Eddy Current and Magnetic Levitation Demo

Eddy Current

Eddy currents are induced current in shape of loop within conductors due to changing magnetic fields(Faraday’s Law).
The current flows in perpendicular to magnetic field and magnitude of the current depends on some variable.

1. The strength of magnetic field.(Proportional)
2. The area of loop.(Proportional)
3. The rate of change flux.(Proportional)
4. The resistivity of the material(Inversely Proportional)

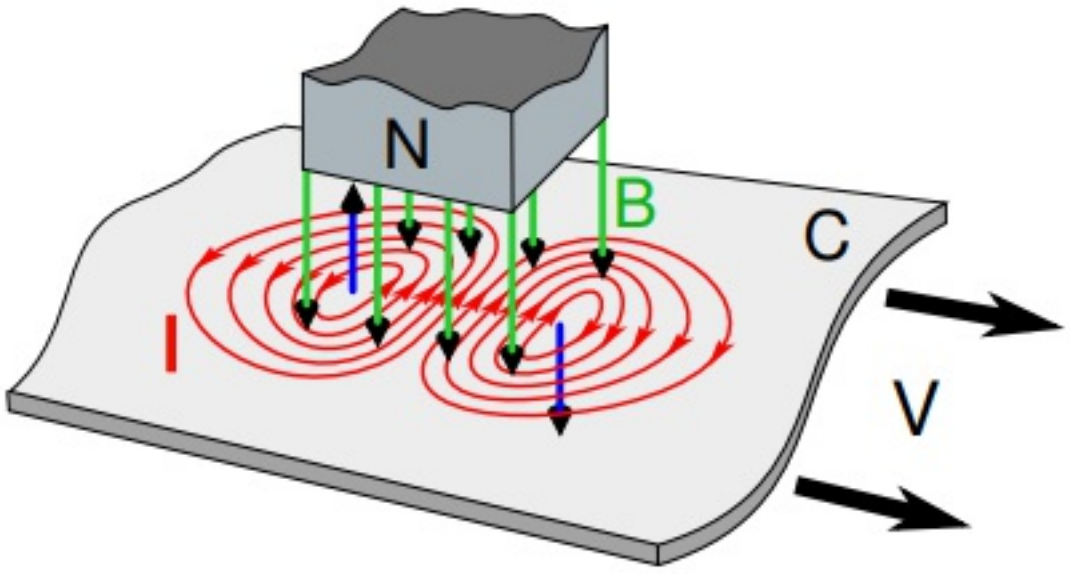

Figure 1:Basic Representation of Eddy Current in Constant Magnetic Field with moving conductors

Eddy current creates a magnetic field opposed. (Lenz’s Law)
Eddy current is usually unwanted at transformer, inductor and electric motors because of power losses. Also, there are some conservation method. (if you are interested in, search the ‘Lamination’.) However, there are more applications such as electromagnetic braking, identification of metals, attractive effects, vibration and position sensing, Levitation (Repulsive effects).Levitation is our interested area at the demo.

##Levitation
Induced current by changing magnetic field creates a opposite magnetic fields within conductors. So, the conductors behaves like ‘diamagnetic materials’. Diamagnetic materials are repelled by magnetic field. In addition, the repulsive effects are used to overcome gravity at some applications. The materials are pushed up (search ‘Separation of Aluminium with metals’) or lifted to up (Maglev Train).
Our setup was created to observe the repulsive effects of eddy current. Setup consists of a inductor (creating magnetic field) and a aluminium surface (conductors which contains ‘Eddy Current’). The magnetic field is time-varying magnetic field thanks to AC excitations.
Faraday’s and Lenz’s Law declare that eddy currents are created on conductor and these currents create opposite magnetic fields. Thus, repulsive effects occur and the inductor floats at air.

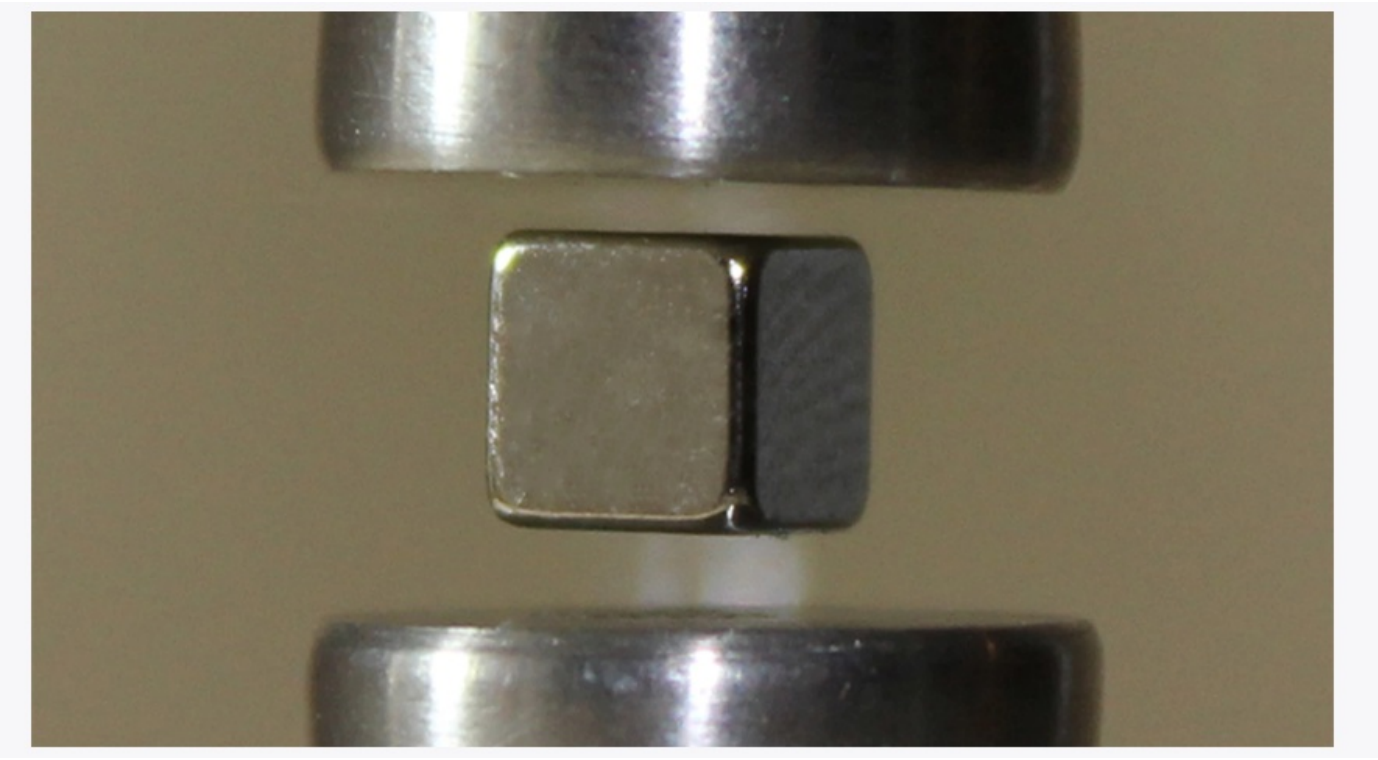

Figure2: Basic Representation of Magnetic Levitation

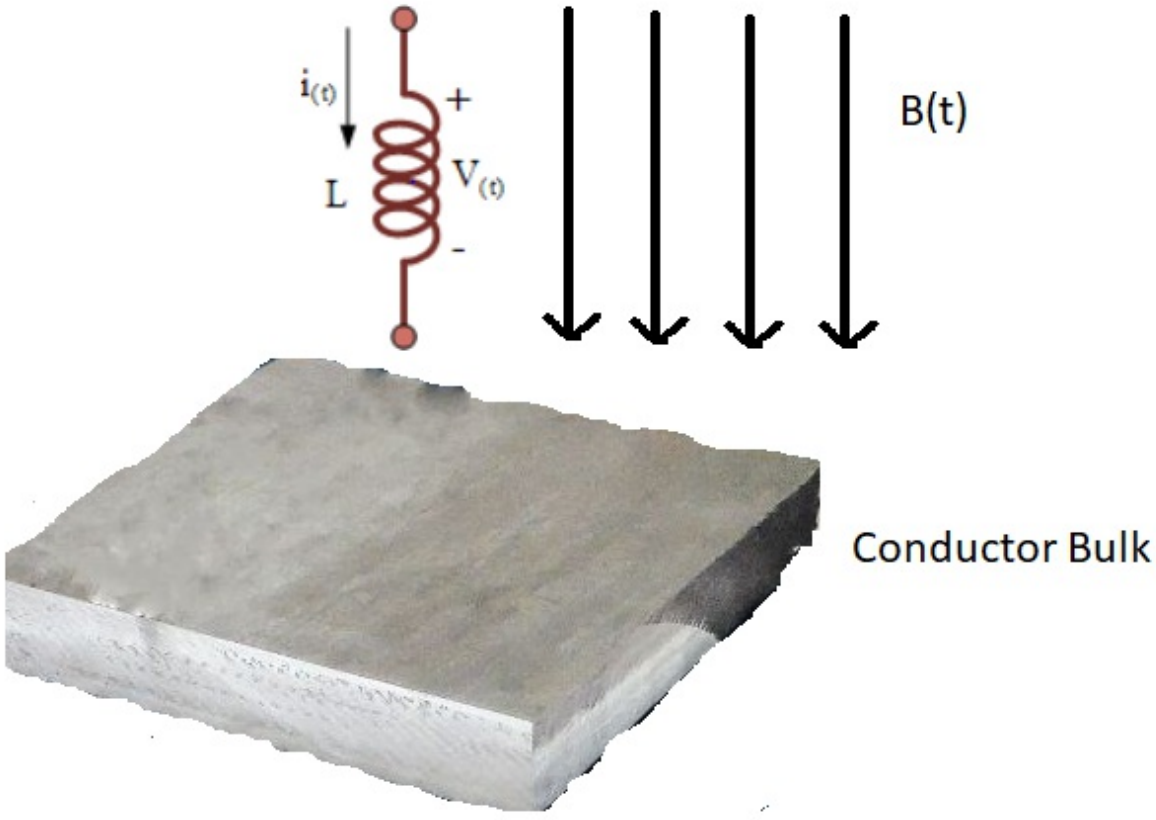

Figure 3:Basic Representation of Setup

References:

1. Princeton.edu. (2018). [online] Available at: https://www.princeton.edu/ssp/joseph-henry-project/eddy-currents/eddy_wiki.pdf [Accessed 27 Oct. 2018].

2. Kickstarter. (2018). Magnetic Levitation Sculpture. [online] Available at: https://www.kickstarter.com/projects/jfehr/magnetic-levitation-sculpture-0 [Accessed 27 Oct. 2018].