IMPROVEMENT OF BRAKING EFFICIENCY IN VEHICLE BY USING FUSION BRAKING SYSTEM

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Abstract - *The main objective of this paper is to improve the braking of the vehicles mostly higher segment vehicles with large amounts of engine power. This system uses disc brakes with addition of ferrite magnets such that the stopping power of the vehicle increases, this way the vehicle stops at a lesser distance at a lesser amount of time which makes the journey comfortable and smooth with confidence braking. This system is mainly for high performance cars or bikes such that the braking is smooth and stable at higher speeds.*

***Key Words*: Fusion braking, AC motor, Disc brake, Electromagnetic braking, and Ferrite magnets.**

1. INTRODUCTION

The main working of the project is to improve the brake efficiency by inducing magnetic field on disc brake using permanent ferrite magnet. AC motor drives the disc with the help of the shaft connectivity and the disc brake is attached to the pistons. The brake is engaged using the brake lever. The power is supplied to the AC motor; shafts start rotating and move the disc. Once the break lever is pressed it protrudes the piston from the calipers and holds the disc and slows down it rotation speed additionally the permanent magnet is pushed towards the disc so it creates an opposite magnetic field and improving the braking efficiency.

2. EXPERIMENTAL SETUP

2.1 Frame: First the frame is designed as per specifications using CATIA v5 software and then this designed frame is analyzed and tested using ANSYS software. Later these blocks are welded together to form a base of the frame. Then after forming the base the next step is to make a support for placement of motor. This process is done by taking a small rectangular block of carbon steel and is welded at the end of the frame over the block a square carbon steel plate is installed over the block this acts as a support were the electrical motor can be installed over the plate.

2.2 Electric Motor

The motor is then placed over the carbon steel plate over the frame which supports it, the input of the motor is given to an electrical switch and the output is actually connected to the shaft. This motor produces 0.25HP which helps in rotation of the disc up to 1500RPM.

2.3 Shaft

The shaft used in this project is about 32cms in length and around 4cms in diameter. This shaft is connected at one end to the electrical motors output and other end is welded to the disc using TIG welding method.

2.4 Disc and Disc Caliper

In this process the calipers are setup over the disc and also the disc is mounted over a rectangular block which is perpendicular to the frame by means of welding over both the ends of the block.

2.5 Brake Lever Setup

The brake lever is setup over the separately designed handle and a mount were the brake lever and master cylinder is setup over it, it is setup in such a way that the braking while the brake lever is pressed must be linear and smoother as such of the brakes in most of the bikes.

2.6 Magnets Arrangement and Setup

Here the magnets are first mounted over two rectangular plywood pieces such that they stay firm enough and then they are attached to a sliding base, the magnets are kept in such a way that opposite sides face each other creating an attractive force. The sliding base is kept over slider which faces the disc. This way the setup is arranged.

Fig-1 : Fusion braking system

3. EXPERIMENTATION

In this process the setup is introduced to variable loads such that variable speeds can be defined, by variable speeds of the discs variable stopping time can be determined and can be tabulated such that various results are to be obtained.

In this process we see that by adding loads we can get different operating speeds from the motor by varying speeds around 1300-1500 rpm.

3.1 Brake Disc Free Run

Here first we give the motor some electrical input such that the motor starts rotating at 1500rpm at max producing 0.25hp of power, here is where we use a tachometer such that the rotating speed is defined and later we find out the stopping of the brake disc by free run of the disc.

1. 1300rpm - 2.9sec

2. 1400rpm – 3.2sec

3.1500rpm – 3.5sec

3.2 Disc Brake

Here is where we use a tachometer such that the rotating speed is defined and later we find out the stopping of the brake disc by the application of 2 piston disc brake.

1. 1300rpm – 1.92sec

2. 1400rpm – 1.96sec

3.1500rpm – 2.10sec

3.3 Permanent Magnets

Here is where we use a tachometer such that the rotating speed is defined and later we find out the stopping of the brake disc by the application of permanent magnets.

1. 1300rpm – 1.92sec

2. 1400rpm – 1.96sec

3.1500rpm – 2.10sec

3.4 Disc Brake and Permanent Magnet

Here is where we use a tachometer such that the rotating speed is defined and later we find out the stopping of the brake disc by the application of permanent magnets and disc brake simultaneously.

1. 1300rpm – 1.08sec

2. 1400rpm – 1.09sec

3.1500rpm – 1.10sec

4. RESULTS

After different tests have been conducted, with different setups and different test beds we come to a conclusion that fusion braking i.e. application of disc brake and magnet at same time reduces the amount of braking time and also increases the amount of braking force with addition of lesser amount of force used to press the brake lever.

As per the tests we see that fusion braking applied over the disc rotor at 1300 rpm reduces the time taken to stop the brake is 1.08 sec.

At 1400rpm the braking effect of the fusion braking system is around 1.09 sec.

At 1500rpm the braking effect of the fusion braking system is around 1.10 sec.

S.NO	Motor Speed 'rpm'	Disc free run 'sec'	Disc brake 'sec'	Permanent magnet 'sec'	Fusion braking (disc + magnet) 'sec'
1	1300	2.9	1.92	2.65	1.08
2	1400	3.2	1.96	2.86	1.09
3	1500	3.5	2.10	3.20	1.10

Fig-2 : Best Optimized Value Using Fusion Braking

5. CONCLUSIONS

This way we conclude that fusion braking is better than that of the standard disc brake setup; the braking time is much lesser of that of the 2 piston caliper disc brake.

Braking time of the vehicle is decreased as that of standard 6 piston caliper ventilated disc brake, lesser amount of force is applied over the lever such that higher braking output is obtained, Is accessible for electronics such as ABS, EBD, TC, EB, the project can be used in all types of vehicles and specially designed for superbikes, supercars and hyper cars.

REFERENCES

[1] Akshyakumar S.Puttewar, Enhancement of Braking System in Automobile Using Electromagnetic Braking IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 54-59 .

[2] AbhijeetNaikwadi, Design and Analysis of Electromagnetic Disc Brake for Automobiles GRD Journals-Global Research and Development Journal for Engineering | Volume 2 | Issue 3 | February 2017 ISSN: 2455-5703

[3] Sevvel.p, Innovative Electro Magnetic Braking System International Journal of Innovative Research in Science, Engineering and Technology An ISO 3297: 2007 Certified Organization Volume 3, Special Issue 2, April 2014.

[4] Masrat Bashir, FRICTION AND WEAR BEHAVIOR OF DISC BRAKE PAD MATERIAL USING BANANA PEEL POWDER IJRET: International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.

[5] Swapnil R. Abhang, Design and Analysis of Disc Brake International Journal of Engineering Trends and Technology (IJETT) – Volume 8 Number 4- Feb 2014.

[6] Rhythm Dhoot, Design & Theoretical Study of Electromagnetic Braking System, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 6 Ver. VI (Nov. - Dec. 2016), PP 87-96.

[7] Naveen. S, Electro Magnetic braking System - EMBS An Improvisation of the Heuristic Anti-Lock Braking System, IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 9, September 2015.

[8] Virendra Kumar Maurya, EDDY CURRENT BRAKING EMBEDDED SYSTEM, International Journal of Applied Engineering and Technology ISSN: 2277-212X, 2011 Vol. 1 (1) January-April/ pp104-113

[9] Smit Patel, Development of the Electro-Magnetic Brake, IJIRST –International Journal for Innovative Research in Science & Technology| Volume 1 | Issue 12 | May 2015 ISSN (online): 2349-6010.

[10] M.A. Maleque, Material Selection Method in Design of Automotive Brake Disc, Proceedings of the World Congress on Engineering 2010 Vol III WCE 2010, June 30 - July 2, 2010, London, U.K.