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# Solid Modelling of Electromagnetic Braking System

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## ABSTRACT

This paper describes a replacement approach of braking system using magnet. Conventional brakes use friction to apply brake on vehicle. This methodology of braking system is frictionless kind. Electromagnetic braking system provides economical, reliable, and stable braking force. Less use of friction reduces the temperature of the braking system, so there is less wear of braking elements and long life of whole braking system. These brakes offer smart benefits to boost the braking performance of business vehicle. This paper proposes a sway strategy of brake, that is concentrated on the comfort assessment of vehicles. The road conditions are known by the identification parameter, that is obtained once the slip-ratio reaches a particular purpose. The strategy is ready to pick the most swiftness, in line with road conditions still because the comfy feeling of the drivers. The moving speed of the braking pedal is employed to evaluate the driver's non-emergency brake intention. The braking force is distributed on the front shaft and therefore the rear shaft ideally, with the shaft load and therefore the gravity position is taken into thought.

**Keywords :** Electromagnetic force, frictionless brakes, eddy current, magnetic field.

## I. INTRODUCTION

The frictionless type of electromagnetic braking system utilises the principle of electromagnetism. This braking system use the eddy current to slow or stop the vehicle. According to principle of electromagnetism, when a rotating disc is placed between the magnet, magnetic flux passes through the disc in perpendicular direction that causes the eddy current to opposes the rotation of disc by applying force in opposite direction. These brakes are a wonderful replacement on the convectional types of brakes because of their several benefits. Since these brakes are

frictionless brakes, they have long life, reliability and need less maintenance. Temperature of whole braking system isn't a lot and there is no friction so wear of braking system is reduced and require less maintenance.

## II. CONSTRUCTION

### 1.1 Pulley

It has been used to rotate the metal disc together with it. It provides the rotation from motor to the disc by the employment of V-belt. One pulley is used on motor spindle and another is used on disc spindle and connected with the belt and thus motor rotates the disc upon which braking force is applied.

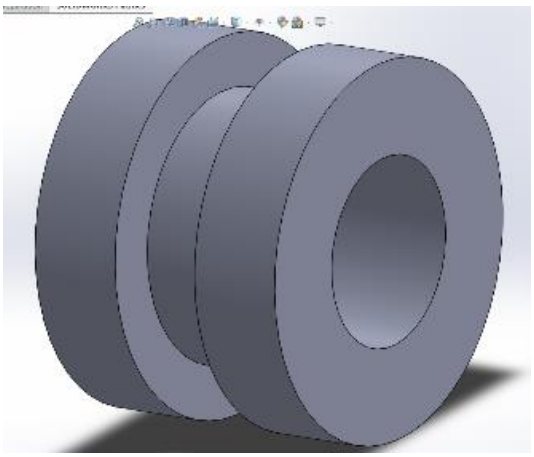

Fig 2.1 Pulley

### 1.2 Metal Disc

The metal disc is one of the important components been used here. It is placed on spindle which is connected to the pulley which rotates with It is made up of cast iron plate of 2 mm thickness. The reason for using cast iron plate is that the plate is to be magnetic material. The diameter of the disc is 255 mm and it has a hole of 90 mm in diameter in order to reduce the weight. There four holes are drilled for 4 mm screw. The holes are drilled at the reference circle of 65 mm diameter. At last, the disc is fitted with the pulley by the use of 4 mm screws.

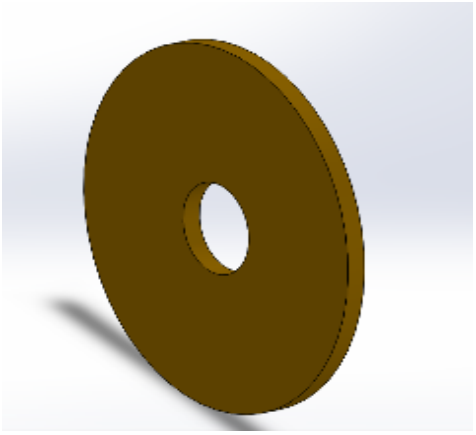

Fig. 2.2 Metal Disc

### 1.3 Electromagnet

Electromagnet is the device which get magnetized when the current is feed into it. Here the electromagnet is designed by modified a typical transformer. The transformers have double side “E” shape outer core around the inner core. This outside “E” shape core of the transformer is removed and then arranged as single side. Now it is act as an electromagnet.

### 1.4 AC Motor

The rotary motion of the wheel is given by the AC motor. The electric motor converts electric energy into mechanical energy by electromagnetic induction. The motor been used here is the typical grinder motor.

Fig. 2.3 Ac Motor

### 1.5 Belt

A belt is made up of a polymer material used to transit power between two or more rotary shafts, mostly parallel in arrangement. Belts may be used to transmit power effectively. Belts are fitted over grooves in pulleys and also may have twists between pulleys, and the shafts need not to be parallel in all conditions. Flat belt, vee-belt, round belt is some important types of belts. Here the vee-belt has been looped over the driving motor and the driven wheel.

### 1.6 Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction.

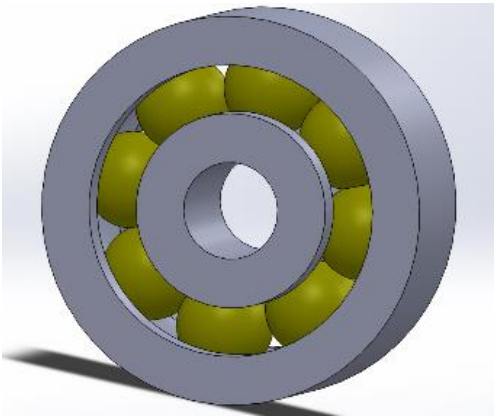

Fig. 2.4 Bearing

## III. DESIGN

Preparation of design of various parts using part drawing in Solid works. A detailed design has been made with an integrated set of parts, which works collectively to obtain desired results.
It consists of Frame, motor, pulley belt system, disc, electromagnets, bearings and spindle.

Material and quantity of various parts are described below in the table;

| S. No. | Parts | Material | Quantity |
|---|---|---|---|
| 1. | Frame | Cast Iron | 1 |
| 2. | Pulley | Steel | 2 |
| 3. | Bearings | Copper alloy | 2 |
| 4. | Ac motor | - | 1 |
| 5. | Electromagnet | - | 2 |
| 6. | Disc | Cast iron | 1 |
| 7. | Spindle | Mild steel | 1 |
| 8. | Belt | Polymer | 1 |

Table 3.1 Parts Detail

## IV. ASSEMBLY

Prepare the assembly in Solid works of various parts designed in part drawing as shown in figure. To create an assembly from a part: click make assembly from part/assembly (standard toolbar) or file > make assembly from part. An assembly opens with the insert component property manager active. Click in the graphics area to add the part to the assembly. solid works makes the first component fixed. To scale an entire solid works assembly, it is possible to scale each part independently, however this could be extremely tedious for an assembly with a large number of components. Alternatively, you can save the assembly as a multi body part and scale this part in a single step.

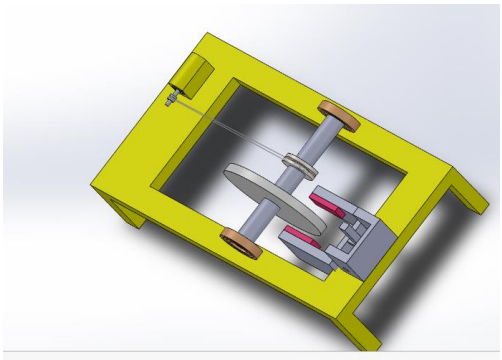

Fig. 4.1 Assembly of Electromagnetic Braking system

## V. WORKING

The working principle of the Electromagnetic Brake is based on the creation of Magnetic Field with in a metal disc rotating between two electro magnets, which sets up a force opposing the rotation of the disc.

- Disc is rotated in magnetic field.
- Eddy currents will be produced in disc.
- Eddy currents induced in disc will produce a torque.
- Produced torque in disc opposes actual rotation of disc.

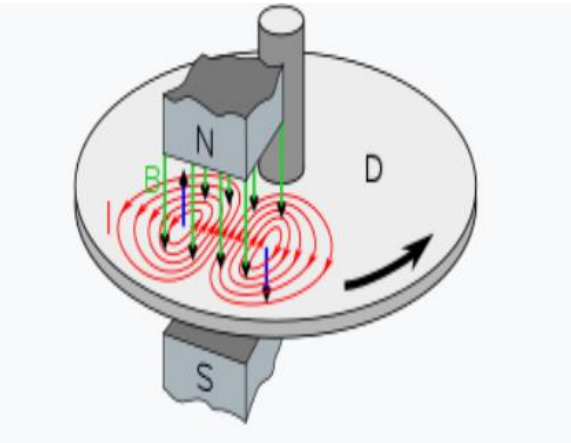


Fig. 5.1 Working

## VI. RESULT AND DISCUSSION

Electromagnetic brakes are frictionless types of brakes. There is no contact between rotating part and electromagnet that is applying force on rotating part. There is no frictional surface thus temperature of braking system is reduced very much. This will lead to less wear and long life of braking surface and there is less requirement of maintenance. Therefore, these brakes are preferred over conventional frictional brakes. Due to frictionless, efficiency of these brakes is also sufficiently increased. These brakes are simple in design, there is fewer mechanical parts used than the conventional brakes. These brakes represent the future aspects of braking technology.

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