

# Electromagnetic Braking System

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**ABSTRACT:** In this thesis a new mathematical version for electromagnetic brakes is proposed to explain their static characteristics (angular pace as opposed to brake torque). The overall performance of the new mathematical version is higher than the opposite three models to be had with inside the literature in a least rectangular sense. Compared with Vintage model that deal with reluctance as a consistent this version treats reluctance as a feature of pace. In this manner, the version represents exactly the mixture impact of all facet results together with diploma of saturation of the iron withinside the magnet the magnet, demagnetizing results and air gap. The software program application written in mat lab may be used to code distinctive brake characteristics (each Static and dynamic) and examine their overall performance in distinctive avenue scenarios.

**KEYWORDS:** Eddy current, Controller, Magnet, Rotating disc, Microcontroller, Microcon pedals, Circuit board

## I. INTRODUCTION

In this venture we are seeking to make a braking device which may be relevant in wheeler at excessive pace and occasional renovation fee. Here we are using Electromagnetic coil and a plunger. There is electromagnetic impact which actions the plunger withinside the braking path. When energy is implemented to the area it creates and inner magnetic flux. That flux is then transferred right into a hysteresis disc passing via the area. The hysteresis disc is connected to the brake shaft. A magnetic drag at the hysteresis disc permits consistent drag or eventual stoppage of the output shaft. This tasks intense to the layout and implementation of the latest device of retardation for motors the design of the new break is based upon the the phenomenon of electromagnetic induction and Eddy Currents. The layout essentially includes very sturdy magnet and rotating metal wheel. The Will develops Eddy Currents because of the extrade in magnetic flux related to the wheel because of its rotation. The

eddy modern improvement of ways maxwell's regulation of electromagnetic induction and lenz's regulation of path of caused modern. The modern in Flip dissipates the rotational strength of the wheel as heat bringing the wheel to a prevent.

The basis of braking in vehicles includes the conversion of kinetic energy into heat. This excessive energy conversion consequently needs the appropriate rate of heat dissipation if a reasonable temperature and overall performance balance are to be maintained. While the layout creation and region functions seriously restricting the warmth dissipation feature of the friction brake, electromagnetic brakes work in a relatively cool condition and keep away from troubles that friction brakes face via way of means of the use of a completely distinctive running precept and set up region. By the use of the electromagnetic brakes as supplementary retardation system, the friction brakes may be used much less regularly and consequently nearly in no way attain excessive temperatures. The Brake Linings has a consequence have an extended lifestyles span and the potential 'brake fade' problem can be avoided. It is apparent that the electromagnetic brake is an important supplement to the secure braking of heavy Motors.

## EXECUTIVE SUMMARY

**Objective:** Design an electromagnetic braking device – Replacing the traditional braking device – Less fee with more overall performance – No want for renovation and/or substitute.

**Research:** Other styles of electromagnetic braking device – Electromagnetic braking device with brake pads – Eddy-modern braking device.

## II. PRODUCT REQUIREMENTS

Overall – Power deliver to strength the device – Hub and spindle meeting to simulate the real spinning of the rotor – Custom made rotor with steel organized for the best result – Brake pedal to simulate the actual environment – Three electromagnets to generate braking pressure

Hardware and “oftware –8051 microcontroller  
Reading the braking stage from pedal Varying the  
braking pressure via obligation cycle –Custom  
constructed circuit board Regulating enter voltage  
Powering up the 8051  $\mu$ C Amplifying the output  
voltage to electromagnets

## GENERAL PRINCIPLES

### 1. INSTALLATION LOCATION:-

Electromagnetic brakes paintings in a pretty cool situation and fulfill all of the strength necessities of braking at excessive speeds, absolutely with out using friction. Due to its precise set up region (transmission line of inflexible motors). There are in lifestyles numerous styles of electromagnetic retarder. In particular, there are electromagnetic retarders of the axial kind and electromagnetic retarders of the Focal kind. An electromagnetic retarder of the axial kind is designed to be located on a transmission shaft among a rear axle and a gearbox of the automobile. In that case, the transmission shaft is in elements, for mounting among the ones of the retarder. An electromagnetic retarder of the Focal kind is designed to be located immediately on a transmission shaft at the output facet of the gearbox or at the axle of the automobile. The axle of a automobile drives as a minimum one avenue wheel, which avenue wheel drives as a minimum one wheel of the equal automobile.

### 2. WORKING:-

The running precept of the electrical retarder is primarily based totally at the introduction of Eddy currents inside a steel disc rotating among electromagnets, which units up a pressure opposing the rotation of the disc. If the electromagnet isn't energized, the rotation of the disc is loose and quickens uniformly below the movement of the burden to which its shaft is linked. When the electromagnet is energized, the rotation of the disc is retarded and the strength absorbed seems as heating of the disc. In this form of electromagnetic braking device, electromagnet is constant withinside the returned plate on this manner the unequal braking impact at one shoe are balanced, even though the liner on one shoe is worn extra than different the plunger will pass to 1 facet in order that shoe nonetheless percentage same appearing pressure. In this braking device, any individual shoe out of will remove & as opposed to it we can use the electromagnetic coil. As the modern passes via this electromagnetic coil, it's going to produce the magnetic flux, this flux will entice the shoe with a great deal pressure, and brake will apply. A standard retarder includes

stator and rotor. The stator holds sixteen Induction coils, energized one at a time in agencies of four. The coils are made from varnished aluminum cord mounded in epoxy resin. The stator meeting is Supported resiliently via anti-vibration mountings at the chassis body of the automobile. The rotor is made from discs, which offer the braking pressure while concern to the electromagnetic have an effect on while the coils are excited. Careful layout of the fins, which can be imperative to the disc, allow unbiased cooling of the association.

## USED DEVICES

### Capacitor

A capacitor is a passive terminal electric factor used to keep electric strength quickly in an electric powered area. The varieties of realistic capacitors range extensively, however all include as a minimum electric conductors (plates) separated via way of means of a dielectric (i.e. an insulator which could keep strength via way of means of turning into polarized). The conductors may be skinny films, foils or sintered beads of steel or conductive electrolyte, etc. The non accomplishing dielectric acts to growth the capacitor's fee capacity. Materials usually used as dielectrics consist of glass, ceramic, plastic film, air, vacuum, paper, mica, and oxide layers. Capacitors are extensively used as elements of electrical circuits in lots of not unusual place electric devices.

### DC motor

DC motor is any of a category of electrical machines that converts direct modern electric strength into mechanical strength. The maximum not unusual place kinds depend on the forces produced via way of means of magnetic fields. Nearly all styles of DC cars have a few inner mechanism, both electromechanical or digital, to periodically extrade the path of modern waft in a part of the motor. Most kinds produce rotary movement; A linear motor immediately produces pressure and movement in a instantly line.

### Diode

In electronics, a diode is a terminal digital factor that conducts basically in a single path (uneven conductance) ; It has low (preferably zero) resistance to the waft of modern in a single path, and excessive (preferably infinite) resistance withinside the different. A semiconductor diode, the maximum not unusual place kind today, is a crystalline piece of semiconductor cloth with a p–n junction linked to 2 electric terminals. A vacuum tube diode has electrodes, a plate (anode) and a

heated cathode. Semiconductor diodes had been the primary semiconductor digital devices.

#### Resistor

A resistor is a passive terminal electric factor that implements electric resistance as a circuit element. Resistors act to lessen modern waft, and, on the equal time, act to decrease voltage stages inside circuits. In digital circuits, resistors are used to restriction modern waft, to alter sign stages, bias lively elements, and terminate transmission strains amongst different uses.

#### Transformer

Transformer is an electrical tool that transfers electric strength among or extra circuits via electromagnetic induction. Electromagnetic induction produces an electromotive pressure inside a conductor that is exposed to time various magnetic fields. Transformers are used to growth or lower the alternating voltages in electric powered strength programs various modern withinside the transformer number one winding creates a various magnetic flu withinside the transformer middle and a various area impinging at the transformers secondary winding. This various magnetic area on the secondary winding induces a various electromotive pressure  $E$  or voltage withinside the secondary winding because of electromagnetic induction. Making use of faradays regulation found in in conduction with excessive magnetic permeability middle houses transformers may be designed to extrade successfully  $C$  voltages from one voltage stage to every other inside strength networks.

#### Ferromagnetism

Ferromagnetism is the fundamental mechanism via way of means of which positive materials (together with iron) shape everlasting magnets, or are interested in magnets. In physics, numerous distinctive styles of magnetism are distinguished. Ferromagnetism (which include ferrimagnetism)[1] is the most powerful kind: it's miles the simplest one which normally creates forces sturdy sufficient to be felt, and is chargeable for the not unusual place phenomena of magnetism in magnets encountered in normal lifestyles. Substances reply weakly to magnetic fields with 3 different styles of magnetism, paramagnetic, diamagnetism, and antiferromagnetic, however the forces are normally so susceptible that they are able to simplest be detected via way of means of touchy contraptions in a laboratory. An normal instance of ferromagnetism is a fridge magnet used to preserve notes on a fridge door.

#### APPLICATION

Already in use below a few railway device. Can be used for any avenue motors. Equally relevant to heavy and mild motors. Can be used as extra retarder for aircrafts. May additionally locate software in without a doubt any rotating device that have metal elements. This brake device may be use in wheeler. Electromagnetic braking device may be used as a current generation of braking in automobile. Electromagnetic braking device may be utilized in all styles of mild motor automobile like vehicle and heavy motor automobile.

#### LIMITATION

Failure to behave as a keeping tool. Usage of electrical strength for braking. Less powerful below very low velocities. The set up of an electromagnetic brake could be very hard if there's Not sufficient area among the gearbox and the rear axle. Need a separate compressor. Maintenance of the system additives together with hoses, valves has to achieved periodically. It can not use grease or oil. Dependence on battery strength to energise the brake device drains down the battery a great deal faster. 2) Due to residual magnetism found in electromagnets, the brake shoe takes time to return back returned to its authentic position. three) The set up of an electromagnetic brake could be very hard if there isn't sufficient area among the gearbox and the rear axle.

#### Electromagnetic Brake

Limitations operating Model RPM VDC Resistance Acceleration Weight Continuous Power Diameter  
HB-2.five 20,000 12 36 Ohms 41,a hundred rad/s<sup>2</sup>  
.24 lbs five Watts 1.25 in HB-sixteen 20,000 12 32 Ohms 17,900 rad/s<sup>2</sup> . sixty five lbs 20 Watts 1.ninety seven in

#### Advantages

Problems of drum distortion at extensively various temperatures. Which is not unusualplace for friction-brake drums to exceed 500 °C floor temperatures while concern to heavy braking needs, and at temperatures of this order, a discount withinside the coefficient of friction („brake fade“) unexpectedly occurs. This is decreased substantially in electromagnetic disk brake structures. Potential chance of tire deterioration and bursts because of friction is eliminated. There isn't anyt any want to extrade brake oils regularly. There isn't anyt any oil leakage. The realistic region of the retarder withinside the automobile prevents the direct impingement of air at the retarder. Caused via way of means of the movement of the automobile.

The retarders assist to increase the lifestyles span of the everyday brakes and preserve the everyday brakes cool for emergency situation. The electromagnetic brakes have terrific warmth dissipation performance thanks to the excessive temperature of the floor of the disc that is being cooled. Due to its unique mounting region and warmth dissipation mechanism, electromagnetic brakes have higher thermal dynamic overall performance than everyday friction brakes. Burnishing is the carrying or mating of opposing surfaces. This is decreased substantially here. 11) In the future, there can be scarcity of crude oil; consequently via way of means of merchandise together with brake oils may be in a great deal demand. EMBs will triumph over this hassle. Electromagnetic brake structures will lessen renovation fee. The hassle of brake fluid vaporization and freezing is eliminated. Electric actuation, no fluid. Easier integration with anti-lock, traction, and dynamic balance controls. sixteen) Easy person wheel braking manage.

#### Future work

The proposed winding version need to be tested and its validity with admire to frequency and version parameter settings investigated. In the middle version the static hysteresis version need to be improved, specifically concerning the modelling of youngster loops. E.g., the distribution feature of the pseudo debris and the relation among reversible and irreversible methods need to be studied extra in detail. In the dynamic magnetization version the optimization of the Cauer circuit sections and the frequency and amplitude dependency of the parameter  $V_0$  can be studied. If it's miles viable to locate that dependency for a category of cloth, this will make this version a totally beneficial tool. Then the simplest vital adapting step could be to healthy the static curve to the measured static curve. The composite transformer version need to additionally be tested in different operation modes like brief overvoltage. A extra distinctive reluctance community version of the transformer which include 3 dimensional flux paths in the tank and creation info need to be advanced and tested. A static magnetization version that takes B as enter and returns H need to be advanced.

### III. CONCLUSION

Electromagnetic brakes are crucial supplementary retardation system further to the everyday friction brakes. They had been utilized in heavy motors along with Coaches, buses or vehicles below situations along with lowering velocity on motorways and trunk roads and braking

for extended intervals for the duration of downslope operations. New styles of electromagnetic brakes were below improvement for lighter motor as well. Regular friction brakes have an remarkable and Critical load soaking up functionality if saved cool. Electromagnetic brakes assist friction brakes to maintain this functionality below all situation with the aid of using soaking up electricity at a separate region primarily based on a very specific running precept. In this take a look at, we propose a change static mathematical version for the electromagnetic brakes. A sliding mode controller is designed and simulated for a nominal car version below specific Street flow situations. Microcontroller implementations of electromagnetic Anti Lock Braking System is evaluated. The overall performance of the changed mathematical version of electromagnetic break is higher than other three models is to be had withinside the literature in a least rectangular sense. There is simplest 1-Global version which may be used at each low velocity and excessive velocity regions. Unfortunately this version has now no longer trust the experimental outcomes with inside the excessive velocity area. Based 80 at the phenomena summarise from remark with inside the excessive velocity area we changed the antique Global version with the aid of using the reluctance impact into account. After this motivation we will version the velocity torque courting greater accurately. A sliding mode controller is designed to put into effect the wheelslip manipulate machine. A nominal car machine version is utilised in a Matlab's feature simulation for trying out the controller overall performance in specifically Street floor scenarios. According to the simulation outcomes the controller overall performance is satisfactory. The wheel slip is saved in the right variety and brake torque is managed to evolve to the brand new street floor fast each time the street floor changes. The wheel slip manipulate machine may be applied with the aid of using the excessive velocity exceptionally included virtual microcontrollers along with Motorola the 68HC11 series. The on-chip enter/output hardware like 8 bit analogue input the excessive velocity enter seize feature and serial communication permit interfacing with sensor and actuators. The Practice set and structure of the Motorola 68HC11 satisfy the requirement of the wheel slip manipulate layout. The new generations of 16 bit microcontroller must have higher actual time overall performance the and input/output functionality than the Motorola 68HC11. It may be concluded from this, take a look at the the that the electromagnetic brake is a powerful supplementary retardation tool. The



utility and manipulate of electromagnetic waves must be included with the layout of motors and their friction braking structure in order that they are super in shape of the complimentary blessings of each structures is probably received to boom protection to a most even as lowering car working charges to a minimum apart 76%.