LabReport_ElectromagneticField

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1 Investigation of Electromagnetic Field Produced by a Copper Wire Coil under Varying Conditions

1.1 1 Introduction

Electromagnetism is a fundamental force that governs the interactions between electric charges and magnetic fields. It describes the relationship between electric currents and the magnetic fields they produce. Understanding this relationship is crucial in various fields of science and technology, as well as for the engeneering of numerous devices, including motors, generators, and transformers.

The purpose of this experiment is to investigate the electromagnetic field produced by a copper wire coil. By passing an electric current through the coil, we can observe the formation of a magnetic field. Using a simple wireless magnetic field sensor to measure the strength of the magnetic field inside the coil which factors of stand in which relation to how its strength. Factors that were explicitly investigated were distance from the center of the coil, the number of wire turns and the diameter as well as the length of the coil.

1.1.1 1.1 Background Knowledge

To understand the relationship between electric currents and magnetic fields, we turn to Maxwell's equations, which describe the behavior of electromagnetic fields. One of Maxwell's equations, known as Ampere's law, reveals the connection between the current flowing through a wire and the magnetic field it generates.

According to Ampere's law, when an electric current passes through a conductor, a magnetic field is created around it. The strength and direction of the magnetic field depend on the magnitude and direction of the current. The magnetic field forms a closed loop around the conductor, with the field lines curving around it.

The relationship between current and magnetic field can be further understood through the right-hand rule. If the thumb of the right hand points in the direction of the current, the curled fingers represent the direction of the magnetic field lines around the conductor. The magnetic field strength decreases as the distance from the conductor increases, proportional to the inverse of the square of the distance ($H = \frac{I}{2\pi r}$, where H is the strength of the magnetic field, I the current applied and r the distance from the wire).

In this experiment, we will investigate the electromagnetic field produced by a copper wire coil. Copper is an excellent conductor due to its high electrical conductivity. When an electric current is passed through the coil, a magnetic field is generated in its surroundings. Understanding the characteristics of the electromagnetic field generated by copper wire coils is essential for designing

efficient electromagnetic devices and advancing technologies such as energy transmission, wireless communication, and magnetic sensing.

1.1.2 2 Methods

Tools and material Tools and material used include: - Different premanufactured copper coils ([image] should be attached) - The coils were specifically manufactured to have most traits in common with one varying - Wireless magnetic field sensor by Pasco

$e = mc^2$

$\oint \mathbf{B} \cdot \mathbf{dl} = \mu_0 \cdot I_{\text{enc}}$

2 Sources

2.1 Tools and material

1. magnetic field sensor
    2. Produced by pasco (https://www.pasco.com)

2.2 Information, Knowledge

1. https://www.maxwells-equations.com/