



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Rui Jin	Project Number J0718
Project Title How Can Magnetic Fields Spin a Rotor?	
Objectives/Goals Design and build a spinning device completely composed of common materials to study how magnetic fields drive a rotor to follow the rotation of a controller.	
Abstract Methods/Materials The spinning device consists of two portions, a rotor and a controller. Both portions are built with common materials such as screws, wires, boards, etc. The rotor portion is composed of four electromagnets and a rotor that is a magnet. The controller sequentially alternates the current direction of the electromagnets to change magnetic field polarities (N and S poles). The correct electromagnet polarity is ensured by using the Right-Hand Rule. Each time the controller is manually turned 90 degrees, electricity is supplied to one pair of electromagnets that generates magnetic fields to align the rotor with this pair of electromagnets. Therefore, the rotor can imitate the rotation of the controller in a stepper motion. Different electromagnets and resistors are experimented with to improve the performance of the device.	
Results A spinning device is successfully created, reaching the design goals. When the controller is continuously turned 90 degrees per step in a circular motion, the rotor exactly imitates the controller rotation. Changing the dimensions of the electromagnets can increase magnetic field strength to improve the rotor rotation. After experimentation with resistor values in the circuit, a resistor is selected to reduce battery consumption.	
Conclusions/Discussion Magnetic principles can be applied to create a spinning device with the rotor imitating the angle movements of the controller, which is a simple master-slave system. Four electromagnets used in this project are the minimum number for a circular rotation of the rotor. If increased to six or eight electromagnets, the rotor can turn 60 or 45 degrees in each step respectively. Therefore, the number of electromagnets determines the angle of rotor rotation in each step.	
Summary Statement Design and build a spinning device completely composed of common materials to study how magnetic fields drive a rotor to follow the rotation of a controller.	
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