Smt. S. R. PATEL ENGINEERING COLLEGE

FABRICATION OF
EDDY CURRENT BRAKING SYSTEM

BY:-

- **Patel Kuldeep G (110780119015)**
- **Patel Tarun H (110780119067)**
- **Chaudhary Naresh N (110780119090)**
- **Panchal Krunal B (110780119094)**

- **GUIDED BY:- NILAKANTHA SAHU**

Introduction

- green technology
- the importance of environment conservation
- Brake wear debris represent obviously potential hazard
- several hazardous elements that may interact with DNA of living organisms
- a few researchers also noted that there are few problems with the conventional braking system.
- As vehicle speed increases, a more powerful brake system is required to ensure vehicle safety
- A contactless brake system using an eddy current is proposed to overcome the problems

What is eddy current ?

- when magnetic flux linked with a metallic conductor changes, induced currents are set up in the conductor in the form of closed loops .

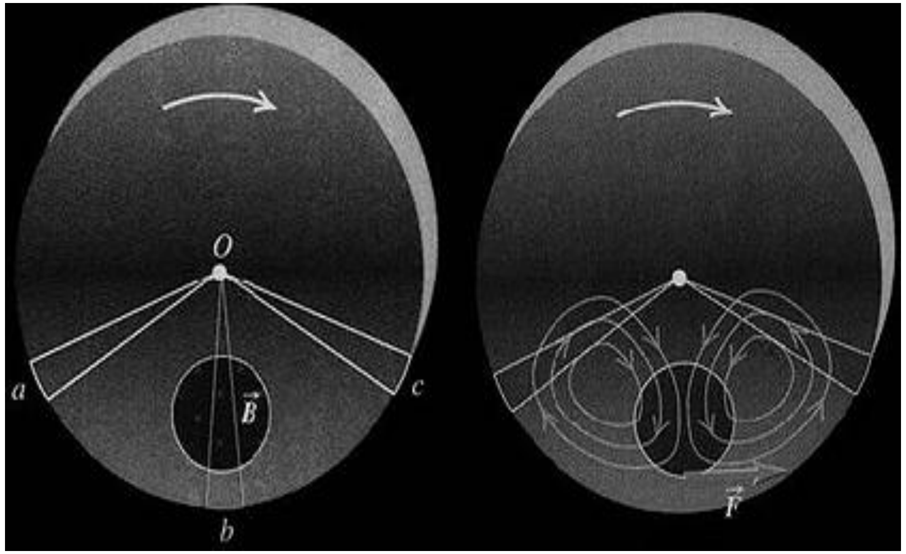
- currents look like eddies or whirl pools and likewise are known as eddy currents

- eddy currents circulate inside the conductor generating magnetic field of opposite polarity as the applied magnetic field.

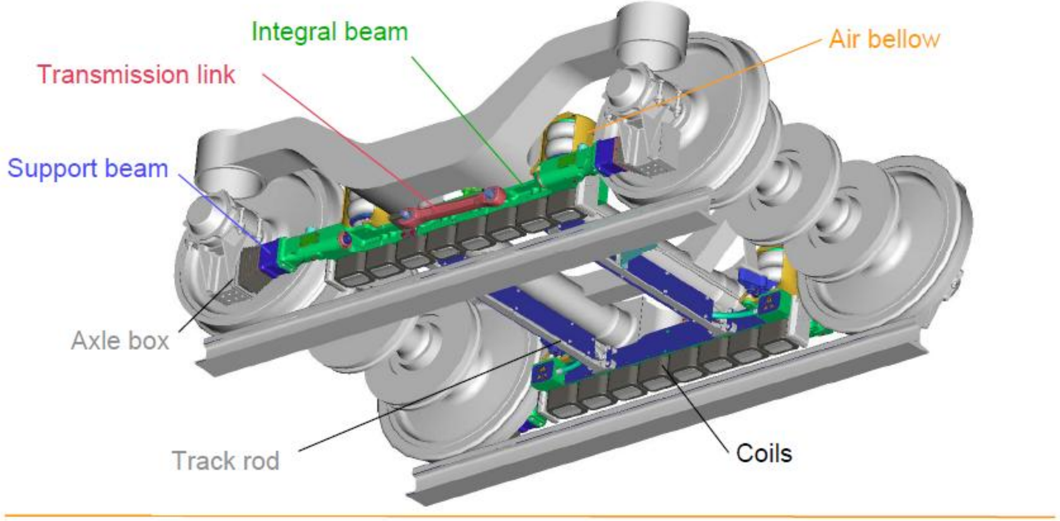
- eddy currents will be dissipated into heat and the force will die out.

TYPES OF EDDY CURRENT:-

CIRCULAR EDDY CURRENT BRAKE

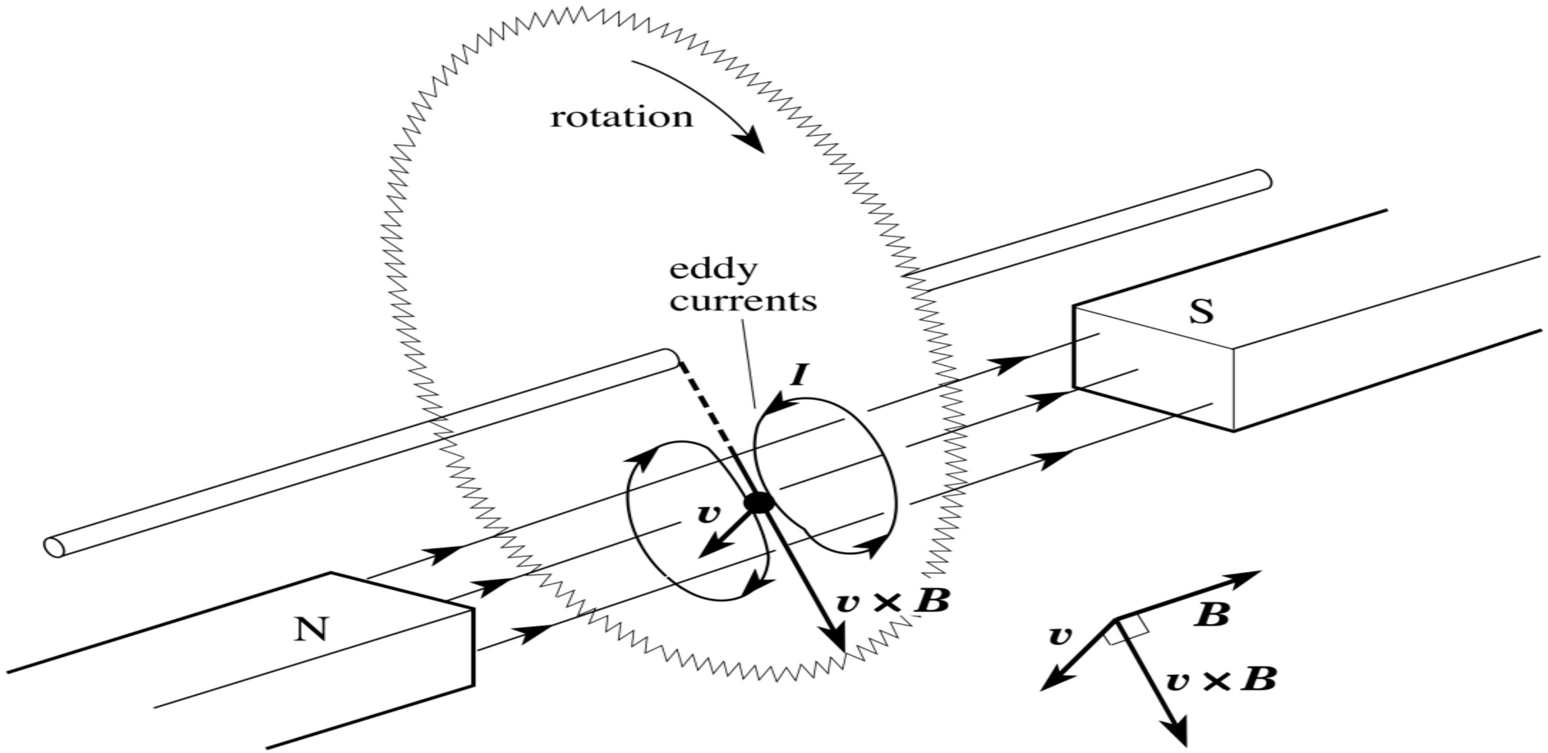


LINEAR EDDY CURRENT BRAKE



WORKING PRINCIPLE OF EDDY CURRENT BRAKES

- Based on Lenz's law. Faraday's law



ADVANTAGES

- 1. Quitter in operation.
- 2. No moving parts hence no friction
- 3. Almost no wear (Wear only if coolant system failure).
- 4. Essentially zero maintenance.
- 5. Produce no chemical pollution.
- 6. No parts need to be replaced
- 7. Can be activated at will via electrical signal
- 8. There is no need to change brake oils.
- 9. The eddy current brake (retarders) help to extend the life span of the regular brakes and keep the regular brakes cool for emergency situation.
- 10. No noise or smell
- 11. Due to its special mounting location and heat dissipation mechanism, eddy current brakes have better thermal dynamic performance than regular friction brakes.
- 12. In the future, there may be shortage of crude oils; hence by-products such as brake oils will be in much demand. Eddy current brake will overcome this problem.

DISADVANTAGES

- 1. Need conventional brakes to hold a vehicle stationary
- 2. Excess heat would cause structural issues and Reduce brake effectiveness
- 3. Increased cost
- 4. Decreased braking force with Decrease speed of vehicle
- 5. No ability to hold the load in position at standstill
- 6. Eddy-current brakes can only be used where the infrastructure has been modified to accept them.
- 7. Dependence on battery power to energize the brake system drains down the battery much faster

LITARATURE RIEVIEW:-

TITLE	CONCLUSION
Test-Bed Test System of Automobile Eddy Current Retarder[1]	Yunda HU Et al ,In motoring condition, power is not suspended under some rotation, and is balanced between power and load braking torque of retarder. In the process, torque balance is also needed to be detected and recorded, as well as balanced temperature of rotor and stator.
Optimal robust control of a contactless brake system using an eddy current[2]	kapjin Lee Et al mentioned .maximum braking torque obtained when ,a=120,b=40,r=88mm From simulation and experimental results, it is observed that the eddy current brake (ECB) provides a fast braking response because it is capable of fast anti-lock braking.
3 Design considerations for an automotive magnetorheological brake[3]	Kerem Karakoc Et al mentioned However, the proposed MRB configuration was not able to generate sufficient braking torque to stop a vehicle. Therefore, an improved MRB design should be suggested (e.g. by increasing the number of disks or completely redesigning the magnetic circuit configuration) in future designs, taking into account the temperature effects and more accurate description of the material properties as well.

Performance evaluation of a hybrid electric brake system with a sliding mode controller[4]	Jeonghoon Song Et al mentioned Because it is a contactless brake system, the HEBS reduces or eliminates the heat dissipation, brake pad wear, and noise generation problems that occur when a CBS is used. It also alleviates the problems of energy consumption, heat dissipation, and current saturation that arise when an ECB is used at low vehicle speeds.
Geometry optimization of solid rotor eddy current brake by using sensitivity analysis and 3D finite elements[5]	Konstantinos V. Tatis Et al mentioned A geometry optimization methodology based on analytical solutions and 3D finite elements method has been applied to optimize the rotor geometry of a solid rotor eddy current brake used as over-speed protection in a permanent magnet generator wind turbine. The method involves a reduced number of design variables and constraints and requires a very limited number of iterations

Design optimization of double-sided permanent-magnet radial-flux eddy-current couplers[6]	S. Mohammadia Et al mentioned The results obtained from the analytical model were also in a reasonable agreement with those obtained by the FEM. This research is also being carried out for axial-flux couplers that will be presented in another occasion.
Improved braking torque generation capacity of an eddy current brake with time varying magnetic fields: A numerical study[7]	Kerem Karakoc Et al mentioned In , the radial component of the eddy current density within the conductor disk at the boundary was set to zero by introducing an imaginary current source outside the disk. By doing this, the model effectively represents a conductor disk of a finite radius

DESIGN OF EDDY CURRENT BRAKES

- **COILS :-**
- We find out the resistance of coils:-
- R=$\rho l\ /A$
- where R=resistance, ρ=electric resistivity, =1.68×10-8Ω·m at 20ºc l=length of copper wire, m
- A=cross section area of copper wire,m2
- $A = \pi r 2$
- d=diameter of copper wire coil, m

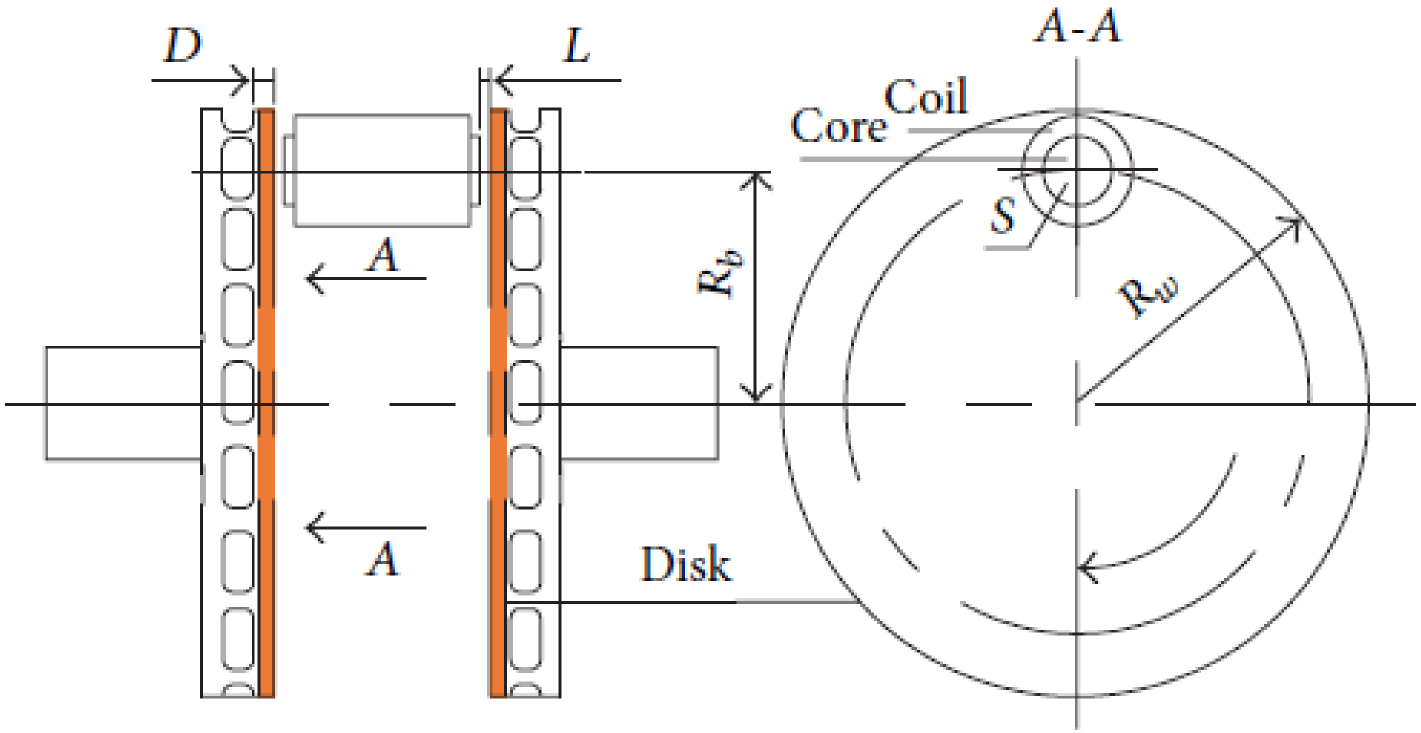
POWER SYSTEM

- Find out current flow in coils
- Find Out Suitable System:-
- INSTALLATION LOCATION
- ELECTRIC CONTROL SYSTEM

DESIGN STEPS FOR TORQUE GENERATED IN EDDY CURRENT BRAKE:-

- Ø= F R……………(1)
- Ø =flux and R are magneto motive force and magnetic reluctance, respectively, which are represented by the following expressions (2) and (3).
- F=Ni………………(2)
- R=li/μ0s………………(3)
- B=$\frac{\emptyset}{S}$=$\frac{F}{S\cdot R}$=$\frac{\mu_0 N_i}{l_q}$ ……..(4)
- T_b =σR^2Sd$\left(\frac{\mu N}{I_g}\right)^2$ i^2Ө……..(5)
- $T_{b=}T_i i^2$Ө…………..(6)
- T_i=αCσR^2Sd$(\mu N/l)^2$ ……(7)
- α=1-$\frac{1}{2\pi}\left[4arctan\left(\frac{b}{a}\right)+\frac{b}{a}\ln\left(1+\left(\frac{a^2}{b^2}\right)\right)-\frac{a}{b}\ln 1+\left(\frac{b^2}{a^2}\right)\right]$…………(8)
- C=0.5$\left[1-\frac{ab}{\pi\left(1+\frac{R}{r}\right)^2(r-R)^2}\right]$……………………………(9)

DESIGN STEPS FOR TORQUE GENERATED IN EDDY CURRENT BRAKE:-



METHODOLOGY

PROBLEM IDENTIFICATION OF CONVANTIONAL BRAKES

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SELECT EDDY CURRENT BRAKES TO OVERCOME THE PROBLEMS

↓

PREPARE IDEA GENERATION CANVAS

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ANALYSIS OF EDDY CURRENT BRAKING SYSTEM

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FIND AND ANALYSE THE RESEARCH PAPPER

↓

FIND THE PARAMETER OF DESIGN

↓

CHOOSE THE ELECTRIC POWER SYSTEMS

↓

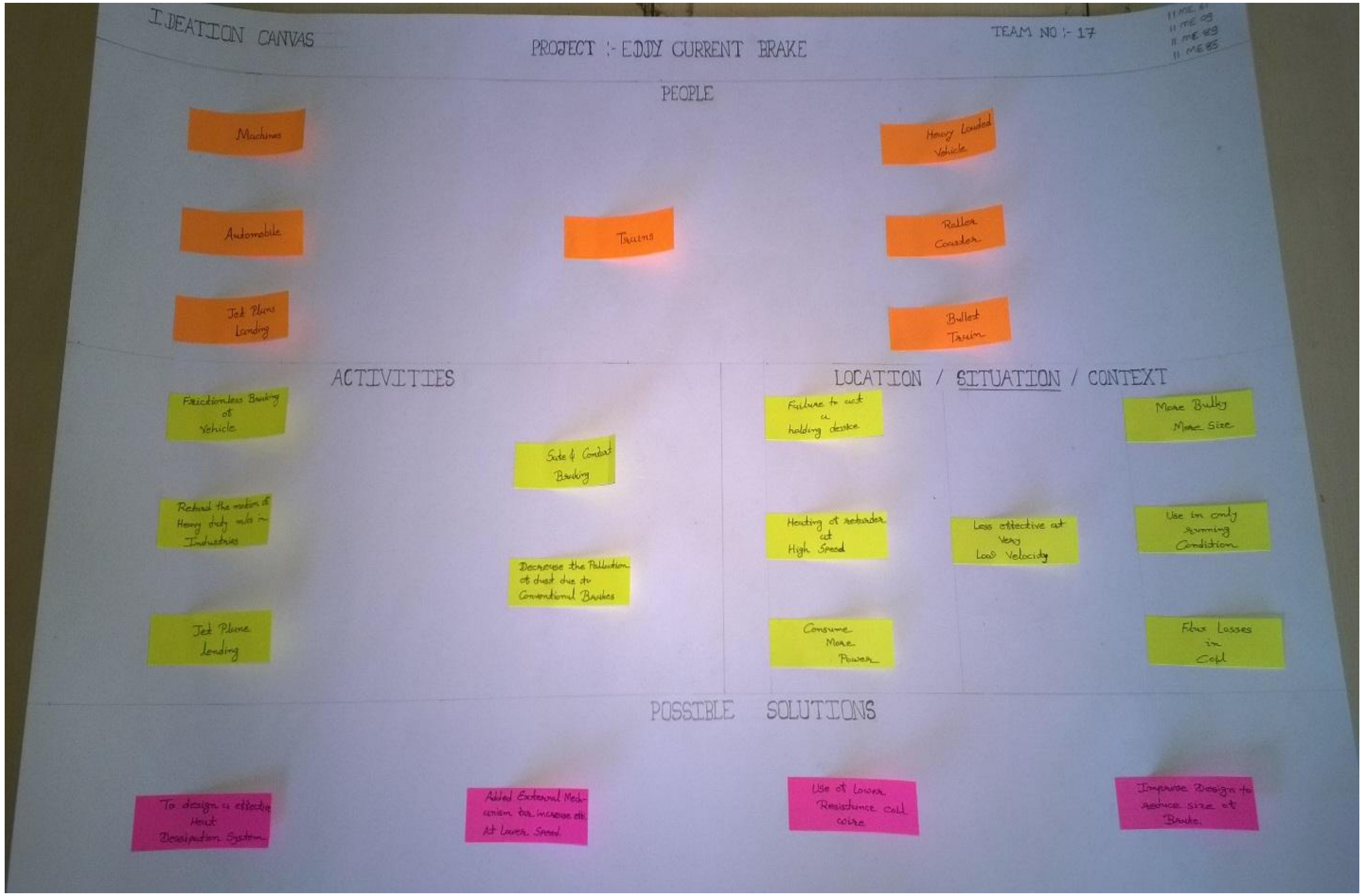
ANALYSIS OF THE DESIGN

↓

FABRICATION OF EDDY CURRENT BRAKE

CANVAS

IDEA GENERATION CANVAS



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1. Yunda HU “The Research on Test-Bed Test System of Automobile Eddy Current Retarder” 2012
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3. Kerem Karakoc, Edward J. Park *, Afzal Suleman” Design considerations for an automotive magnetorheological brake” 22 February 2008
4. Jeonghoon Song“Performance evaluation of a hybrid electricbrake system with a sliding mode controller”, 1 September 2004
5. Konstantinos V. Tatis *, Antonios G. Kladas 1, John A. Tegopoulos “Geometry optimization of solid rotor eddy current brake by using sensitivity analysis and 3D finite elements”,2005
6. S. Mohammadi[a,*], M. Mirsalim”,Design optimization of double-sided permanent-magnet radial-fluxeddy-current couplers”, 20 December 2013
7. Kerem Karakoc , EdwardJ.Park [a,b], AfzalSuleman” Improved braking torque generation capacity of an eddy current brake with time varying magnetic fields: A numerical study”, 13 June 2012