Eddy Current Demonstrations for Children

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Abstract

Performing scientific experiments for children is an interesting and important part of stimulating their development. Eddy currents can be attractive for children and teenagers. In this article there are presented several simple experiments showing the effect of eddy currents. They are easy to carry out and can be done with commonly available materials. Some children can repeat the activities with their parents at home. Teenagers can perform it themselves.

Introduction

It seems that experiments are the most important role in education in teaching and learning science, especially in physics. Experiments in lectures are not popular at school in teaching children in Poland but it is very important, especially for younger students. Children and teenagers like experiments and ask how to perform them at home. Its encourage students to become interested in physics and in teaching or learning science and make physics more learner-friendly for them. Performing scientific experiments for children is important part of stimulating their development. This form of activity often leads to increased interest in science. We teach children how to perform scientific experiments in Academy for young Explorers in Wroclaw University of Technology. The meetings take place at the Institute of Physics [1].

Experiments with eddy currents make lectures more interesting and exciting.

Experiments

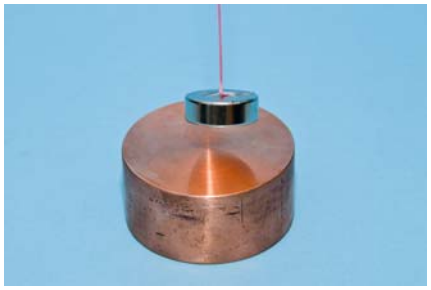
I will present here some experiments related to eddy currents.

1. Eddy currents in thin metal plates (Al., Cu, Zn, Pb etc.)

For this experiment you will need a few different thin metals plates with a similar dimension. The metal plates have to be non-magnetic ones. The magnet has to be hold between your fingers above the plate. Move the magnet quickly along the plate so as to change the magnetic field surrounding it and enforce it to move. The aluminum plate is the easiest to move.

2. The Magnetic Pillow

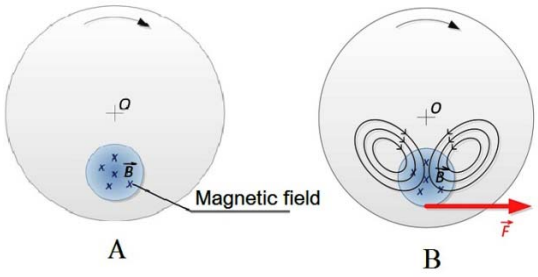
For this experiment a thick copper disc is needed. We put the disc on the table or on the floor. Drop a magnet on a copper and we observe the motion of a magnet. The magnet interacts with the copper disc and falls much more slowly.



3. The Magnetic Breaks

This experiment we can show two ways:

The first method is very simple. We move the neodymium magnet to the rotating aluminum wheel (disc). The wheel will stop after a while.

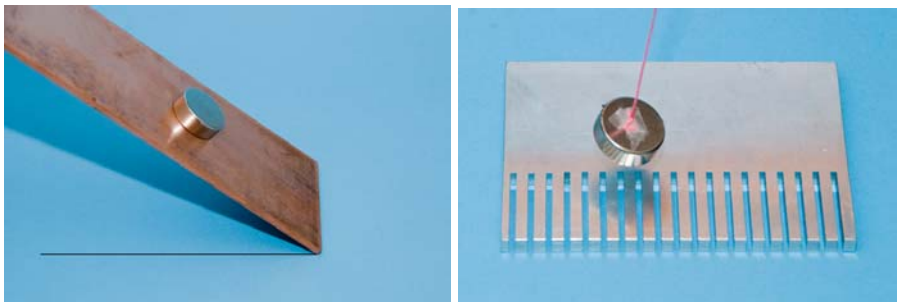


Eddy currents induced in a rotating metal disk. [2]

A. Metal disc rotating through a magnetic field.

B. Resulting eddy currents and braking force.

For the second method we will need a thick copper or aluminum plate. You will also need an aluminum plate nicked from one side of it. Prepare a magnetic pendulum in advance by hanging the magnet on a string. Put the pendulum in free vibration. Put the nicked side of plate underneath the pendulum. That will have no influence on pendulums speed. Now change the side to the not nicked. The pendulum will stop after a while.



4. The Magnet Racing

We can play with magnets in the race. Children can have fun in racing magnets in pipes or on an inclined plane.

In pipes:

For this experiment we will need a few pipes of the same diameter made of various materials such as aluminum, copper, plastic etc. Drop the magnets down the tubes and see who the fastest fall. For example, the magnet does not affect the plastic and there aren't eddy currents in the pipe. The magnet will be fell in it only under the influence of gravity. But an eddy current is set up in a conductor in response to a changing magnetic field. The magnet will fall more slowly.

In addition, we can cut the copper pipes along and compare the speed of the falling.

We can also perform an experiment with cupper pipe frozen in liquid nitrogen. The temperature change affects the change in tube resistance, and hence the eddy currents.

On the inclined plane:

Let observe the motion of a magnet on an inclined plane made of copper, and made of wood or plastic. On the curvilinear motion of magnets on an inclined plane of copper will have a big impact eddy currents.

5. The Pendulum Made of Can of the Beverage.

Cut out a shape of the pendulum from aluminum beverage can (in similar to that shown in the figure). Cut the circle in the shape of the pendulum. Hang the pendulum on the two blades or sticks and move closer in and back the magnet to the wheel. The pendulum will start to move.

6. A Spinning Can

For this experiment we need an empty can of beverage (eg Pepsi, Mountain Dew or other beverage). We cut the upper lid of the can and put it on the water surface in the plate. The can of beverage can float freely on the surface of the liquid. We attach the thread to the magnet and leave it inside the can. When we rotate the magnet, the can also spins around the axis.

Literatura

[1] www.amo.if.pwr.wroc.pl
[2] Sears and Zemansky's University Physics With Modern Physics (Addison-Wesley Series in Physics)