**Marwari college Darbhanga**

**Subject---physics (Hons)**

**Class--- B. Sc. Part 2**

**Paper---04. ; Group – A**

**Topic--- Electricity ( Electromagnetic Damping )**

**Lecture series – 49**

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# Electromagnetic Damping

## Damping

Damping plays an important role in controlling the motion of an object. It is an opposition offered to the motion of an object. The damping tends to reduce the speed of a moving object. The object can possess various types of motion; Rotatory motion, linear motion, oscillatory

motion etc. Thus, the number of damping techniques are used in rotating, moving and oscillating systems. Which includes, fluid friction damping, air friction damping, conventional friction damping, and electromagnetic damping to name a few.

## Electromagnetic damping

Among all these techniques, electromagnetic damping is one of the most fascinating damping technique. This uses electromagnetically induced current to control/regulate/slow down the motion of the object without any actual physical contact with the moving object. To understand this interesting damping technique it is important to understand two concepts, that is Eddy current and Electromagnetic induction.

## Electromagnetic induction

The concept of Electromagnetic induction was first studied by Michel Faraday during the year 1831. He defines Electromagnetic induction as “Changing magnetic field a induces emf(electromotive force) into a conductor.” It is achieved either by moving a conductor across the steady magnetic field or by placing the conductor in the varying magnetic field.

## Eddy current

This induced emf results in inducing a current across the conductor. This induced current is called the Eddy current. Due to Eddy current, the electrons in the conductor follow

has a unique pattern, they swirl around the conducting line similar to swirling of water in a whirlpool.

The eddy current in the conductor swirl in a way as to generate a magnetic field in the system. The conductor also experiences external a magnetic field. The magnetic field generated due to eddy current opposes the change in the magnetic field experienced by the conductor according to Lenz's law. Thus, Eddy current swirl perpendicular to the magnetic field.

## The theory behind electromagnetic damping

A damping force is generated when these Eddy current and magnetic field interact with each other. This is called electromagnetic damping. Which is a resistive force by nature. This opposes the motion of conductor/object. Thus, we can define that **"It is a damping technique where electromagnetically induced current slowdown the motion of an object without any actual contact"**

## The dependency of electromagnetic damping

As the distance between magnet and conductor decrease the damping force increases. The electromagnetic damping force is proportional to the induced eddy current, strength of magnetic field and the speed of the object. Which implies that faster the object moves, greater will be the damping and slower the motion of object lower will be damping which will result in the smooth stopping of the object.