

8.1: Background Material

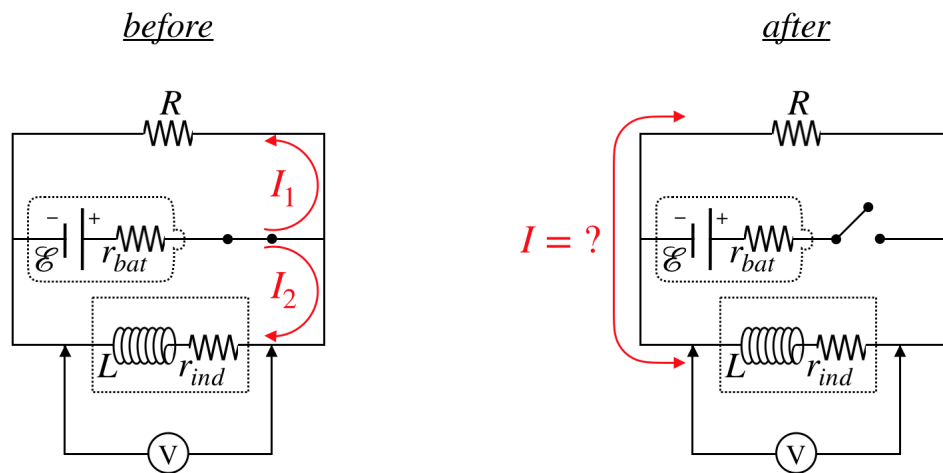
Text References

- [LR Circuits](#)

A Decaying Circuit

To study the effect of inductance, we will create a circuit in which an initial current that flows steadily through the inductor, decays down to zero. To set up this scenario, we employ the following circuit:

Figure 8.1.1 – Decaying LR Circuit



The circuit includes a battery, a resistor, an inductor, and a switch. A voltmeter is used to measure the voltage drop across the inductor at all times. Note that the circuit diagram includes the internal resistances present in the battery and inductor.

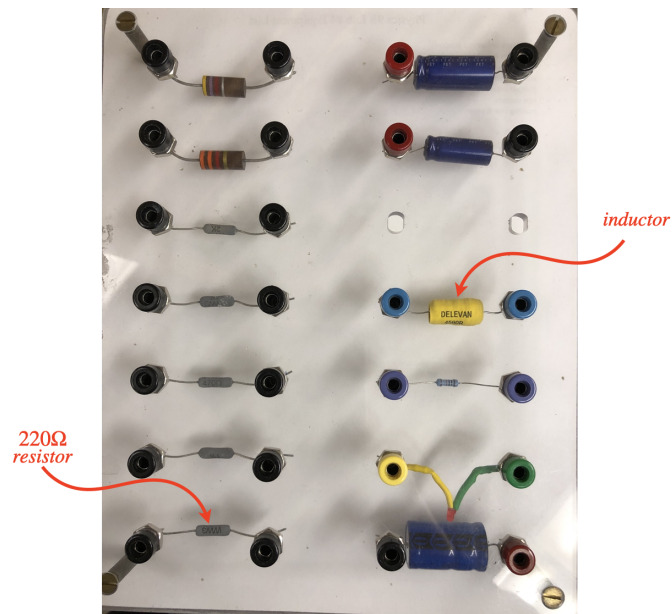
The process begins with a closed switch, such that currents are flowing through both the resistor and the inductor. It is left closed a long time, so that the inductor has no potential drop resulting from a varying current – it only comes from its internal resistance. The graph of the voltage measured by the voltmeter as a function of time is a flat horizontal line while the switch remains closed. We will make direct measurements of the resistances of the resistor and the inductor with an ohmmeter, but this doesn't work for the battery. To get a measurement of the battery's internal resistance, we will measure its terminal voltage with no current (i.e. with a voltmeter), and compare it to the current that flows from the battery in the "before" setting, which we can get from the voltmeter reading and the load resistances.

Very suddenly the switch is then opened, taking the battery out of the circuit. One question we will seek to answer is, "What should the voltmeter measure at the moment when the switch is closed, and as a function of time thereafter?" Then from the time-dependence of the voltmeter reading after the switch is opened, we'll use our [usual graphical approach](#) of converting the data into what we expect to be a straight line in order to find the time constant of this circuit, and from that the value of the inductance of our inductor.

Where to Find Things

We will be using the component board one last time in this experiment. Here is where you will find the components we will be using:

Figure 8.1.1 – Component Board



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