An Experimental Study on Strong EMF Generation without Moving Magnetic Core and Magnetic Field

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Abstract

The magnetic core is used in electric generators to provide high permeable path for magnetic field lines. Due to this reason flux density in core increases and strong emf produces when change in flux occurs within conductor. For that either magnet or magnetic core should be move. But in present paper experimentally it is proved that it does not require to move magnetic core as well as magnet in place of that we can fix both and only by moving coil we can produce stronger emf.

Keywords: emf, induced current, induced voltage, magnetic core.

1. Introduction

In 1831 Michael Faraday was invented way of electricity generation by simple experiment as per his experiment he said that *an emf is produces in conductor if magnetic field changes within it.* After that he made first electric generator which could produce continuous electricity but amount of emf produced by this method was very low and it was not usable to generate electricity in practical level.

To avoid this problem in modern electric generators Cu wire wrapped in magnetic core and emf produced is increased due to increase in magnetic flux density in core. These magnetic lines of flux likened to the rubber bands under tension. Hence, the bent lines of flux up a mechanical force on core. It will be seen that this force is in a direction opposite to that of core moment. That cause if we want to move magnetic core in magnetic field then we have to work against magnetic force and this work is increases with increase in strength of magnetic field. Other than that due to change in magnetic flux into magnetic core iron losses also occurs which reduces efficiency of energy conversion. Now if we take coil without magnetic core and try to move in magnetic field then required work is less because of nonmagnetic nature of copper at same time induced emf is also less due to less change in flux into coil. So this experiment is performed to get method in which we will be produce strong emf and for that we will not be required to move magnetic core.

2. Experiment

2.1. Apparatuses

The experimental apparatuses shown in Figure 1. A hollow permanent magnet OD 52 mm, ID 25 mm and height 34 mm. A ferromagnetic core with 120 mm length and 6 mm thick was used. A galvanometer was used to detect the induced current. A digital multimeter was used to measure induced voltage. Four copper coils ID of 8 mm and height 5 mm, 6 mm, 11mm, 14 mm with 18, 35, 65 and 110 turns were used.

2.2. *Experimental procedure*

Experiment arrangement is done as shown in Figure 1. Now in first step only coil moved upward then downward direction. In second step coil moved with ferromagnetic core. In third step magnetic core fixed in centre of magnet then coil was moved. In all steps due to change in flux density induced current and voltage was produced which measured using galvanometer and multimeter.

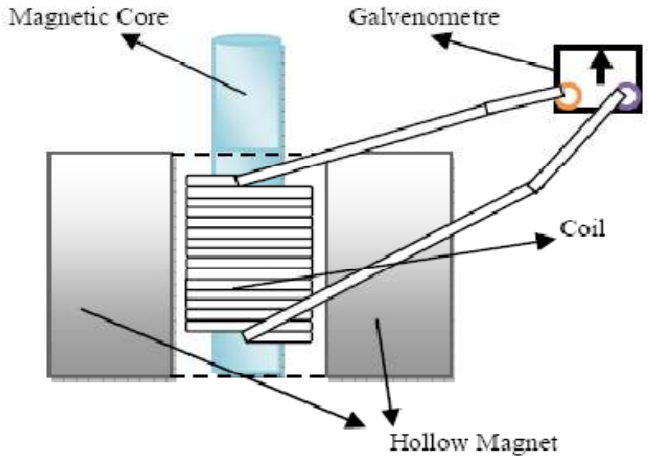


Figure 1 Experiment Setup

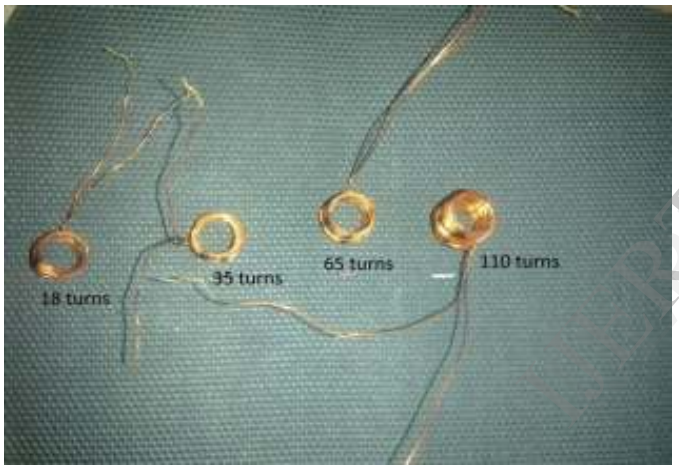
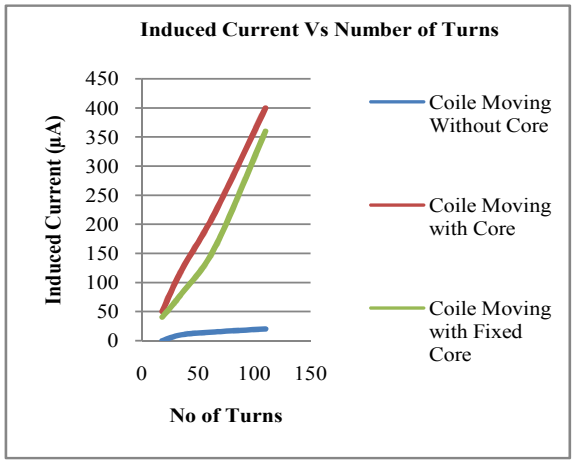
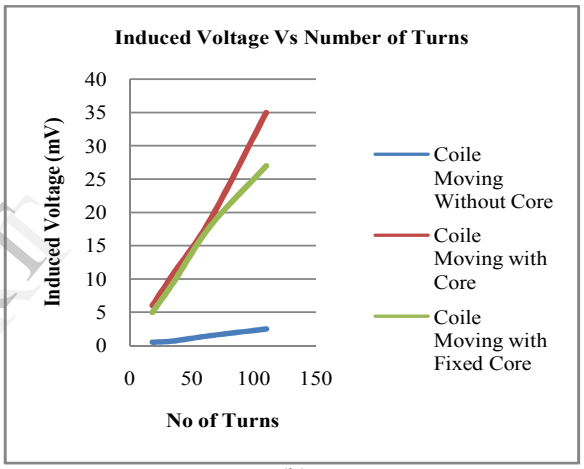


Figure 2 Cu Coils



(a)



(b)

Figure 3 Effect on induced current and voltage with respect to increase in number of turns

3. Result and Discussion

As shown in Figure 3 induced current and voltage is greater if coil move with magnetic core and lower if coil move without magnetic core. Figure 3 also shows that if we move coil by fixing magnetic core then induced current and voltage is greater than coil moving without core but lower then coil moving with core.

One thing we know that induced current or voltage will increase if induced emf is increases and emf depends on change in flux density into conductor (if no change in coil or core material as well as magnetic field also not increased). So it does not matter how you are changing flux density in coil but thing is maximum flux should be change

Concept behind the emf production in this method can understand in this way when a magnetic core placed in centre of hollow magnet then due to higher permeability, magnetic field lines are concentrate in core and flux density increases in centre of core. But vertically in upward as well as in downward direction flux density reduces that because when coil with minimum gape from surface of core is move either upward or downward direction then due to change in high flux density an emf induces. This induced emf is greater compare to without use of magnetic core and work requires moving this coil is less compare to move coil with core.

4. Conclusion

In this experiment following things concluded which shown bellow….

1. Strong emf can be produce without moving magnetic core.
2. Iron loss is zero because of non moving magnetic core.
3. Due to fixed magnetic core there is no extra work requires against magnetic force.
4. Energy loss reduces due zero iron loss, reduction in weight of armature core and reduction in magnetic drag force.
5. Maximum utilization of magnetic flux by moving conductor in hollow magnet compare to moving in front of solid magnet.

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