ECE 205: Lab 1

Thevenin Challenge

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1 Statement of Purpose

The purpose of this lab was to develop familiarity with the LTSpice software and to determine the power dissipated across the load resistor in a Thevenin circuit. We accomplished this by modeling a Thevenin equivalent circuit with $V_{th} = 10\ V$ and $R_{th} = 100\ \Omega$ with the LTSpice software. With the aforementioned Thevenin circuit, we then determined the power dissipated across a load resistor with a resistance ranging from 10 - 1,000 Ω.

2 Procedure

To begin, we opened LTspice version 24.0.12 on Windows OS. We then constructed a simple Thevenin equivalent circuit, by adding a voltage source, two resistors, and ground. For the second resistor, we varied the resistance utilizing the command *'.step param Rload 10 1k 1'*, telling the program to change the run the simulation with R_{Load} ranging from 10 - 1000 Ω with a step size of 1 Ω. With all of these parameters added to the simulation, we then ran the trial. The circuit we utilized is presented below, in Figure 1.

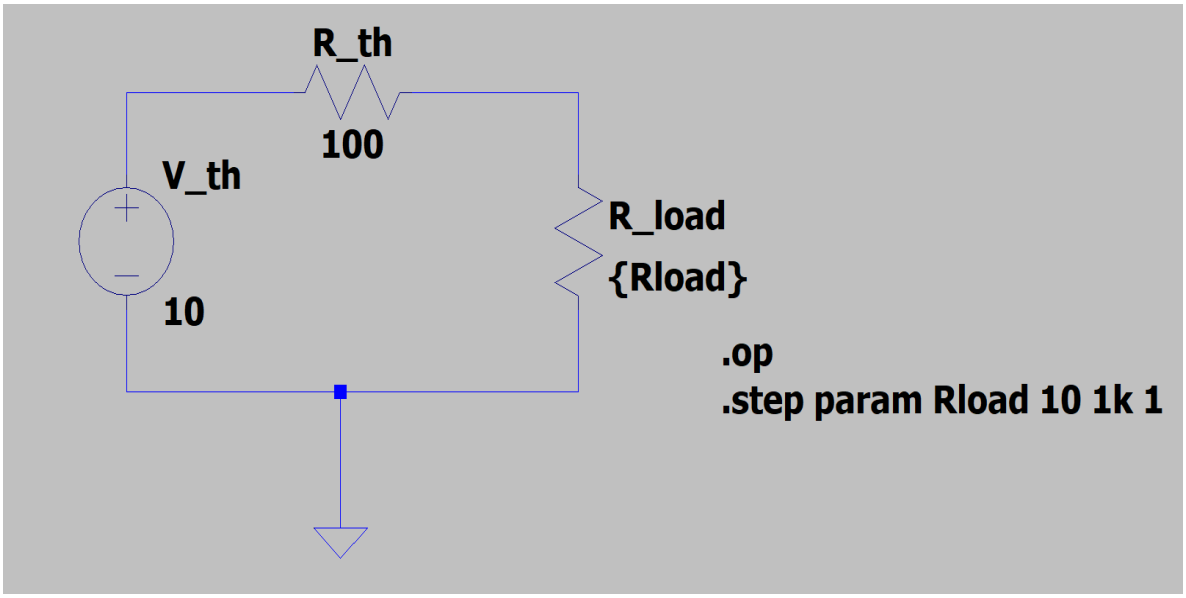

Figure 1: Experimental Set-Up, diagram of utilized LTspice circuit.

3 Observation and Data

After executing the simulation, we exported the voltage at node 2, the top-right most corner in Figure 1, multiplied by the current across R_{Load}, and the resistance of R_{Load} to obtain power dissipated across

R_{Load}. Finally, we constructed Figure 2, presenting the power dissipated across R_{Load} as a function of the resistance of R_{Load}.

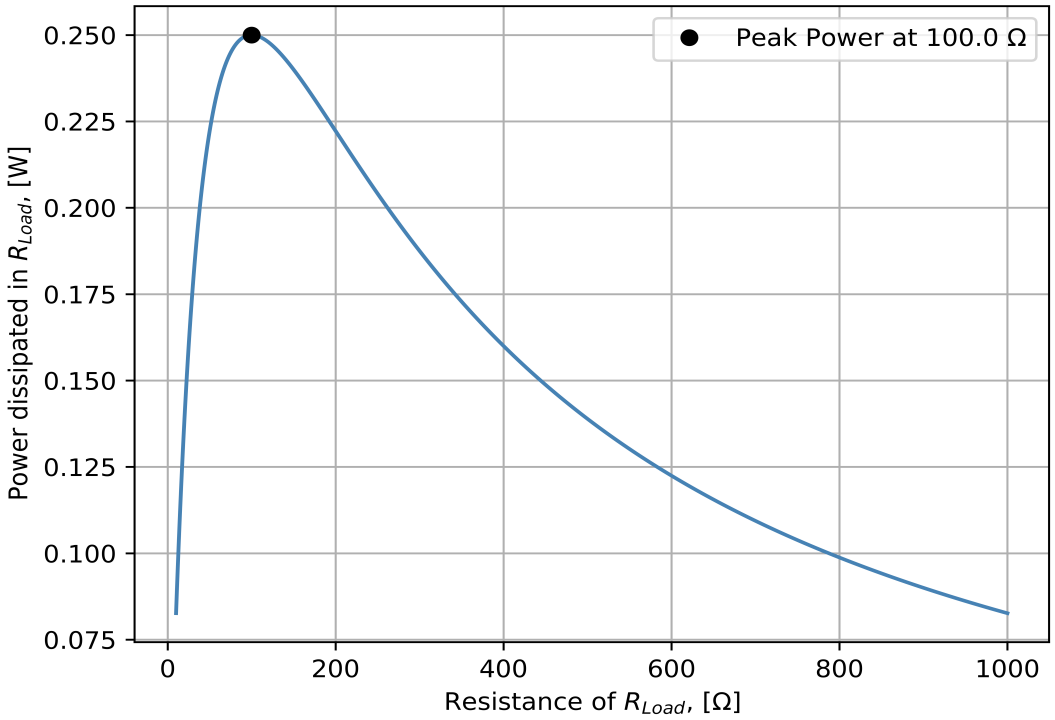

Figure 2: Power dissipated across R_{Load} [W] as a function of resistance of R_{Load} [Ω]

4 Analysis

From Figure 2, we see how power dissipated in the load resistor varies as a function of load resistance. We observe a sharp increase in power with a low load resistance, which then peaks and slowly decreases asymptotically as load resistance increases. The observation is expected as the maximum power occurs when the load resistance corresponding to maximum power dissipation is equal to the Thevenin resistance, which are both 100 Ω. We have also gained experience with LTspice, and are overjoyed to add LTspice to our repertoire of software.

5 Conclusion

From this lab, we learned how to use LTSpice to simulate circuits and model the power dissipated across a resistor, but, more specifically, power dissipated across a load resistor in a Thevenin equivalent circuit.

In regards to what went wrong, we ran into various compatibility errors with the LTspice program. First, we were unable run LTspice on Joseph Specht's laptop, which, although is a Lenovo machine, operates using the GNU/Linux, Ubuntu 24.04 x86_64 platform. Further, Nathan Glaser's computer is a Macintosh M2 Pro running Sonoma 14.5, and we were unable to export the resulting data to a .txt or .csv file on this computer. To resolve these compatability issues, we had to utilize one of Talbot Laboratory's first-level computer-lab Windows desktops to execute the LTspice software. Once we installed LTspice on the Windows desktop, we were able to execute the procedure and export the data to a .txt file. Although, we were not able to simply email the file to ourselves, and thus resorted to utilization of Secure Copy Protocol (SCP) to a remote research server named Pinchot, and then again to our respective computers.

6 Appendix

For our output data, please refer to this google sheet.