**Electromagnetic Braking(EB)**

**HW 3**

**Review of various EB system**

K. Karakoc and his team worked on an analytical model for the Electromagnetic brake or Eddy current braking by using the Maxwell’s Equations for the case of time varying fields. The Lorentz force which is given by

**F = q (E + v x B)**

where **B = H** and **D = E** are the Magnetic flux and Electric flux densities respectively, **v** is the linear velocity of the conductor, **F** is the Lorentz force, **q** is the electric charge of the particle, is the permeability of the medium and is the permittivity of the medium.

Using this, the Eddy current density **J** for the material with conductivity and the time varying fields can be obtained by

**J = σ (E + v x B)**

The magnetic field and Electric field can be expressed in terms of the potential by the relation

**x A = B**

**E =**

where **A** is the magnetic vector potential and is the Electric Scalar Potential

Now by using the Maxwell’s equations

**x H = J +**

and substituting the above relevant relations in the above Maxwell’s equations, we get

**2 + =**

These two equations are solved by using Boundary conditions and a few assumptions to obtain the vector magnetic potential **A**. By using this potential, we can calculate the torque by the relation

**Tb =**

Where **Tb** is the braking torque and **rp** is the position vector. The team has also validated this analysis by using Finite Element Method (FEM). They have concluded that the application of time varying fields increases the braking torque generation capacity of an electromagnetic brake

Sivasubramanian R and his team created a working model of an EM brake by using motors, pulley, belt, regulator, Electromagnet, Switches and a Disc. The block diagram is show below.

The power supply is given to the Electromagnet coil to generate magnetic field. This coil develops magnetic lines of flux between the metal disc thus attracting the armature to the face of the metal disc. When the current or voltage is removed from the brake (electromagnet) the metal disc is free to rotate. Here springs are used as medium to hold the armature winding of the electromagnet away from the disc. Rotating motion in wheels is achieved by switching controls of the supply to the coil.

**References**

[1] K. Karakoc et al., Analytical modeling of eddy current brakes with the application of time varying magnetic fields, Applied Mathematical Modelling (2015).

[2] Sivasubramanian R, Siva sundar S, Umakhesan A, Rajavel M, Saravanan M, Design and Development of Electromagnetic Braking System, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-4S, February 2019.

A screenshot of a cell phone

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