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Contactless Eddy Braking System

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Abstract: *A Contactless Braking system uses force to own interaction the brake, but the ability required for braking is transmitted manually. The disc is connected to a shaft and so the magnet is mounted on the frame .When electricity is applied to the coil a flux is developed across the coil thanks to this flowing across the coil and causes coil to induce attracted towards the coil. As a result it develops a torsion and eventually the vehicle involves rest. throughout this project the advantage of victimization the Contactless braking system in automobile is studied. These brakes is incorporated in serious vehicles as academic degree auxiliary brake. The Contactless brakes is used in industrial vehicles by dominant this provided to supply the magnetic flux. making some enhancements among the brakes it's used in cars in future.*

Keywords : *Brakes, Eddy Current, Magnet Material.*

I. INTRODUCTION

Road, rail, and air vehicles all swear chiefly or entirely on mechanical friction brakes. These brakes unit of measurement composed of two purposeful parts: a rotor connected to the wheels and a stator fixed to the chassis of the vehicle. The rotor is either a drum or a disc usually made up of cast iron for road and rail vehicles, and carbon fiber for craft. The stator contains shoes (drum brakes) or pads (disc brakes) made up of a soft friction material associate degreed associate mechanism, usually a hydraulic piston.

Although the principle is that identical for drum and disc brakes, the word used from there on refers to disc brakes. The contact between the soft material of the pads and so the surface of the rotor is characterized by a high friction constant. once braking is commanded by the actuation, the mechanism presses the pads against the rotor, thus inducement a friction force tangential to the surface of the rotor, that opposes the motion of the vehicle. The braking force is proportional to the ancient force developed by the mechanism pressing the pads against the rotor and so the constant of friction.

This is {often this can be} often associate electrical braking system that works on the principle that eddy current created in it opposes the driving torque. This opposing torsion is 5 used to brake the cars. chiefly this system is merely supported Faraday's laws of magnetism induction and Lenz's law. For operative this a control switch is provided on the steering column in associate passing position for simple manual. The skidding and complexity of mechanical braking system is shriveled by this system. in addition the injury and tear of the vehicles is reduced. many of the quality brakes, that unit of measurement being used presently days stop the vehicle by suggests that of mechanical obstruction. This causes skidding and wear and tear of the vehicle. And if the speed of the vehicle is unbelievably high, the brake cannot provide that abundant high braking force and it will cause problems.

These drawbacks of ordinary brakes is overcome by an easy and effective mechanism of braking system 'The eddy current brake'. it's academic degree abrasion-free methodology for braking of vehicles further as trains. It makes use of the opposing tendency of eddy current Eddy current is that the moving current created in associate passing conductor, that's subjected to a change in flux. thanks to the tendency of eddy currents to oppose, eddy currents cause energy to be lost. extra accurately, eddy currents work extra useful kinds of energy like kinetic energy into heat, that's so much less useful.

In many applications, the loss of useful energy is not notably fascinating. but there unit of measurement some wise applications. Such academic degree application is that the eddy current brake .

II. LITERATURE REVIEW

Forms of Eddy Current Brakes There unit of measurement a pair of forms of eddy current brakes per the strategy of excitation.

1.1 Electrically excited eddy current brake
1.2 Permanent magnet eddy current brake

1.1 Electrically Excited Eddy Current Brake

Electrically excited eddy current brakes unit of measurement abruption-free methodology for braking. In high-speed trains they supply associate honest totally different to the mechanical rail brakes that unit of measurement being used presently a days. During braking, the brake comes in-tuned with the rail, and so the magnetic poles of brakes unit of measurement energized by a winding provided.

Magnetic poles of brakes unit of measurement energized by a winding given current from the battery. Then the magnetic flux is distributed over the rail. The eddy currents unit of measurement generated among the rail, producing academic degree magnetism braking force. This forms of braking need a additional safety power supply once there unit of measurement breakdowns among the electrical power supply. permanent magnet

1.2 Permanent Eddy Current Brake

Recently, permanent magnet eddy current brakes area unit developed for subways, trams and native trains. These brakes need a mechanical mechanism to point out the magnets jn academic degree on and off position. the foremost advantage of this kind of brake is safety. i.e. it does not wish electrical power supply to energise the magnet.

Magnetic poles of brakes square measure energized by a winding furnished current from the battery. Then the magnetic flux is distributed over the rail. The eddy currents square measure generated within the rail, manufacturing Associate in Nursing magnetism braking force. This styles of braking want a further safety power provide once there square measure breakdowns within the wattage provide.

Eddy current brakes (ECB) square measure electrically controlled and non – contact actuators used as helpful brakes in vehicles. ECBs exhibit meager generated braking torsion at low speeds. so as to beat the matter of meager braking torsion generation at low speeds.,

Kerem Karakoc et al worked on the braking performance improvement eg. Contact less braking, silent operation, no friction will be achieved with the replacement of the prevailing typical hydraulic brakes with eddy current brakes (ECBs). They used AC magnetic fields with mounted and variable frequencies in several wave forms at each low and high speeds. Finite part Associate in Nursing analysis valid by an existing analytical model is performed for electricity and AC magnetic fields. it's shown that improved braking performance will be obtained once AC magnetic fields square measure used each at low and high velocities. Time variable fields in several wave forms (e.g. Sinusoidal, square, saw tooth and triangular waves) were applied. The triangular wave field application resulted within the highest braking torsion. additionally, the frequency of the applied field is optimised victimization generic algorithms on a generic fourteen ECB configuration. induced currents seem once electrical conductors bear conditions of variable magnetic flux. 2 procedures to attain such conditions square measure.

Exerting a time variable field of force on a static piece , Exerting a gentle field of force on a moving one The latter case is investigated. It consists of a rotating auriferous disc that is subjected to the field of force gift at the gap of Associate in Nursing magnet. Eddy currents seem within the disc and brake its rotation Following many sorts of measurements which will be dispensed with the found out square measure Braking time of the disc that is measured as perform of excitation intensity - Eddy current losses versus angular speed - Eddy current losses versus excitation intensity

1.1.1. M.Z.Baharom found that Al is that the best material to be used as brake disc compared to Copper and Zn as Al has higher electrical conduction has focussed on two series of aluminium because the brake disc that square measure Al6061 and Al7075. The authors compare each the series for varied Eddy current parameters like air gap, range of turns and brake disc thickness. The findings shows that smaller the air gap, the larger the magnetic attraction turns and better the disc thickness, higher braking force is generated and thus an excellent performance for Eddy current braking. Also, it's found that the upper electrical conduction influenced the generation of larger braking force.

1.1.2. Der – Ming Ma, Jaw – Kuen Shiau have bestowed four systematic engineering style situations to style a braking system. they're - a continuing force field - an best force field distribution - Piecewise constant magneticfields. Section wise guide rail with a relentless force field Simulation results of the higher than four styles show that the optimum forcefield encompasses a retardation peak of 9g that isn't appropriate for many folks. twelve Piecewise constant force field has the advantage of a pre-set terminal speed and inevitable wire current however it produces a better speed. Piecewise constant force fields and section wise guide rail with a relentless magnetic field have tolerable retardation and straightforward producing. AN experimental braking system exploitation constant force field was designed to demonstrate the planning procedure. for prime speed trains (speeds up to 350Km/hr.) with heavier hundreds on the shaft and a lot of advanced functions, the traditional braking systems looking forward to the adhesion force between the rail and also the wheel aren't any longer adequate. first of all the rise in braking distance is unusable. Secondly, weather dependence of braking system is mismated. Thirdly, within the event of failure of brake supported adhesion force between wheel and rail, it needs alternate braking system that shall perform the profitable braking.

1.1.3. Sergey Kitanov and Anatoly Podol'ski describe the investigation of eddy current and magnetic rail brake structures. A brake that contains magnet items and mixing each magnetic rail brake and eddy current brake is made. Comparisons on experimental and computed operational characteristics of eddy current and magnetic rail brakes to be used on a tram automotive, on a rail road vehicle and on high speed train square measure bestowed. it's found that a brake designed up from magnet items that mixes each magnetic rail brake and eddy current brake permits the foremost profitable braking action through the full vary of acceptable speeds from zero (a parking brake) to 350Km/hr. it's found that braking result becomes a lot of pronounced at the speed worth 50Km/hr. than at speed 14Km/hr. Measured braking distance worth is 520m.

1.1.4. Hyun – Rok Cha examines magnet eddy current couplings and brakes. exploitation two dimensional finite component analysis, the authors deals with the influence of the magnetisation patterns and one among the planning parameters on the performance of the magnet eddy current devices. thirteen the essential structure of eddy current device includes the moving (or stationary) set of magnets that square measure separated from the stationary (or moving) conducting cylinder by AN air gap. The eddy current couplings and brakes utilized high energy product metal – iron – B (NdFeB) permanent magnets that act on iron backed Copper drums to produce force transfer from motor to load while not mechanical contact. A 2 dimensional finite component analysis is performed to predict the magnetic attraction behaviour and also the force speed characteristics of magnet kind eddy current couplings and brakes underneath constant speed operation. it's found that the parallel magnetized eddy current topology has the superior braking force capability. Also, it's found that by increasing magnet thickness, the air gap concentration will increase there by increase in braking force.

1.3 Problem Definition

When you got to brake quickly, the sole factor that comes between safe stopping and disaster is that the straightforward science of friction: you slow to a halt when two surfaces rub along • magnet eddy current brakes are a simple and reliable different to mechanical or magnetism brakes in transportation applications. larger the speed greater is that the eddy current braking potency. • Friction brakes have an enormous disadvantage too: whenever you utilize them, they wear out a bit bit, which suggests that they are comparatively pricy and there constant of friction decreases with time, therefore attainable probability of accident. • One possibility is to slow things down with the force of electromagnetism rather than friction. Advantages - Quiet ,Wear less , Noiseless, No smell or pollution ,Cheap(80% less than friction brakes) very little or no Maintenance

1.4 Objectives

We are planning and developing a "Test rig on Eddy-Current braking system" a conveyable equipment, which might be used as a resistance braking system. this technique relies on the principle Faraday's law and Hendrik Antoon Lorentz principle.

Improvement of the understanding of the interaction between the eddy-current brake and the Al disc. Design of a check setup and check web site that allows the approval tests for linear eddy-current brake systems focusing not solely on the practicality however conjointly on thermal, mechanical and magnetism necessities. Development of recent style, engineering and operational pointers for eddy current brakes. It should be straightforward to use.
The check rig ought to offer the correct and precise results It should be sturdy and insensity.

III. METHODOLOGY

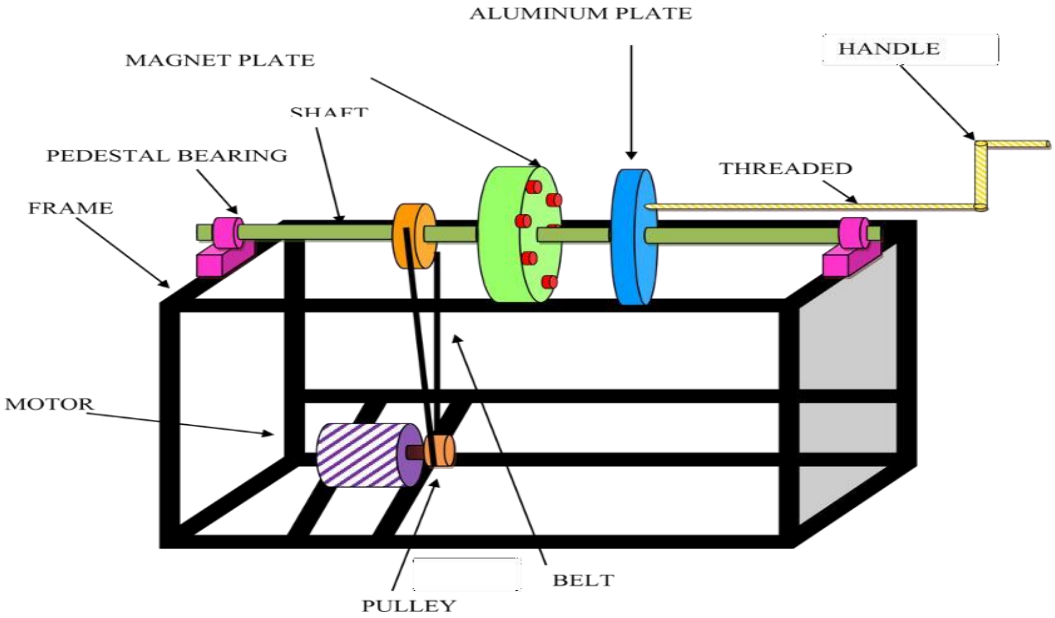

Fig 3.1 Design

When associate electrical conductor, like copper or aluminum, moves through the sector of a magnet or associate magnet, magnetism induction creates eddy currents, that dissipate K.E. the mechanical energy into Joule heat and leads to speed the motion of the conductor. This principle is used within the construction of magnetic brakes. This Demonstration shows magnetic braking applied to a rotating metallic disk. This might, as an example, serve to manage resistance to motion in exercise machines. Magnetic braking may find applications in roller coasters and railroad trains, during which the metallic conductor has the form of a linear rail. In distinction to traditional friction brakes, there's no direct contact between interacting surfaces, that makes magnetic braking more reliable and reduces wear and tear. A magnetic brake could be a device that leverages sturdy magnetic forces to slow a vehicle down. There are varied differing types of magnetic brake systems, as well as ones that use electromagnets to actuate ancient friction pads, and people that leverage magnetic repulsion itself to supply resistance. These may be found on a range of vehicles, from trains to roller coasters. By increasing or decreasing the quantity of electrical current, the stopping power of associate degree Eddy current brake may be correspondingly attenuated up or down. instead of pads twenty one pressing tougher on a rotor, the resistive attraction is amplified.

Though there is no physical contact, the method still generates magnified speed, along side heat, as a results of the resistance. Eddy current brake systems area unit used principally in larger vehicles, like trains. A sub-type of the Eddy current brake is understood because the linear Eddy current brake. rather than the conventional circular style, magnetic coils are wound around a straight rail. The coils alternate between a positive and negative magnetic charge, so, once activated, generate resistance and speed action. This style is a smaller amount wide used than ancient magnetism brakes on train systems, but, in places like Europe, is turning into additional common on high-speed rail systems. unpowered versions of the linear style — that instead use permanent, rare-earth element magnets — area unit the brake of alternative on most roller coasters. As anyone who has ridden a roller coasterwill remember, these non-electromagnetic varieties work on associate on-off basis, and can't be simply modulated. This leads to terribly abrupt periods of speed, and, for this reason, they're not a well-liked alternative on additional comfortoriented vehicles, like train

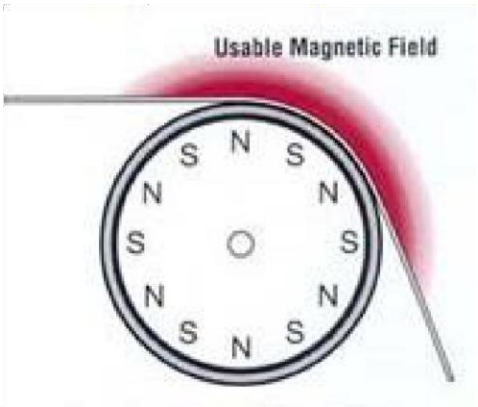

Fig 3.2: Magnetic Field

A sub-type of the Eddy current brake is understood because the linear Eddy current brake. rather than the conventional circular style, magnetic coils are wound around a straight rail. The coils alternate between a positive and negative magnetic charge, so, when activated, generate resistance and deceleration action. This style is a smaller amount wide used than ancient magnetic force brakes on train systems, but, in places like Europe, is turning into a lot of common on high-speed rail systems.

Unpowered versions of the linear style — that instead use permanent, group magnets — are the brake of selection on most roller coasters. As anyone who has ridden a roller coasterwill remember, these non-electromagnetic varieties work on an on-off basis, and can't be simply modulated. This leads to terribly abrupt periods of slowing, and, for this reason, they're not a well-liked alternative on additional comfortoriented vehicles, like trains.

IV. CONCLUSION

Eddy current brakes are the most effective alternative when demands for dependability and safety are the very best. They work even within the toughest environmental conditions. Even the strike of lightning won't end in the loss of the braking force.
Eddy current braking system isn't widespread currently a days. however we tend to hope that the eddy current braking system that is less complicated and simpler can take the place of the standard braking system and that we will do expect it to be the norm one in few years of your time.

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