Development of Electromagnetic Braking System

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Abstract— The proposed mechanism implements this phenomenon in developing a braking system. The potential applications of the braking system can be a decelerating system to increase the safety of an elevator or any guided rail transportation system. To provide scientific investigation for industrial application of magnetic braking, this study presents four systematic engineering design scenarios to design a braking system. The constant magnetic field is the simplest and easiest design to implement.

Keywords: Electromagnetic Braking System

I. INTRODUCTION

Most of the braking systems utilize friction forces to transform the kinetic energy of a moving body into heat that is dissipated by the braking pads. The overuse of friction-type braking systems causes the temperature of the braking pads to rise, reducing the effectiveness of the system. The relative motion between the magnet and the metal (or alloy) conductor produces an eddy current that induces a reverse magnetic field and results in deceleration. Without using friction, an eddy-current braking system transforms the kinetic energy of the moving body into heat energy that is dissipated through the eddy current in the conductor. However relative velocities between the magnet and the conductor are required to activate an eddy-current braking system. Because of the simplicity of this mechanism, it can be used as a decelerator or auxiliary braking system to ensure the safety of system.

Studies on the actuation of electro-mechanical machines using an eddy current can be traced back to the early 20th century. The mathematical description of the eddy current induced in a conductor under varying magnetic fields is rather complicated. Therefore, in developing eddy current braking systems, designers usually make certain assumptions to allow a simple mathematical representation of the magnetic field. This makes it possible to derive the analytic solution of the induced eddy current distribution caused by the interaction between the moving conductor and the magnetic field. The eddy current braking force can then be computed accordingly.

II. LITERATURE REVIEW

1) Der-Ming Ma, Jaw-Kuen Shiau:- A magnetic brake provides braking or locking capability and is remotely controlled by electric power. The magnetic brake comprises a rotatable shaft and a brake disc mounted on the shaft. A non-rotating core housing assembly located around the shaft includes a permanent magnet and a bipolar solenoid. A magnetic armature adjacent to the core housing assembly is capable of movement toward the core housing assembly and toward and into engagement with a brake disc to prevent rotation of the shaft. A spring urges the armature away from the core housing assembly and into engagement with the brake disc. The brake does not use any electric power to maintain the brake in the set mode with the rotating shaft fully locked or in the released mode with the rotating shaft fully released. The permanent magnet is of sufficient strength to hold the armature against urging of the spring until an opposite polarity is supplied by the solenoid.

2) Sevelop1,Nirmal Khanna nv2:- An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. The electromagnetic brakes can be used in commercial vehicles by controlling the current supplied to produce the magnetic flux. Making some improvements in the brakes it can be used in automobiles in future.

3) Mohd Shahrizan B.Sahri:- An ultrasonic car braking system includes; an ultra sonic wave emitter provided in a front portion of an automatic braking car producing and emitting ultrasonic waves frontward in a predetermined distance in front of the car. In this study, four systematic engineering design scenarios to design a braking system are presented: a constant magnetic field, an optimal magnetic field distribution, piecewise-constant magnetic fields and a section-wise guide rail with a constant magnetic field. The constant magnetic field is the simplest and easiest design to implement. Furthermore, the constant magnetic field can be generated by utilizing permanent magnet to achieve a nearly maintenance-free system.

4) Eung Soo Kim:- This module can detect the distance between front vehicle and driver’s vehicle to keep a constant distance using a sensor and operate the brake system forcibly if the driver does not decrease the speed of car.

5) Sahil Jitesh:- ABS generally offer advanced vehicle control and minimize the stopping distance in slippery and dry surface, conversely on loose surface like gravel or snow covered pavement, ABS can significantly increase braking distance, although still improving vehicle control.

III. OBJECTIVE

1) To design an electromagnetic braking system.
2) To replace the conventional braking system.
3) To purchase with less cost.
4) To achieve the greater performance.
5) To reduce time saving and efficient.
6) To reduce manual work.
IV. COMPONENTS

A. AC Motor:
An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Less commonly, linear AC motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

B. Electromagnet:
An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. The magnetic field disappears when the current is turned off. Electromagnets usually consist of a large number of closely spaced turns of wire that create the magnetic field. The wire turns are often wound around a magnetic core made from a ferromagnetic or ferromagnetic material such as iron; the magnetic core concentrates the magnetic flux and makes a more powerful magnet. A simple electromagnet consisting of a coil of insulated wire wrapped around an iron core. The strength of magnetic field generated is proportional to the amount of current.

The main advantage of an electromagnet over a permanent magnet is that the magnetic field can be quickly changed by controlling the amount of electric current in the winding. However, unlike a permanent magnet that needs no power, an electromagnet requires a continuous supply of electrical energy to maintain a magnetic field.

Electromagnets are widely used as components of other electrical devices, such as motors, generators, relays, loudspeakers, hard disks, MRI machines, scientific instruments, and magnetic separation equipment. Electromagnets are also employed in industry for picking up and moving heavy iron objects such as scrap iron and steel.

C. Metal Frame:
1) The metal frame is the base of the whole equipment.
2) The metal frame is suitable for the withstand the load of the assembly on it so it is design properly.
3) There is the use the metal frame for the support the whole assembly on it.
4) The metal frame is made from the cast irons. The blocks of the cast iron are cut by the cutting machine.
5) Arc Welding is use for the join the cast iron blocks as per the requirement so the frame.

D. Shaft:
1) The shaft is the life line of the any equipment.
2) In this project there is the use the 8mm cast iron shaft for the mounting the disk and electric motor.
3) The shaft is attached to the motor and aluminum disk with help of the flange coupling.
4) The shaft is supported on the frame by the bearing and bearing blocks.

E. Bearing (608):
A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

The most common standardized ball bearing size is the 608 series. In the 608 series, the ball bearing typically consists of optional closures, inner race, outer race, balls, and ball retainer. It is characterized by an 8mm inner diameter (the bore of the ball bearings), a 22mm outer diameter, and a width of 7mm.

F. Bearing Block:
The fundamental application of both types is the same which is to mount bearings safely enabling their outer ring to be stationary while allowing rotation of the inner ring. The housing is bolted to a foundation through the holes in the base. Bearing housings are either split type or unsplitted type. Split type housings are usually two piece housings where the cap and base can be detached, while certain series are one single piece housings. Various seals are provided to prevent dust and other contaminants from entering the housing. Thus the housing provides a clean environment for the expensive bearings to freely rotate, hence increasing their performance and duty cycle.

Bearing housings are usually made of grey cast iron. However various grades of metals can be used to manufacture the same.

G. Flange Coupling:
A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation, however there are torque limiting couplings which can slip or disconnect when some torque limit is exceeded. The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. By careful selection, installation and maintenance of couplings, substantial savings can be made in reduced maintenance costs and downtime. This coupling has two separate cast iron flanges. Each flange is mounted on the shaft end and keyed to it. The two flanges are coupled together with the help of bolts and nuts. The projected portion of one of the flanges and corresponding recess on the other flange help to bring the shaft into line and to maintain alignment. A flange which is provided with a shroud which protects the bolts heads and nuts is called protected type flange coupling.
V. OPERATIONS

A. Turning of Shaft:
Turning is the machining process in which a cutting tool, typically a non-rotary tool bit, describes a helical tool path by moving more or less linearly while the work piece rotates. In this operation reduce the diameter of the shaft. The tool’s axes of movement may be literally a straight line, or they may be along some set of curves or angles, but they are essentially linear.

B. Welding:
Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material that cools to become a strong joint with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. In this operation, fix the sprocket on the shaft.

C. Fix Bearing Supports:
1) Bearing is use for smooth rotation of shaft on which disk is mounted.
2) Bearing fix at both side of disk on support which mount over the frame.
3) When disk start rotational motion, due to bearing support it easy to operate disk.
4) By screwing of bearing support, fix over frame at both side of disk.
5) Due to that starting of disk motion is quick and frictionless.

D. Coupling of Motor Shaft and Disk Shaft:
1) For coupling of motor shaft and disk shaft two clamps are use.
2) Both this clamp has same dimensions and hole for coupling.
3) By nut and bolt this both shaft mount separately on motor shaft and disk shaft.
4) When separate mount of clamp is done then this both clamp coupled together by nut and bolt.

E. Assembly of All Components:
1) At last the assembly of all parts is done on suitable space on frame.
2) Disk is mounting over shaft which in bearing support at both side.
3) Motor shaft and disk shaft is coupled by clamping method.
4) Then after electromagnet are mount at one side of disk but in opposite side.
5) For rotational motion of disk there is 2000 rpm motor mount with clamping.
6) At front side of frame sensor is mount.
7) For proper way for electricity process switch are provide.

VI. FUTURE SCOPE
Reliable intelligent driver assistance systems and safety warning systems are still far behind. However, as computing power, detection capacity and wireless connectivity for vehicles increases, the concept of assisted driving and proactive safety warning is accelerating towards reality. As technology improves, a vehicle will become a computer with tires. Driving on the roads will be like browsing the Web: there will be traffic congestion, but there are no injuries or fatalities. Advanced driver assistant systems and new detection technologies can be very beneficial along with a lot of work on automated vehicles. These findings suggest that research into autonomous vehicles within the field of STIs is a short-term reality and a promising area of research, and these results constitute the starting point for future developments. Some suggestions for extension and/or future related works are identified and summarized below:

1) New sensory and sensory fusion systems should be explored to connect the additional information to control the system.
2) This work can be extended to include different maneuvers to make the driving system capable of handling all driving environments.
3) Future issue may also include algorithm for the autonomous training of cooperative driving.

REFERENCES