

LABORATORY 3

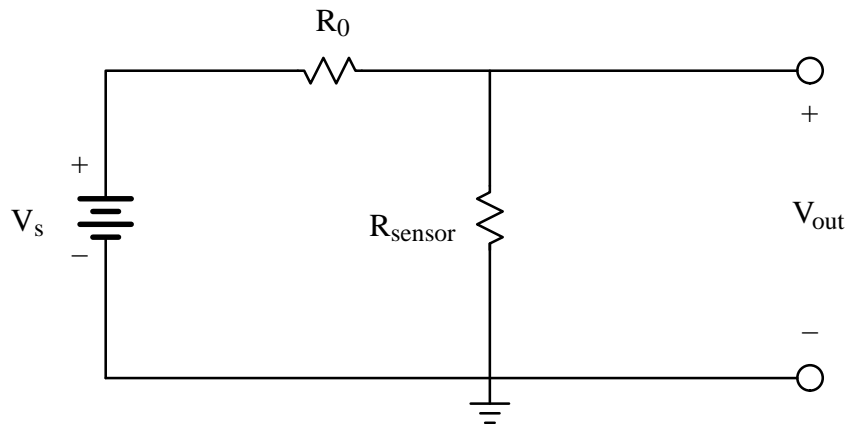
Voltage Dividers, Temperature Sensors, and Bridge Circuits

We have several objectives in lab this week. Some of the things we will do include:

- Analyze a voltage divider to determine the best resistance value to use in a sensor configuration
- Set up and test a voltage divider and a bridge circuit using a thermistor to measure temperature
- Combine two voltage dividers to form a bridge circuit that compares two temperatures and turns on a light to indicate the higher temperature.
- If we have time, we will get an introduction to the PSpice circuit analysis program.

Designing a Voltage Divider Sensor

As discussed in class, voltage divider circuits are often used in measurement instruments to convert a physical quantity such as light intensity, temperature, or elastic strain into a voltage. An example circuit is shown below.



A material that changes its resistance in accordance with light is called a *photoresistor*, and a material that changes its resistance in accordance with temperature is called a *thermistor*. The resistor R_{sensor} in the above circuit represents such a device. Voltage dividers are also used for things like volume controls on radios and televisions, dimmer switches on lights, and intensity controls on computer screens. In these applications, the resistance of a *potentiometer* (or “pot” for short) is varied by the user to change the output voltage.

The above circuit produces an output voltage V_{out} that lies between the source voltage and ground. Please derive the relationship between the output voltage and the source voltage, as determined by