

UNIVERSITY ☺ OF P☺ RTLAND
Sch☺☺l ☺ of Engineering

EE271- Electrical Circuits Laboratory
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Lab Experiment #2: Simple Resistive Circuits

Simple Resistive Circuits

I. Objective

In this experiment, the students will design, build and/or experiment simple resistive electrical circuits to gain some experience in using Ohm's law, Kirchhoff's laws, and their extensions such as voltage and current divider principles to analyze circuits consisting of series- and parallel-connected resistors.

II. Procedure

PART 1: Voltage and Current Divider Principles

Part 1(a): Verification of the Voltage Divider Circuit

1(a)- Pre-lab Assignment: For the circuit shown in Fig. 1(a), calculate the output voltage V_{out} using the voltage divider principle.

1(a)- Lab Experiment: Construct the circuit shown in Fig. 1(a). Measure and record the actual values of the resistors R_1 and R_2 used in your circuit. Measure and record the output voltage V_{out} . Check to see if your measured V_{out} value agrees with the V_{out} value calculated in the pre-lab assignment and comment. Next, use the function generator and replace the 5-V power supply voltage in the circuit with a sinusoidal voltage source $V_s(t)$ with 5-V peak voltage (amplitude) and 10-kHz signal frequency. Observe the two signals $V_s(t)$ and $V_{out}(t)$ on the oscilloscope simultaneously. Verify that the voltage divider circuit still works.

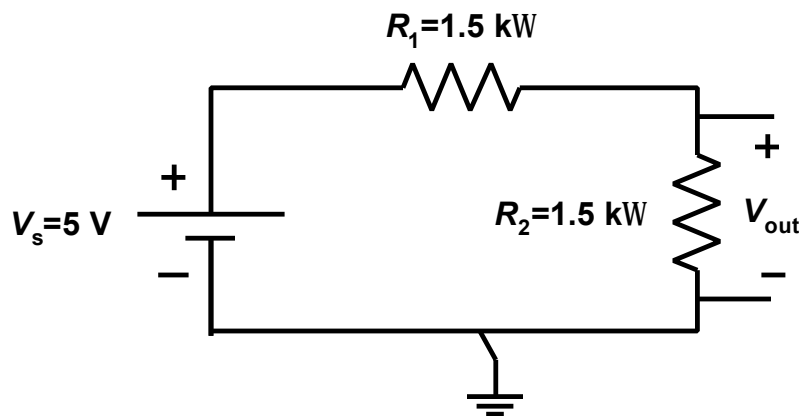


Fig. 1(a). The voltage divider circuit.

Part 1(b): Verification of the Current Divider Principle

1(b)- Pre-lab Assignment: Connect a shunt resistor R_{shunt} across the $R_2=1.5\text{ k}\Omega$ resistance of Fig. 1(a), as shown in Fig. 1(b). Calculate the values of the individual currents I_2 and I_{shunt} flowing through the resistors R_2 and R_{shunt} and the voltage V_{out} for three different values of R_{shunt} resistance which are $150\ \Omega$, $1.5\text{ k}\Omega$, and $15\text{ k}\Omega$ respectively. Present your calculated current and voltage values in a table.

1(b)- Lab Experiment: Construct the circuit shown in Fig. 1(b). Measure and record the actual values of the resistors R_1 , R_2 and R_{shunt} used in your circuit. Measure and record the values of the currents I_2 and I_{shunt} and the output voltage V_{out} for each R_{shunt} resistor connected across the R_2 resistance. Present your measured current and voltage values in a table. Compare the current and voltage values calculated in the pre-lab assignment with the measured values and comment.

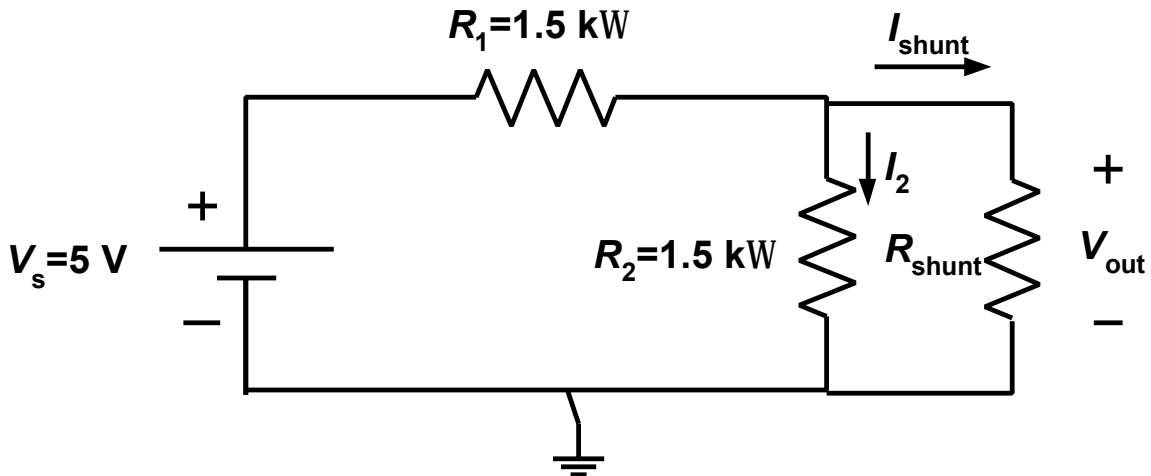


Fig. 1(b). The current divider circuit.

PART 2: Design of a Voltage Divider Circuit

2(a)- Pre-lab Assignment: Design two separate voltage divider circuits similar to the one shown in Fig. 2. Each circuit will convert a fixed power supply voltage of 5 V to a voltage equal to 2 V. For each circuit, all you have available is four $1.5\text{ k}\Omega$ resistors. Show both circuits you designed on paper. Also, determine which circuit is the best choice in terms of minimum power consumption.

2(b)- Lab Experiment: Test your designed circuits in the lab. Measure and record the value of the output voltage in each circuit and verify your design.

2(c)- Lab Experiment: Next, use each circuit designed to supply 2 V to the unknown resistive load provided in the lab. Hook up the resistive load across the output terminals of each circuit and measure the voltage supplied to the load in each case. Does anyone of your voltage divider circuits work? If no, explain why.

2(d)- Lab Experiment: Measure the equivalent resistance of the load and redesign your voltage divider circuit accordingly so that your circuit takes the fixed 5 V voltage and supplies 2 V to the load. Again, as before, all you have is four 1.5 k Ω resistors. One clue, since you now know the equivalent resistance of the load, can you design your circuit in such a way that no power is dissipated during the time the load is not connected to it.

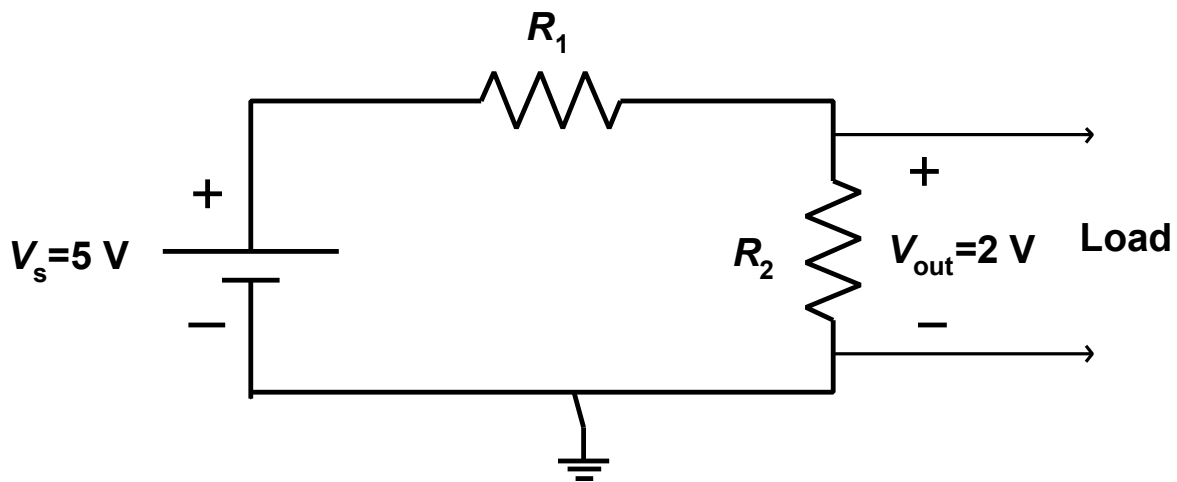


Fig. 2. Voltage divider circuit.

III. Discussions & Conclusion

In this section, discuss the various aspects of Experiment # 2 and make some conclusions. In your write-up, you should at least address the following questions:

1. What was the objective of this experiment and was the objective achieved?
2. Did any of your measurements have more than 5% error? What was your maximum % error?
3. What sources of error may have contributed to the differences between the theoretical values and the measured values?
4. Other comments relevant to this experiment.