Electromagnetic Induction Lab Notes

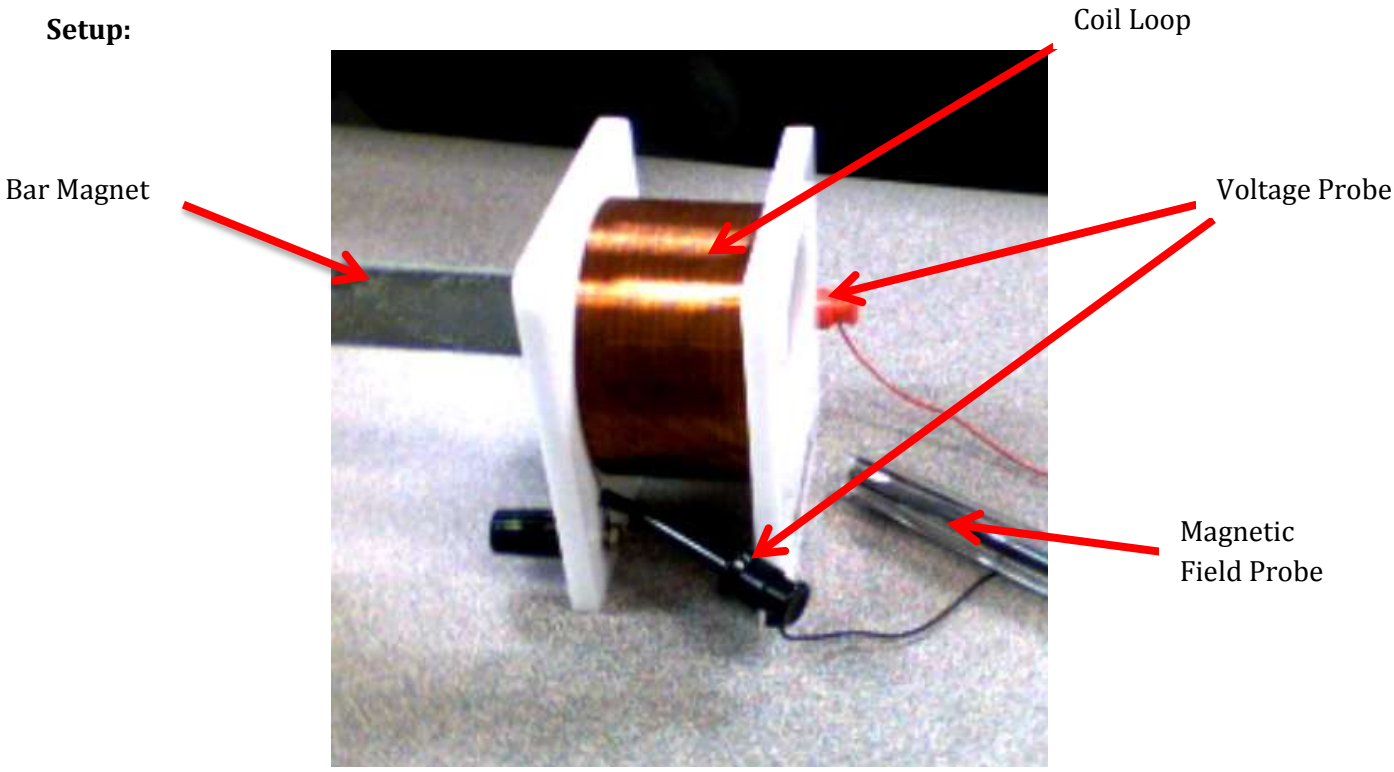
Part 1

The electromagnetic induction lab is set up in two parts, the first, an observation experiment, with the goal of having students observe the variables necessary to induce a current in a coil of wire. This part of the lab will lead them to realize that it is a changing magnetic field that causes a an induced current. They will learn this by moving the magnet around the coil in several configurations, realizing that that a current is only induced when the magnet is moving.

It is important for students to realize that it is not simply THAT the magnet is moving, but that the RATE at which the magnet, and therefore the magnetic field, is changing that effects the induced current. It would be beneficial for the students in the phase to also realize that the amount of loops in the coil will also affect the induced current, hence the need to supply them with more than one coil.

Part 2

Setup:



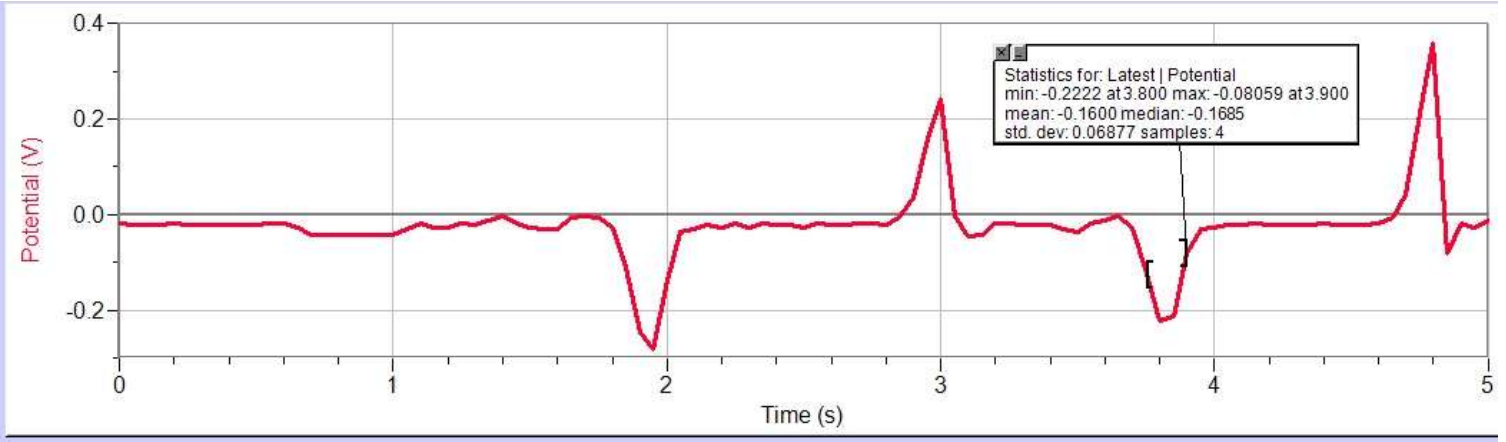
After Conducting experiment with the above setup, data is significant enough to verify Faraday's Law. The Voltage probe should be one with the sensitivity setting set to ±5 V, since the response of the probe due to the field is pretty small. It may even be preferable for students to use galvanometer, rather than probe. This inserts a bit more uncertainty, but will give a larger, more readable reading.

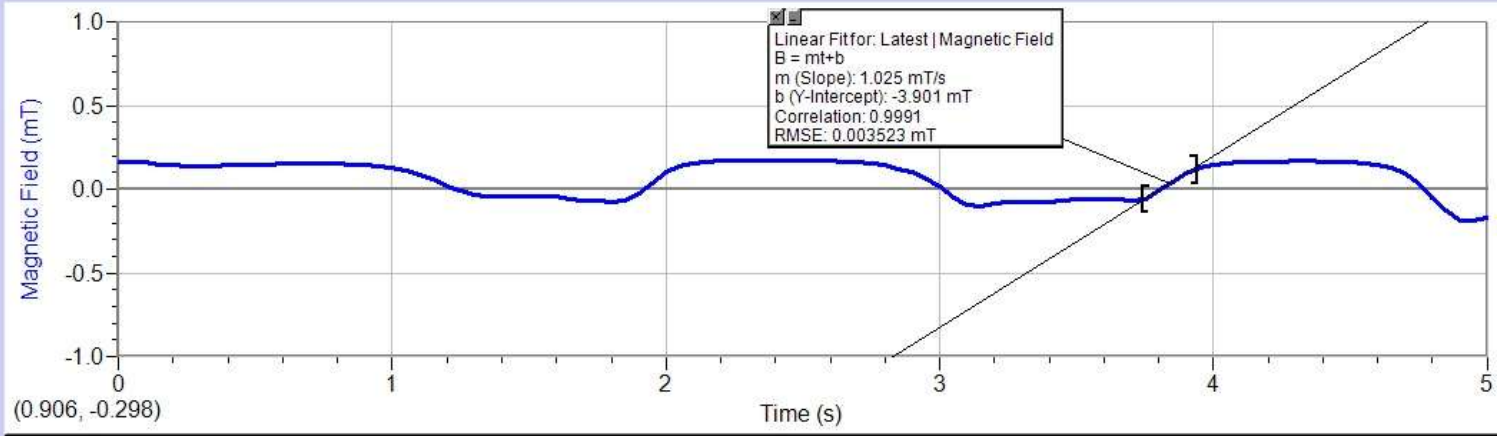
The Magnetic Field Probe works well, though one may have to go by the table data, not the graph, since the probe seems to have a limit, hence the plateau every time the field gets too strong. But it is possible to measure $\Delta B/\Delta t$, and the area of the loop can be calculated to find the flux (see graphical data on the next page).

	Latest		
	Time (s)	Potential (V)	B (mT)
66	3.25	-0.017	-0.0783
67	3.30	-0.022	-0.0746
68	3.35	-0.022	-0.0735
69	3.40	-0.022	-0.0733
70	3.45	-0.032	-0.0680
71	3.50	-0.037	-0.0602
72	3.55	-0.017	-0.0563
73	3.60	-0.012	-0.0551
74	3.65	-0.002	-0.0602
75	3.70	-0.027	-0.0641
76	3.75	-0.125	-0.0557
77	3.80	-0.222	-0.0102
78	3.85	-0.212	0.0475
79	3.90	-0.081	0.0959
80	3.95	-0.032	0.1274
81	4.00	-0.027	0.1475
82	4.05	-0.022	0.1592

Potential
V

Magnetic Field
mT





Using the Logger Pro graph analysis, we can find the maximum induced EMF in the top graph and the slope of the change in magnetic field to find change in magnetic field over time. Give we know the amount of loops in the coil and the area off the loop, we can validate if Faraday's Law is correct.

I was unable to get a count for the loops in the coil, so I myself am unable to validate it with the data given, but presumably there will be a decent amount of uncertainty and assumptions that have to be taken into account to achieve a supporting judgment. Over all, though, the execution of the experiment is fairly easy. The areas of complication will most likely be in the analysis of the data and the ability for the students to realize that the data given by the B-field probe is not flux.

Lab Setup

- Each student can be given all the equipment at once. Each lab bench should have a:
  - Bar Magnet
  - 2 coils with different number of loops
  - Galvanometer
  - Vernier Logger Pro interface
  - Magnetic Field Probe
  - Voltage Probe (set to ±5 V)
- Make sure each station has enough wiring to attach the coils to the galvanometer