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Theoretical and Experimental Contactless Eddy Current Braking System

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Abstract:- Contact less braking system works on the principle of eddy current. It is opposite to the friction brake. It is try to quick in response most braking system are work on the principle of heat dissipation from kinetic energy to heat energy but its work totally opposite to this system our project check out the different speed of aluminum disc and check at which speed the disc stop quicker by the neodymium magnet and Ferrite magnet.

I. INTRODUCTION

Eddy current brakes are new technology which is highly popular in current days. It has higher safety due to its widely used in their field. It's eliminating the friction so it has high heat dissipation capacity. Permanent Magnetic brakes are making from of one or two rows of neodymium magnets. When a Aluminum disc passes from the rows of magnets, eddy current will generated in the disc, which creates a magnetic field opposing the disc's motion. The final braking force is directly proportional to the speed at which the disc is moving by the brake element. This variation property is also one of the permanent magnetic brake's disadvantages in that the eddy current force itself can never completely hold a aluminum disc in ideal condition. It is very necessary to hold the aluminum disc in place with an additional set of eddy current brakes which are simple neodymium magnet which have good magnetic field for effectively stop it. In the operation of every machinery the most primary safety system is the braking system. The most important designs of the braking system include the conversion of kinetic energy in to heat energy by friction. This is carried out by friction between two rubbing surface. These brake have several problems i.e. significant wear, fading, complex and slow actuation , lack of fail-safe features, increased fuel consumption because of power assistance and requirement for anti-lock controls. This phenomenon involves a metals disk which will conduct eddy current generated by magnets.

A. There are mainly two types of eddy current brake

- Electrically excited eddy current brakes i.e., Electromagnets
- Permanent magnet eddy current brake

B. Electrically excited eddy current brakes i.e., Electromagnets:

In this type of eddy current brake electromagnets are used. Electromagnet is energized by the external DC power source i.e; battery . Due to external power source magnetic field is created by electromagnet. These brakes are not use in hazardous place.

C. Permanent magnet eddy current brake

In this type of eddy current brake permanent magnet is used. Permanent magnet is not required external power source for magnet field. This type magnet have very heavy magnetic field like neodymium magnet.

II. WORKING METHODOLOGY

A. Our project work on the mainly two principle

- Faraday's law of electromagnetic induction
- Lenz's law

Faraday's law of electromagnetic induction states that "when conductor passes from the magnetic field eddy current is generated in the conductor". Lenz's law states that " The eddy current which is generated in the conductor is in opposite direction of motion".

According to this two principle in our project the aluminum disc which is work as conductor rotated in magnetic field of permanent magnet. Due to magnetic interaction between magnetic field of conductor which is created by the eddy current and magnetic field of permanent magnet disc motion is stopped.

D. Components of Permanent magnet eddy current brake

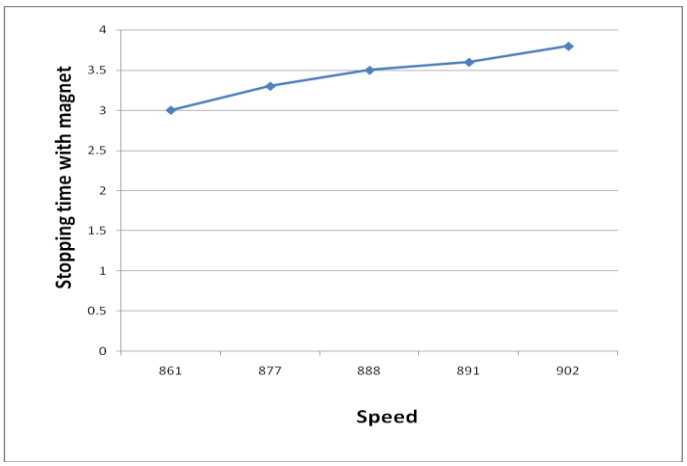
- *Neodymium magnet*: For strong magnetic field.
- *Aluminum disc*: Eddy current is generated in the aluminum disc.
- *Motor:* Motor which provide motion to the aluminum disc.
- *Frame:* Frame is used for as a based purposed which support the system.
- *Sprocket:* Drive Sprocket is attached with motor and driven Sprocket is attached with shaft.
- *Chain drive:* Chain drive is used for transmit the power from motor to shaft.

III. RESULT AND DISCUSSION

A. Experimental reading table for 15 mm air gap.

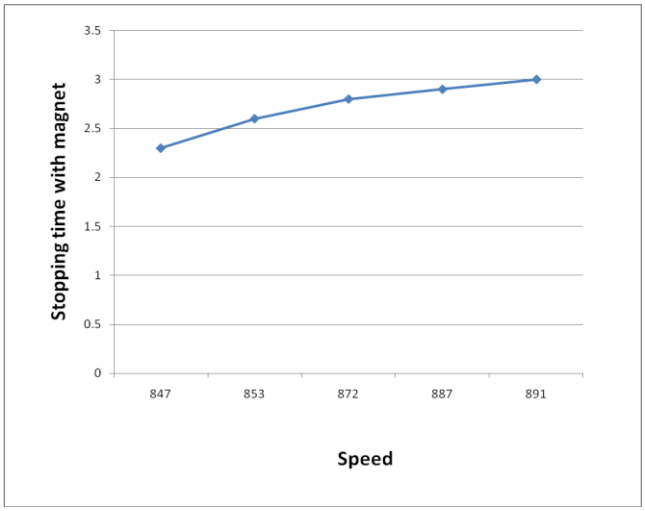
No	Voltage (V)	Current (A)	Speed (rpm)	Air gap (mm)	Stooping time without magnet (s)	Stooping time out magnet(s)
1	250	1	861	15	6.0	3.0
2	250	1	877	15	6.0	3.3
3	250	2	888	15	6.2	3.5
4	250	2	891	15	6.3	3.6
5	250	5	902	15	6.5	3.8

	Voltage (V)	Current (A)	Speed (rpm)	Air gap (mm)	Stooping time without magnet(s)	Stoopin g time out magnet(s)
1	250	1	847	10	6.0	2.3
2	250	1	853	10	6.1	2.6
3	250	2	872	10	6.3	2.8
4	250	2	887	10	6.5	2.9
5	250	5	891	10	6.6	3.0



15 mm Air gap

B. Experimental reading table for 10 mm air gap.



10mm Air gap

IV. CALCULATION

Design data:
Motor power (P) = 0.25 hp
Motor rpm (N)= 1400
Center distance (a)= 430 mm
Drive sprocket (z_1) = 8 teeth
Driven Sprocket (z_2)= 36 teeth
Diameter of shaft (d) =20 mm
Length of shaft (L) =480 mm
Thickness of aluminum disc (t) = 10 mm
Diameter of aluminum disc (D) = 175 mm

Motor selection :
Hence, we are selecting 0.25 hp AC single phase motor.
0.25 hp =186.5 W
RPM of motor = 1400

We know that;
P=2 x ∏ x N x T/(60)
186.5 = 2 x 3.14 x 1400 x T/(60)
T=1.2727 N.mm

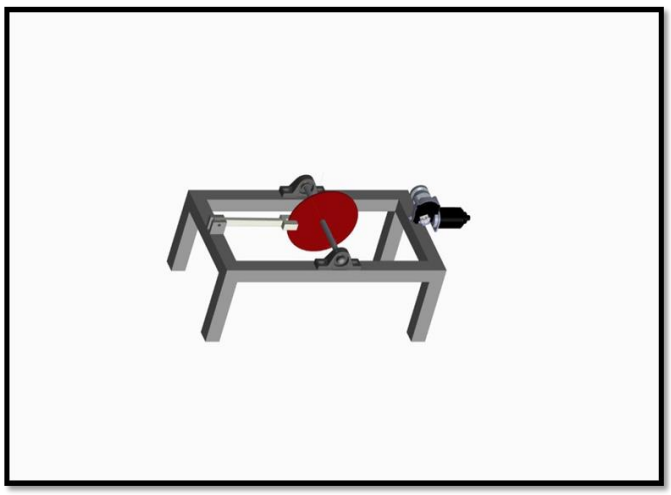


Fig 1:- Cad Model

V. CONCLUSION

- From this project we are able to conclude that if air gap is increased then stopping time is also increased.
- We are also able to conclude that if speed is increased then stopping time is also increased.
- We also conclude that neodymium magnet is best for permanent magnet eddy current brake.

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