EE380 Electromagnetics Project 1—Levitation

Design an experiment to test what characteristic are need to actively levitate a metallic object (or permanent magnet) using an electromagnet.

1. The object should levitate in such a way that it is at least 1 cm from the nearest object.
2. Levitation must be achieved with an actively controlled electromagnet.
3. The object should levitate with a 2 mm stability for a minimum of 10 seconds.

Students should address the following design issues.

1. What are the required characteristics of the electromagnet?
2. What is the most efficient (or at least intelligent) geometry for the project?
3. How will the information be collected for the feedback control system?
4. How can the required current be minimized?

You should have a written outline of the design and test procedure prior to demonstration (full documentation is not required at the time of demonstration).

Submit: Hardware schematic, notebook, calculations, and documentation. Your documentation should include a verification sheet signed and dated by Marc Mitchell or Mark Randall.

EE380 Electromagnetics Project 2—Non-Contact Current Meter

Design an experiment that can measure the AC current in a wire using a probe that is NOT placed in series with the current carrying wire.

1. The probe should be made by the student and not an "off the shelf" probe.
2. The current meter should be designed such that the probe does NOT require physical contact to the circuit in which it is measuring current.
3. The probe should be able to measure the current in conductors up to 5 cm in diameter.
4. When the probe is placed in the measurement position the current reading should NOT depend on the relative position of the probe and the wire. In other words, if the probe moves slightly during the measurement process the measurement should not change.
5. An attempt to minimize error should be demonstrated, and tolerances should be characterized.

Students should address the following design issues.

1. What geometries will allow current measure that is not position dependent and does not physically contact the circuit?
2. How is the system calibrated?
3. How is the current to be displayed?
4. It is the responsibility of the student to demonstrate tolerances in the range between 0-2 A.
5. The meter should be callable of measurements up to 20 A, but demonstration only needs to be up to 2 A.
6. It is the responsibility of the student to create a safe AC current source.

You should have a written procedure prior to demonstration (full documentation is not required at the time of demonstration).

Submit: Hardware schematic, notebook, calculations, and documentation. Your documentation should include a verification sheet signed and dated by Marc Mitchell or Mark Randall.

EE380 Electromagnetics Project 3—Transmission Line Characteristics

Design an experiment that will characterize a transmission line using standing wave analysis. Standing wave analysis means that you will use an injected AC signal to determine the characteristics. The characteristics should include:

1. Length of transmission line
2. Characteristic impedance of the transmission line
3. Attenuation coefficient of the transmission line

Once these characteristics have been obtained design a method to detect impedance mismatches at the terminal end of the transmission line.

You should have a written procedure prior to demonstration (full documentation is not required at the time of demonstration).

Submit: Experimental procedure, notebook, calculations, and documentation. Your documentation should include a verification sheet signed and dated by Mark Randall, or Dr. Mitchell.