E&M Simulations

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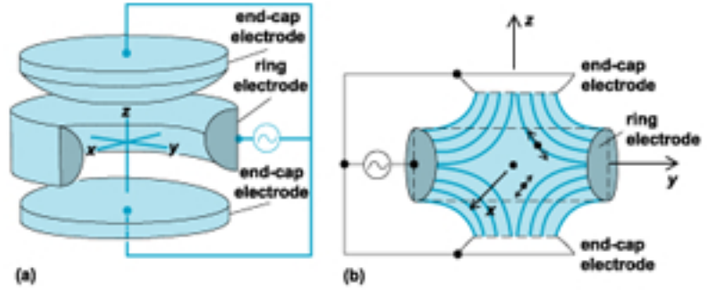
The Characteristics of a Penning Ion Trap

Aim: To present a simplified model for the **conventional Penning Ion Trap**, used to confine single and multiple ions in a trap. It helps physicists to determine charge-to-mass ratios of atomic particles, characteristics of fundamental constants, and advancements in quantum computation. We wanted to prove that existing particles do affect the motion of other particles in the trap.

Design: The design of the trap consists of 2 positive point charges and a negatively charged ring centered halfway between the charges. Charged particles are confined within this configuration due to a combination of a static electric and static magnetic field.
The **MATLAB** simulation **results** support that there must be a **maximum number of ions that can be trapped** at one time.

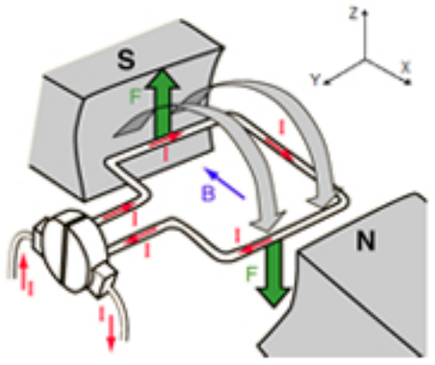


The Model of a DC Motor

The **direct current motor** was the first type of motor to be created to convert electrical to rotational mechanical energy in the 1800s. In industry, the torque-speed curve of a DC motor is the most-widely used characteristic of a motor, to pick motors that can operate on the required load without stress.

Aim: To verify our hypothesized inverse **correlation between the load torque and the angular speed** of an ideal DC motor. Emphasis was placed on the physics behind the torque-speed relationship.

Design: A MATLAB mathematical simulation of a DC motor with various loads 'placed' on the motor was used to observe the steady state maximum rotational speed reached over time. The motor design was simplified to be a metal loop of wire turning in between 2 magnets of opposite polarity. The **result** was observed to be an **inverse relationship** between the torque and speed of a DC motor.



This poster was a Finalist at the National SWE Conference in Orlando in Nov. 2010.