

# RL Circuits Prelab

by

***Dr. Christine P. Cheney, Department of Physics and Astronomy, 401 Nielsen Physics Building, The University of Tennessee, Knoxville, Tennessee 37996-1200***

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Michael Faraday discovered electromagnetic induction in 1831. A changing magnetic field will induce an electric current in a closed loop of wire. The direction of the current will be in a direction that will oppose the change in magnetic field (Lenz's Law).

Read over RL circuits. An RL circuit has a voltage source, a resistor, an inductor, and a switch all in a circuit. When the switch is open, there is no current flowing in the circuit because the circuit is open. Recall from previous labs (Ampere's Law and Helmholtz Coils) that a magnetic field will be generated around a wire when current flows through it. In the RL Circuit lab we put a coil of wire called an inductor into a circuit. When we turn on the current in the RL circuit (either with a switch or with a square wave as we used in the RC Circuit lab), the current and magnetic field in the wire goes from 0 to a maximum value. Thus we have a changing magnetic field in the coil of wire (inductor), and a current that opposes this change is induced in the circuit. There will be an induced voltage or electromotive force (emf) across the coil as that magnetic field changes. Once the current is steady, the magnetic field no longer changes, and the opposing induced current/emf goes to zero. Also note that as the current goes to a steady state, the voltage drop across the resistor reaches its maximum. The voltage across the resistor will exponentially rise as the current goes from 0 to its steady state. RL circuits are used to prevent rapid changes in current.

## Question

1. What is the time constant for the RL circuit that produces a graph of voltage across the resistor vs time as shown below?

Voltage across Resistor vs Time

