DESIGN AND FABRICATION OF ELECTRO MAGNETIC BRAKING SYSTEM

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Abstract: The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles.

In this thesis, a new mathematical model for electromagnetic brakes is proposed to describe their static characteristics (angular speed versus brake torque). The performance of the new mathematical model is better than the other three models available in the literature in a least-square sense. Compared with old models that treat reluctance as a constant, our model treats reluctance as a function of speed. In this way, the model represents more precisely the aggregate effect of all side effects such as degree of saturation of the iron in the magnet, demagnetizing effects, and air gap. The software program written in Mat lab can be used to code different brake characteristics (both static and dynamic) and evaluate their performance in different road scenarios.

Index Terms **- Automobile, braking system, electromagnets, heat transfer, ultrasonic.**

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1. INTRODUCTION

The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles.

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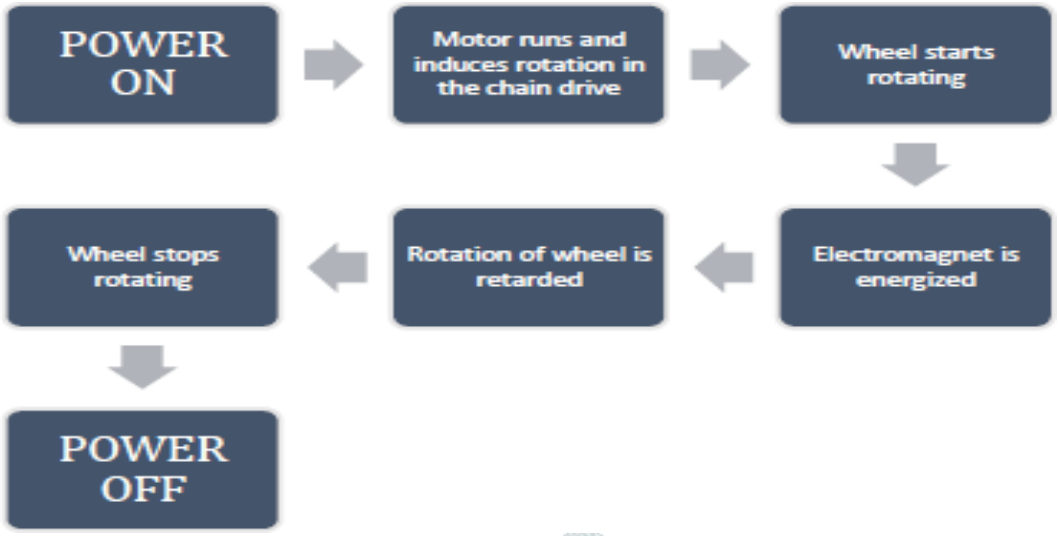
1.1 Working Mechanism



1.2 Working of The Model

The model works with the principle of electromagnetic field where the wheel is made to run at a speed with the help of a motor or manually, when the wheel i s at a certain speed or rpm the power provided to it is released and the wheel is on the free movement it is then the brakes are applied where the two electromagnets are mounted close the disc and an air gap is maintained between the disc and the electromagnet of 0.5mm. The electromagnets gets engaged only when there is a supply of DC power to it, but before that the model is been automated with a regulator, relay and a RF channel controller. Where the regulator generates a fixed output voltage from the supply and to regulate one or more voltages, whereas the relays are the switches that opens and closes the circuit by electrically or electromechanically and they control the circuit by opening and closing contacts in another circuit. The RF channel is the device used to switching on and off of the application by means of a remote controller where by transmitting the signal to the relay and the operation is performed accordingly.

The automated set up is connected to the power supply where then the circuit is connected to the electromagnets so that the automation can be done easily. When the wheel is rotating at a certain revolutions for a period of time the wheel is made to retard or stop with the help of the electromagnets by the help of the electromagnetic fi eld, where the setup is operated by controlling the RF channel remote control where the rotating wheel can be stopped by controlling the RF controller where the controller transmits the signal to the relay where the relay is then activates the circuit and then it directly activates the electromagnets where the electromagnets tends to stop the wheel by applying the force to the disk and hence the wheel is made to stop in fraction of seconds and the controller is disengaged where then the automated setup disengages the electromagnets and then the wheel and the disk connected to it is left free. Thus the amount of retardation in the wheel is made to slow down or stop in an efficient way.

1.3 Scope For Future Work

Since the electromagnetic braking system is used for few applications, looking on to the future uses this method can be implemented for the safety purposes in our daily life where by applying it on to the automobiles we can reduce the amount of road accidents which sometimes takes place at several zones like school zone, traffic signals, pedestrian crossing zones etc.. this can be achieved by automizing the set up and installing a sensor to the automobile where by installing transmitting sensor to the safety zones with a particular range. When an automobile is moving at a speed of assuming 100km/hr and when it comes near the range of the safe zones the sensor form the safe zones emits and hits with the sensing element which is installed in the automobile at a desired range, when the sensing waves comes in contact the sensor gets enabled and transmits the signal to the automated circuit where then the brakes are electrically supplied and activated the automobile is gradually slowed down from a range of 100km/hr to 40km/hr and then brought to a static movement after that when it is at the safety mark. Hence the electromagnetic braking system can be used in future for the automobile sector in concern of the safety use in day to day life.

1.4 Conclusion

The Electromagnetic braking system is found to be more reliable as compared to other braking systems. In addition, it is found that electromagnetic brakes make up approximately 80% of all of the power applied brake applications. Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction of the brakes. This enhanced braking system not only helps in effective braking but also helps in avoiding the

accidents and reducing the frequency of accidents to a minimum. Furthermore the electromagnetic brakes prevent the danger that can arise from the prolonged use of brake beyond their capability to dissipate heat. ABS usage can be neglected by simply using a micro controlled electromagnetic disk brake system. For the brake distribution of the electromagnetic braking system, the abrasion, noise, harmful friction dust, and the risk of thermal failure in braking system were reduced obviously. These electromagnetic brakes can be used in wet conditions which eliminate the anti-skidding equipment, and cost of these brake are cheaper than the other types. The concept designed by us is just a prototype and needs to be developed more. It can not only be used in the field of automotives but also in the field of aeronautics. Hence the electromagnetic braking system can be a better technological revolution in the future application

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