Physics Investigation 9 Teacher Manual

Observation

When a magnet moves near to a coil connected to a galvanometer, the meter deflects.

Problem

How does the movement of the magnet affect the size of the deflection?

Hypothesis

If the magnet is moving faster towards the coil, the voltage induced in the coil will be greater.

Aim

To investigate how the voltage induced in the coil depends on the speed of the magnet moving towards the coil.

Principle

Electricity is produced by a moving magnet.

In this investigation, the following variables are involved :

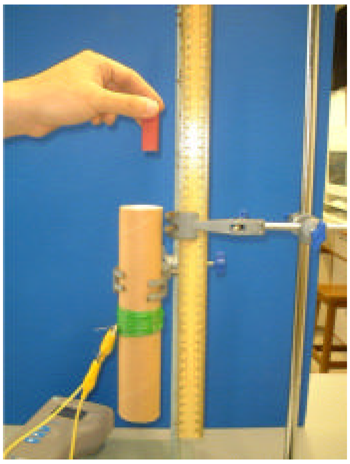
independent variable - speed of magnet

dependent variable - induced voltage

Equipment and materials

1. desktop computer x1
2. datalogging interface x1
3. potential difference sensormeter x1
4. magnet x1
5. coil x1
6. stand and clamp x1
7. newspaper

Set-up



Procedure

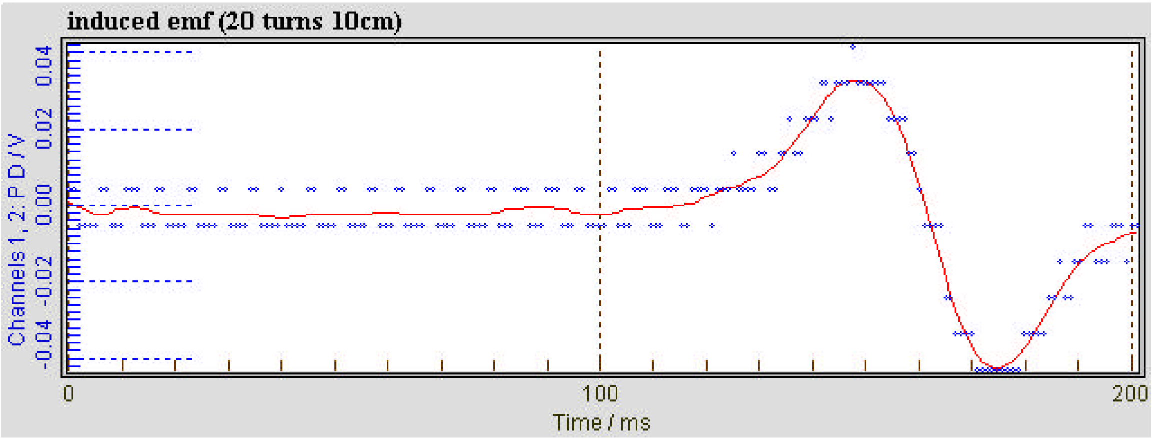
1. Wind a coil of 20 turns on a paper tube;
2. Connect a potential difference sensormeter to the coil;
3. Connect the potential difference sensormeter to the computer via the datalog interface;
4. Choose the range -1V to 1V on the potential difference sensormeter;
5. Set the recording feature of the datalogging to "fast" mode, and choose the time for recording to "**200ms** ";
6. Clamp the paper tube with the coil vertically on a stand;
7. Put a pile of newspaper or other soft materials underneath the coil to protect the bench from being damaged by the falling magnet;
8. Drop the magnet from a height of 10cm above the coil. At the same time, press the record button on the computer;
9. Plot a graph of voltage (induced emf) against time;
10. Repeat steps 8 and 9 for other heights (20cm , 30cm and 40cm) of the magnet above the coil;
11. Compare the graphs.

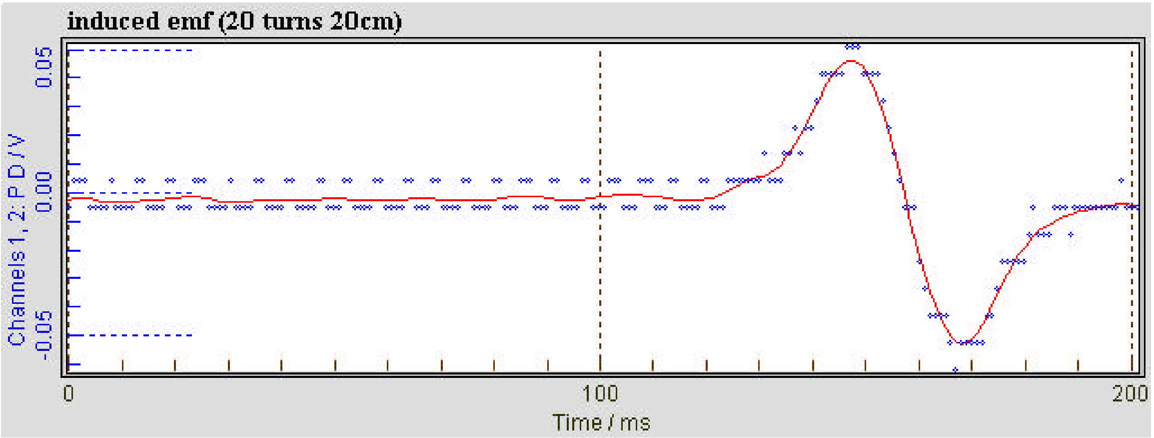
Precautions

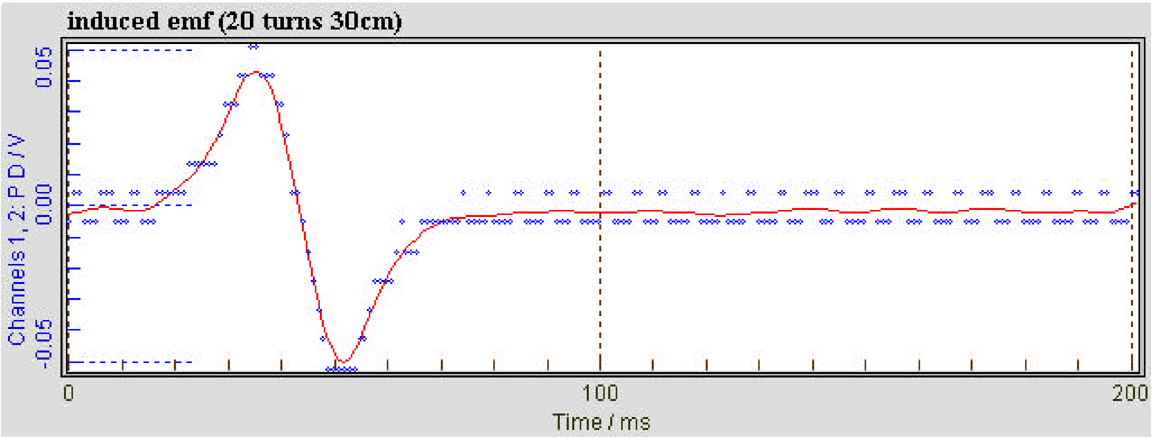
1. The magnet should be allowed to fall vertically;
2. The turns on the coil should be evenly and closely packed;
3. As the interval for recording is very short (200ms), several trails are needed to make sure that the emf induced is within the 200ms time interval.
4. Orientation of magnet should be constant when dropped.

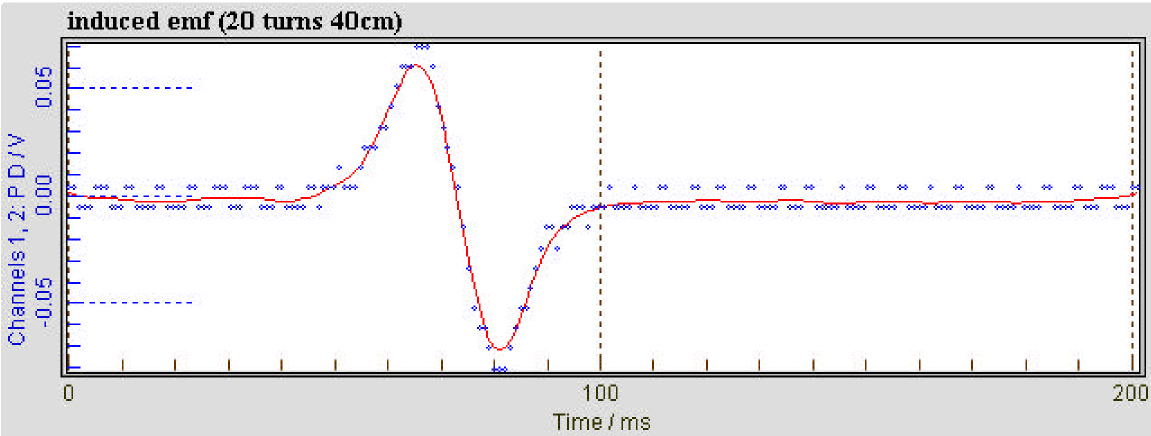
Results

Graph(s) obtained:









Interpretation

When the magnet entered into the coil, voltage was induced in the coil momentarily and dropped back to zero (positive pulse). When the magnet left the coil, voltage was induced momentarily in the opposite direction (negative pulse).

As the magnet accelerated under gravity, the duration of the second pulse was shorter and its magnitude was greater when compared with the first pulse. If the magnet was dropped from a greater height, the magnet entered and left the coil with a greater speed. Greater pulses were induced.

These supported the hypothesis that voltage induced in the coil depended on the speed of the magnet approaching it or leaving it.

Possible errors

1. The turns on the coil were not evenly distributed.
2. As the time of falling was very short, voltage induced momentarily in the coil could not be measured with a high accuracy.
3. Orientation of magnet might not be exactly vertical when dropped.

Improvements

1. If a smaller magnet or a longer coil is used, emf induced in the coil when the magnet is moving inside the coil can be studied;
2. Stronger magnet is recommended;
3. By changing the number of turns, the relationship between the induced emf and number of turns can be studied.

Conclusion

The voltage induced in the coil increased with the speed of the magnet moving towards or away from the coil.