CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J0907

Project Title
Soaring Solenoids

Abstract

Objectives/Goals
It is common knowledge that an electro-magnet attracts ferromagnetic metals and can attract or repel a permanent magnet. How do you get a magnetic coil to levitate over metal? A coil supplied with alternating electric current can induce a magnetic field in a nearby conductor that repels the coil. My project shows how this can be used to levitate a coil and how the thickness and resistivity of nearby sheet of metal affects how high the coil levitates.
My hypothesis is that two factors play a strong role in the force that repels a coil from a nearby sheet of metal. The lower the electrical resistance of the metal sheet, the higher the coil will levitate. The thicker the metal sheet, the higher the coil will levitate.

Methods/Materials
To test my hypothesis, I built a coil powered by alternating current and measured the height it levitated over a sheet of metal. The coil was 250 mm in diameter and 200 windings of copper wire. The alternating current was supplied by a wall outlet (110 VAC, 12 Amps). I measured the height the coil for three different metals at four different metal thicknesses.

Conclusions/Discussion
The data agreed with my hypothesis. The higher the resistance, the lower the coil floated when the metal thickness was 3 mm. When the thickness of the metal increased, the height of the coil increased. However, after a certain thickness the coil did not levitate any higher.

Summary Statement
The effect of electrical conductivity and thickness of a metal plate on the magnetic repulsion force created by an alternating magnetic field.

Help Received
Rick Lee of General Atomics provided materials for a coil; Industrial Metal Supply loaned sheet metal for measurement.