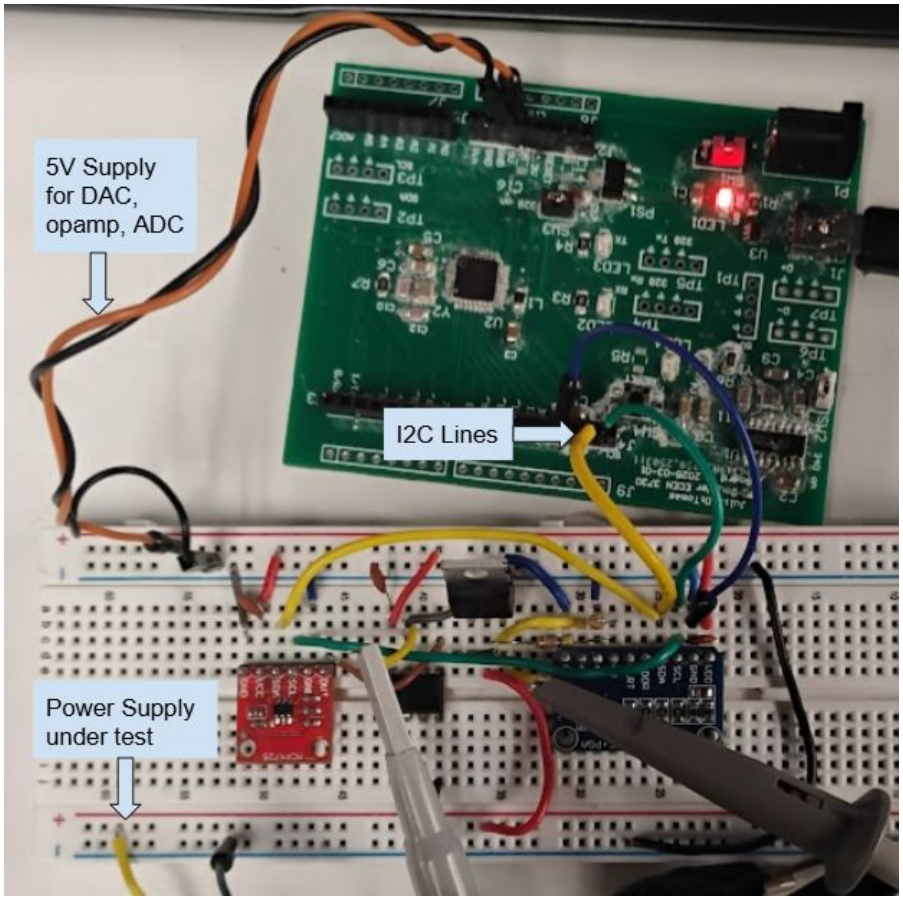
Lab 22

Power Source Characterization Instrument Droid

Julia DiTomas

Objectives

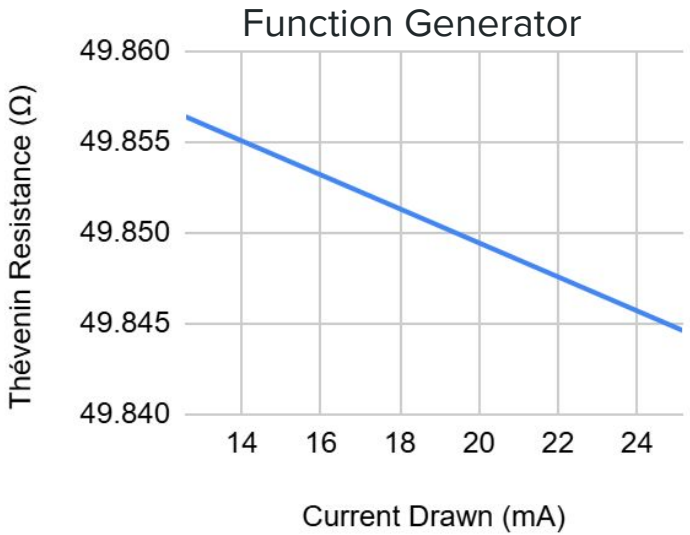
- Construct a SBB circuit to measure Thévenin voltage and resistance from any power supply, up to 12 V and 0.3 A
- Verify that expected results are obtained from known supplies
- Characterize unknown supplies

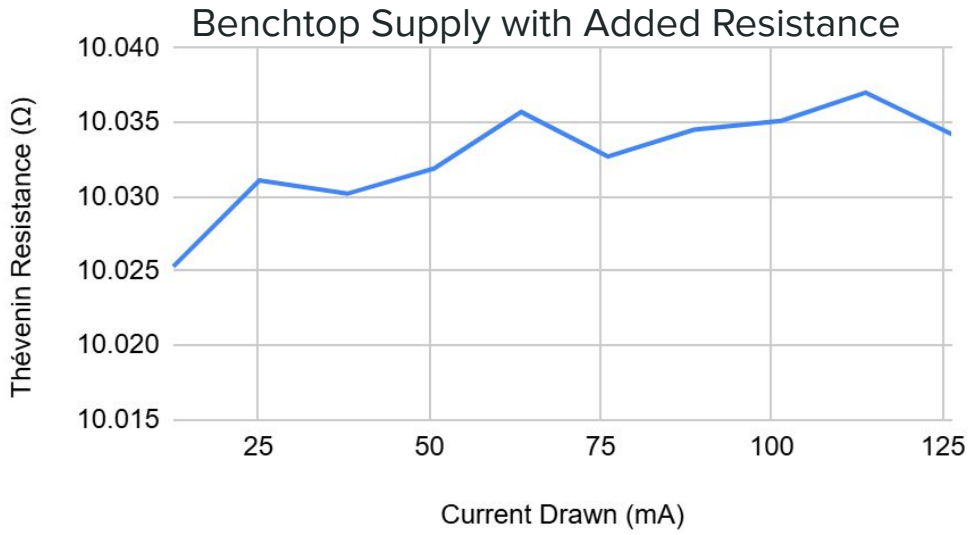


Verification Results

Left: Thévenin resistance of function generator set to 5V DC over output current range. As expected, the resistance is approximately 50 Ω. V_{Th} = 4.991 V (not shown).

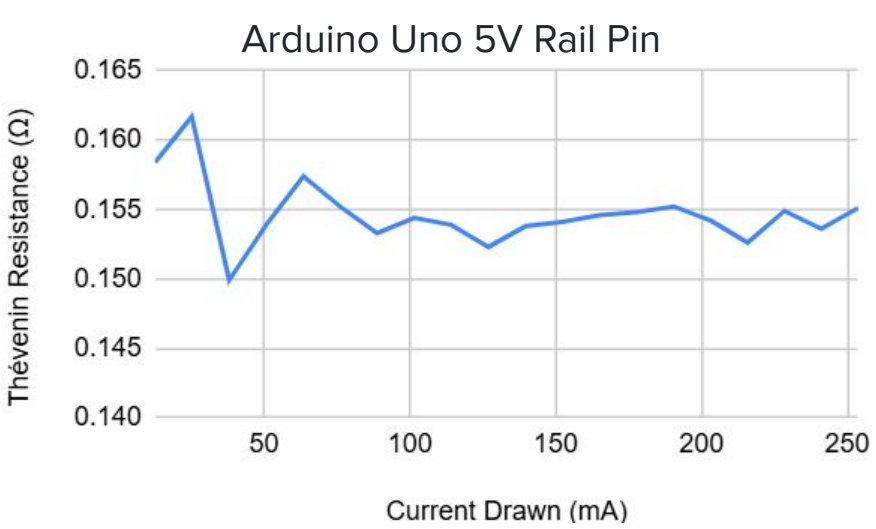
Right: Thévenin resistance of benchtop power supply, set to 5V, in series with 10 Ω resistor. Since the power supply has very low output resistance, we measure about 10 Ω. V_{Th} = 4.989 V (not shown).

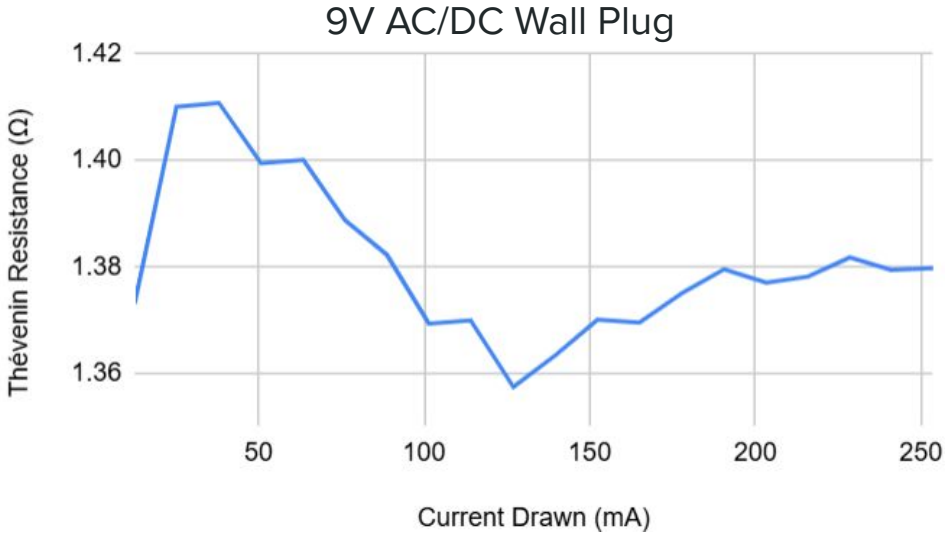




Characterizing Unknown Supplies

The Arduino's 5V power supply pin and the 9V AC/DC power adapter both showed very low output resistance. The Thévenin voltages were 4.965 V and 9.246 V.





Conclusions

Using the DAC, opamp, and MOSFET, we can precisely control the current drawn from the supply under test, and then calculate the equivalent Thévenin circuit for each current setting by measuring the open circuit voltage and loaded voltage.

The slammer circuit is useful for quickly dissipating a lot of power in the sense resistor without damaging it.

There is a tradeoff between measurement resolution and range in the selection of resistor values.

When drawing a lot of current from a power supply, the Thévenin resistance can significantly decrease the voltage across the load.