

Electrical Circuits LAB 3 - Voltage and Current Dividers

Objectives

Understand and apply resistor simplification, voltage and current divider concepts to analysis of Electrical circuit.

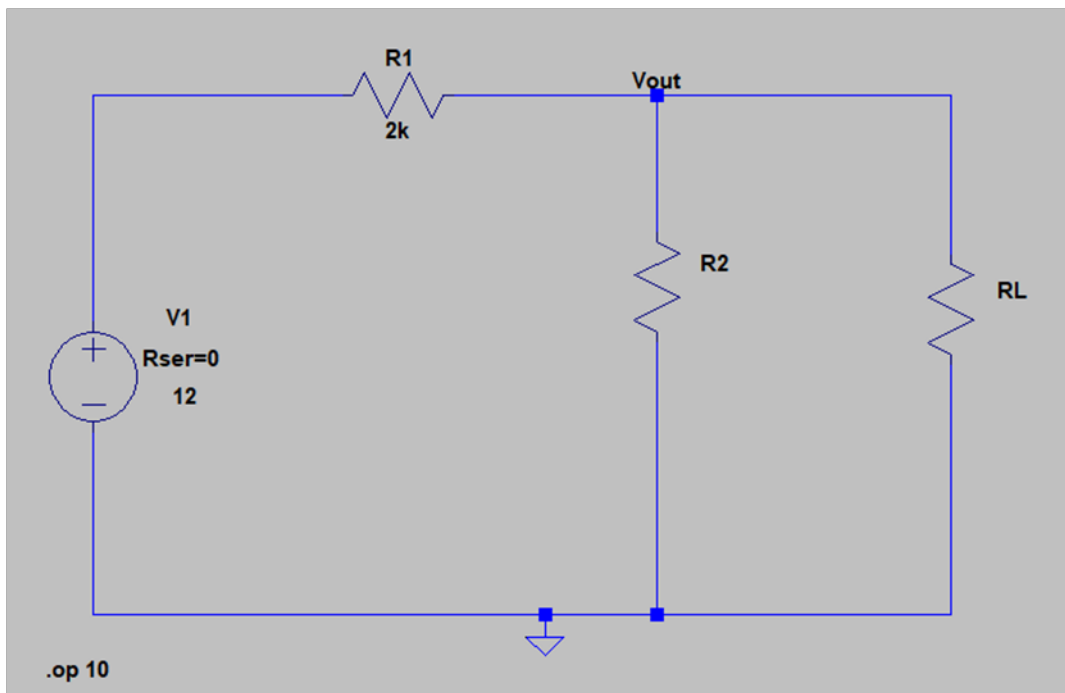
Preparation

Complete the following steps before starting to work on the experiments in this lab:

- 1) Complete Lab 2 and associated report
- 2) Read textbook, watch lecture videos, and complete homework in Chapter 3 “Analysis of Resistive Circuits”.
- 3) Review the video on STEP Command and Waveform Charting at <https://youtu.be/86aXOFw7YQk>.

Experiment 1


Use LTspice to determine the value of R2 in the following voltage divider circuit where Vout is 4V in an unloaded configuration ($R_L = \infty \Omega$).



Experiment 2

Use LTspice STEP function to explore the effect of changing R_L from $100\ \Omega$ to $10\text{k}\ \Omega$ in $100\ \Omega$ steps on the value of V_{out} . Plot and describe the effect of R_L value changes on the V_{out} value.

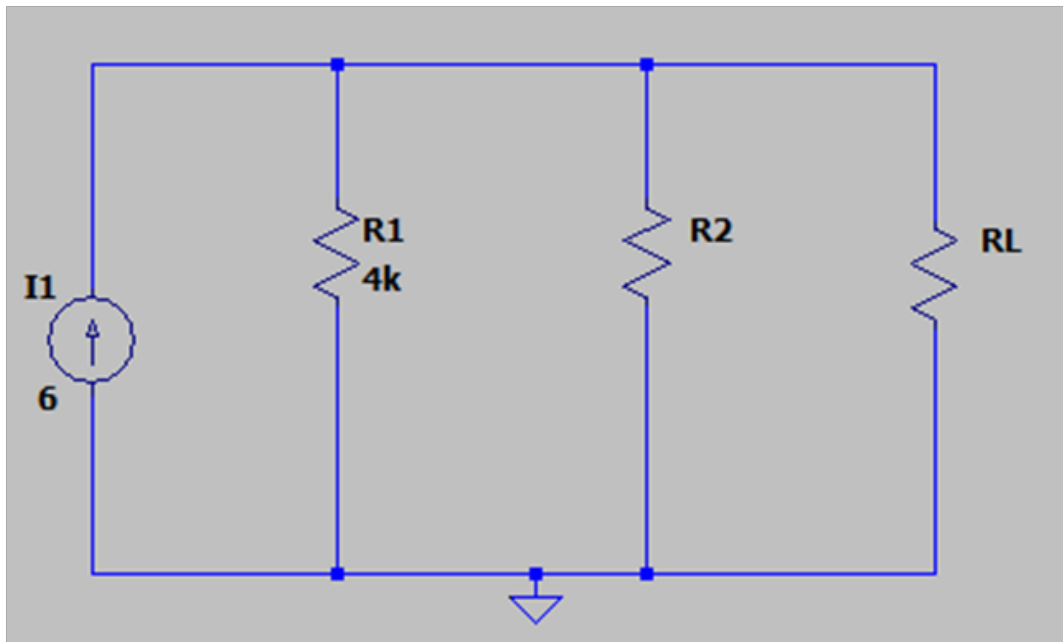
Note:

- 1) Set value of R_L to $\{x\}$ and click on icon  to add the SPICE directive
`.STEP PARAM x 100 10k 100`
- 2) Right click on the chart, left click on "Add Traces" from drop down menu, and left click on $V(vout)$ to add $vout$ trace to the chart. To display value of a point on the graph, left click on $V(vout)$ to active the cursor then left click and hold to drag the cursor to point of interest on the trace.

Describe effect of change (increase or decrease) in values of R_1 and R_2 on reducing V_{out} 's sensitivity to R_L value change. Select a value of R_1 and R_2 that reduces sensitivity based on your understanding and use LTspice to support your selection.

Experiment 3

Use LTspice to determine the value of R_2 in the following voltage divider circuit where the current through R_2 is $4.8\ \text{A}$ in unloaded configuration ($R_L = \infty\ \Omega$).



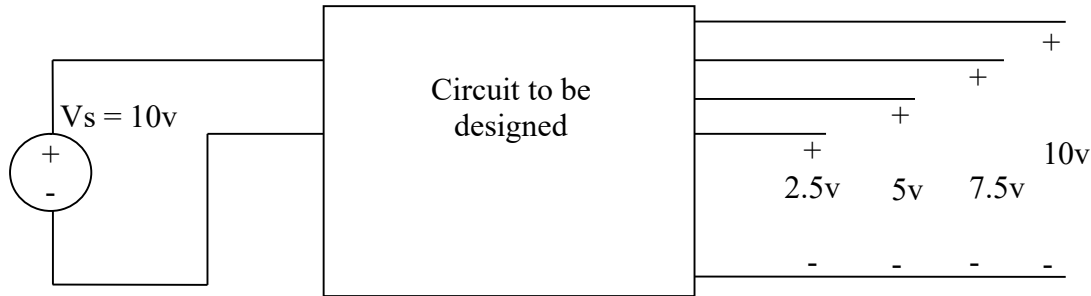
Experiment 4

Use LTspice STEP function to explore the effect of changing R_L from $100\ \Omega$ to $10\ \text{k}\Omega$ in $100\ \Omega$ steps on the current through R_2 . Plot and describe the effect of R_L change on current through R_2 .

Describe effect of change (increase or decrease) in values of R_1 and R_2 on reducing R_2 current's sensitivity to R_L value change. Select a value of R_1 and R_2 that reduces sensitivity based on your understanding and use LTspice to support your selection.

Experiment 5

a) Design a voltage driver that accepts a 10 V supply and produces 4 outputs: 2.5v, 5v, 7.5v and 10v .



Use LTspice to measure the outputs when your circuit's actual output.

- b) Add a 1 k Ω load to each of the output ports. Calculate the percent difference between the voltages of each output in part a (unloaded) with corresponding output voltages in part b.
- c) Describe the best way to reduce the percentage of output voltage changes from unloaded circuit in part a to the loaded circuit in part b.

Report Requirements

This lab and associated report must be completed individually. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum:

For each experiment include:

- Clear problem statement in your words.
- Answer to any specific experiment questions (if any)
- Identify the theory or process and associated calculations
- Documents resulting circuit schematics from LTspice, simulation output and additional tables, timing diagram or chart required by the experiment.

For the whole report include:

- A Cover page with your name, class, lab and completion date.
- A Lessons Learned section which summarizes your learning from this lab in 5 sentences or more.
- A New Experiment section that has description of a new experiment and the experiment's results. Experiment should be related to material covered in class but not simply variation of the existing lab experiments.