

# Transient Signals

## Equipment

- Protoboard Workstation
- Digital Oscilloscope

## Objective

Learn how to use the digital oscilloscope

- Trigger on a transient signal
- Average signals

Analyze  $V(t)$  for a switch to understand “bounce”

Minimize switch bounce

## Conceptual (C-level)

Draw a voltage divider circuit using a potentiometer (variable resistor).

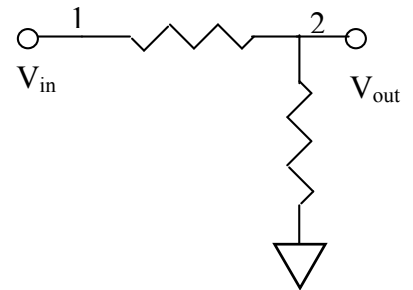
Why should you be careful when using a potentiometer as a voltage divider.

When is the power maximized to a load attached to a voltage divider?

## Basic Lab (B-level)

Build a voltage divider. Measure the voltage output across the second resistor

- Measure the instantaneous and average  $V(t)$  for a simple switch (two wires making contact).
- Measure the instantaneous and average  $V(t)$  for a de-bounced switch (utilize your workstation)
- Compare the switch bounce for a simple switch located just after the  $V_{in}$  (position 1) versus just before  $V_{out}$  (position 2)



Add a capacitor to your simple voltage divider circuit to minimize the switch bounce.

- Where should you place a capacitor?
- What size capacitor is best to use?
- Quantify the improved signal.

## Advanced/Extended Lab (A-level)

Large motors often have diodes reverse biased across their inputs. The diode serves to protect the rest of the circuit from a potentially destructive back EMF. Connect a LED in parallel with an inductor and power with a 1.5V battery.

- Disconnect the battery quickly (you might need to adjust the polarity). Explain the operation of this circuit.
- What is the purpose of the resistor? What size resistor should be used?
- Measure the time constant and determine the inductance.
- What is the smallest inductance you can measure? (Is there measurable inductance from a single loop of wire?)

