**Electromagnetic Braking**

**HW 4**

Most of the braking systems that are in use today utilize the principles of friction to reduce the rotatory motion of a system. This type of braking system works by making contact with the object to apply brake on it which converts the kinetic energy to heat energy. But, In the long run this reduces the efficiency of the brake due to result of wear and tear that occurs every time the brake is in contact with the object. In order to replace this, an electromagnetic brake is introduced which works by application of a brake without any contact. This helps in providing a better long-term efficiency. It works by the principle of generation of eddy currents which induces a magnetic field that acts as a drag on the rotatory motion.

The eddy brake contains a power supply, Electromagnet and an axle. The power supply is used to generate voltage or current into the Electromagnet. The Electromagnet is a device which generates a magnetic field (H) when a current is passed through it. The Electric field (E), induced due to change in magnetic flux and motional effects, along with the magnetic field induces eddy currents into the rotating objects when it is passed through it.

We can use the Maxwell’s equation and Lorentz force to calculate the fields generated by the electromagnet and the Eddy current generated on the rotating object. We can use them to obtain the torque imparted by the eddy current and the fields by the relation

**Tb =**

This torque acts as a braking force which creates a drag around the axle that is connected to the rotating object such as a disk, thereby reducing its rotational velocity.

We can graph a plot between the torque imparted and the current supplied to the electromagnet and the speed vs time characteristics to have a better understanding of how each parameter is affected during this process. By comparing the results of these graphs for each type of material that can be used for the rotating objects, we can find out the best material for the rotating object that can be used an efficient electromagnetic braking.

In the recent years, this system of braking is regarded as one of the ideal braking approaches since it is quiet, frictionless, requires less maintenance and can be used an emergency brake. This is currently used in amusement park rides, to regulate the speed of the rides, as they require a secure braking system for safety of everyone on board. Similarly, they can also be used in high speed trains and industry purposes. The only problem with this type of braking is that it slows down the rotational speed but doesn’t effectively stop them. So, to overcome this problem, a friction break is often used in conjunction with this break to create a near perfect braking system.

**References**

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