CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
J0714

Project Title
How to Generate Electricity Using Michael Faraday's Law

Abstract

Objectives/Goals
The objective of my experiment is to generate electricity by moving a magnet inside a wire coil. This changes the magnetic flux inside the wire coil. Faraday law states that EMF= N delta phi/delta t. EMF is the electromotive force in volts, N is the number of wire loops in the wire coil, delta phi is the change in magnetic flux in Weber, and delta t is the time it takes for the change in the magnetic flux to occur in seconds. My hypothesis is: If the magnetic flux is changed faster, then more electricity will be generated. My independent variable is the time (seconds) it takes for the magnet to move through the wire coil. This indicates the rate of change of magnetic flux. My dependent variable is the generated electromotive force (volts).

Methods/Materials
Three wire coils (200,300,400 loops) were constructed. I moved the magnet through each coil using different speeds. This generated electric sine waves on the oscilloscope. For each wave, I measured the amplitude (volts) which is the dependent variable, and the period (seconds) which is the independent variable. Two orientations of the magnet (vertical and horizontal) were used.

Results
1)When the magnet moved faster in the wire coil, more electricity was generated. There was a linear relationship between EMF and the frequency of the alternating current generated.2) The electricity generated increased as the number of wire loops in the coils increased. For the vertical orientation, the ratio of the slope of the 400 coil graph to that of the 200 coil was 2.1(5% error). The ratio of the slope of the 300 coil graph to the 200 coil was 1.45(3.3% error). 3) The electricity generated in the vertical magnet orientation was consistently higher than the horizontal orientation. The above results are consistent with Michael Faraday law. 4) The direction of the current generated when the magnet was moving towards the wire coil was opposite to when the magnet was moving away from the coil.

Conclusions/Discussion
The electricity generated is 1)directly proportional to the rate of change of magnetic flux. This supports my hypothesis; 2)directly proportional to the number of wire loops in the wire coil; 3)directly proportional to the number of magnetic field lines that are perpendicular to the plain of the wire coil. 4) The direction of the current generated depends on whether the magnetic flux is increasing or decreasing.

Summary Statement
Generating electricity by moving a magnet inside a wire coil

Help Received
Parents helped with guidance and computer. Advisor lent me the oscilloscope and gave me ideas.