

---

## LAB 26. MAKE AN INDUCTOR

### Problem

We have studied the theoretical behavior of components in circuit diagrams, but that doesn't give us a sense of what things are like in the actual world. Manufactured components may as well be alien artifacts if we don't know how they are put together. But if we build components ourselves, we can get a better idea of how the theory works, and how well it works.

### Equipment

Signal generator (computer with Capstone installed, ScienceWorkshop 750 Interface), multimeter, connector wires, precision resistor box, assorted resistors, oscilloscope, magnet wire, iron bar cores, wire cutter, breadboard, connector wires

### Background

An inductor is a circuit component that stores energy of an electric current in a magnetic field. An applied voltage changes the current through an inductor, with the rate of change directly proportional to the voltage and inversely proportional to the inductance of the inductor.

### Activity

You will construct your own inductor from magnet wire and an optional iron core, then test if it follows the theoretical rules of inductors.

#### *Make your inductor*

How is an inductor configured? Make one yourself using the materials at hand, such as magnet wire and an iron nail. Be aware that magnet wire is coated with a thin layer of insulating lacquer. When making an electrical connection between the magnet wire and any other component, you need to scrape the insulation from the ends of the wire.

#### *Test your inductor*

Use the signal generator, oscilloscope, and several different resistors to characterize the transient voltage signal of LR circuits made with your inductor in series with several different resistors. Qualitatively, does the voltage signal behave the way it theoretically is expected to? If it acts as an inductor, what is its inductance? Is its inductance the same in different circuits? Record your observations and measurements in your notebook.

### Lab Report

Use the standard sections: Abstract, Purpose, Theory, Experimental, Observations, Discussion, and Conclusion.

### ***Theory Section***

What are the expected shapes of the graphs of voltage vs. time for the resistor and the inductor when driven by a square wave? How should the voltage graph behave quantitatively depending on the specific values of the inductance and resistance? Explain how one can deduce the inductance of the inductor from the measurements you can make in this activity.

### ***Experimental Section***

Explain how you constructed your inductor, what parts it is composed of, the circuits you used it in, and the measurements you made. Identify the manufacturer and model of any manufactured equipment you used.

### ***Observations and Data***

Tabulate the measurements you made. Including them in a spreadsheet that is shared with me would work nicely.

### ***Analysis and Discussion Section***

Explain how you analyzed your measurements to find the inductance of your inductor, and, for that matter, to find if what you created was indeed an inductor. If you tabulated your measurements in a spreadsheet, it would be great for you to also use the spreadsheet to carry out data processing and graphing. Discuss if your findings show that your device functions as an inductor.

### ***Conclusions***

Did you make an inductor? If so, what is its inductance? Is its behavior in an LR circuit consistent with theory?