Solenoid and Wire Magnetic Field Models

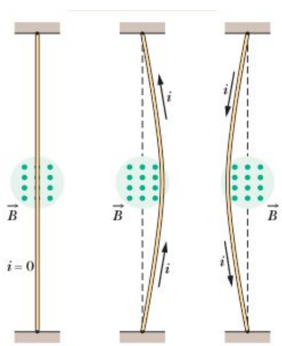
Abstract

Our project involves creating simulations of two physics phenomena: the magnetic field of two straight wires with current running through, and the magnetic field of a solenoid. As there aren't many existing simulations dealing with these two situations, we will represent visually the magnetic field lines in both straight wires and solenoids, and how these field vary with other factors, such as direction of current for a straight wire, or number of turns in a solenoid. Along with a visual portrayal of the changes in magnetic field, we will also display how the numerical value of magnetic field strength changes. Specific to each simulation, there will be a paragraph or two of in depth explanation of how straight wires and solenoids function in relation to the E&M unit, which comprehensively ties together the entire project.

Concepts Utilized

There will be two major concepts modeled in this project: wires and solenoids

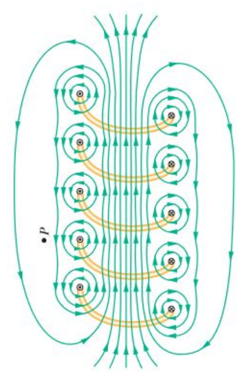
1. **Wires (Textbook pages 820 and onward)**



As the right hand rule dictates, there is an orthogonal relationship between the force on a wire, the magnetic field surrounding it, and current within it. We will model this relationship through the use of small balls to model the flow of charge, and vectors to show the related forces and fields. Everything will be scaled appropriately (ie: a larger field leads to a larger force) and the user will be able manipulate certain variables at the beginning of the simulation.

2. **Solenoids (Textbook pages 848 and onward)**

Solenoids exist as extremely long wires bundled together in a circle manner to create a unique field. Through the common centers shared by the loops, the magnetic field amplifies and grows in intensity. We will show how this field is affected by a number of variables, most notably the number of loops in the solenoid. The user will have the ability to input amounts for certain variables and see the effects varying values will create.



Components

In this project, we will be using the following components:

- Python (For web application functionality)

- Javascript (For backend functionality)
- SVG (Frontend animation base)
- HTML/CSS (Basic frontend formatting/styling)

Upon completion, our application will be hosted on a DigitalOcean Droplet, accessible on the Internet via an IP address. In the case of any technical errors, we also have the option to display our project using Stuyvesant's server (upon which the correct url will be provided.)