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REGENERATIVE BREAKING SYSTEM WITH POWER MONITOR

Satyanarayana N[1], Vikas K[2], Naresh V[3], Naveen Sai Teja R[4], Suresh U[5]

[2,3,4,5]BTech students, Dept of Mechanical Engineering, Lingayas Institute of Management & Technology, Madalavarigudem, Vijayawada, Andhra Pradesh, India

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Abstract - Regenerative braking could reclaim as much as half of that wasted energy, which equates into more motion produced by the fuel we are paying for instead of using that fuel to create heat that is being dissipated uselessly into the environment. We use friction lining arrangement in a brake drum. As a drum rotates the friction lining does not tough the drum as soon as brakes are applied, the friction lining touches the drum from inside and moves the motors connected to lining in same direction, thus generating electricity using motors as dynamo. Thus, this system allows for charging car battery each time brakes are applied, thus providing a regenerative braking system. It moves us another step ahead towards a pollution free transportation system.

***Key Words*:** Regenerative Braking, Friction Lining, Dissipated,

1.INTRODUCTION

The issue of calculating the energy saving amount due to regenerative braking implementation in modern AC and DC drives is of great importance, since it will decide whether this feature is cost effective. However, as the increase of the electric energy cost at the industrial sector, the need for advanced energy saving techniques emerged in order to cut down operational costs. To this direction, this project presents a theoretical, simulation and experimental investigation on the quantization of energy recovery due to regenerative braking application in industrial rotating loads. Finally, a power conversion scheme is proposed for the storage/exploitation of the recovered energy amount.

Fossil fuels become each time less abundant and expensive, and with the problems of worldwide pollution, they also become inadequate to be used in such a large scale.

The automotive industry is one of the biggest spenders of this limited resource. This fact may be changed with the use of electronic propelling systems, such as the appliance of a three-phase induction motor driven by a controlled inverter, replacing the internal combustion engine. The objective of this project is to research, design and implement the most effective regenerative system. The extra energy obtained from braking is used for light the bulb.

1.1 BRAKING SYSTEM

All electric machines have two mechanical operations, motoring and braking. The nature of braking can be regenerative, where the kinetic energy of the rotor is converted into electricity and sent back to the power source or non-regenerative, where the source supplies electric power to provide braking. This project investigates several critical issues related to regenerative braking in both DC and AC electric machines, including the regenerative braking capability region and the evaluation of operating points within that capability region that result in maximum regenerative braking recharge current. Electric machines are used in the power trains of electric and hybrid-electric vehicles to provide motoring or braking torque in response to the driver's request and power management logic.

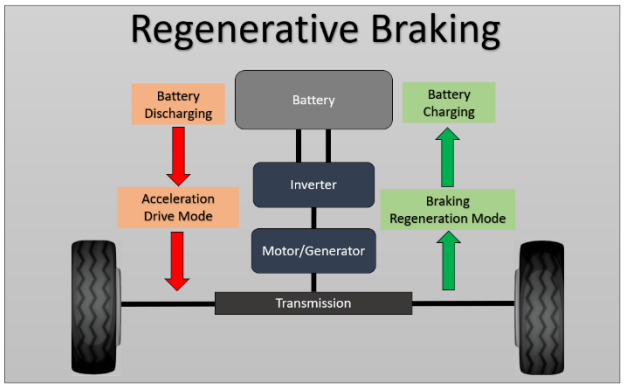

Fig -1: Regenerative braking system.

1.2PROBLEM STATEMENT

The invention of Regenerative Braking System is viewed as a solution to these 4 problems, as it recovered wasted energy and restored to another form of useful energy. Although the valuable and positive effect brought by Regenerative Braking System is realized, it still has its issue or problem to be solved one of the major problems is observed as the suitable battery to be used in this type of vehicle.

2. LITERATURE SURVEY

Regenerative Braking for an Electric Vehicle Using Ultra capacitors and a Buck-Boost Converter: An ultra capacitor bank control system for an Electric Vehicle has been simulated. The purpose of this device is to allow higher accelerations and decelerations of the vehicle with minimal loss of energy, and minimal degradation of the main battery pack. The system uses an IGBT Buck-Boost converter, which is connected to the ultra-capacitor bank at the Boost side, and to the main battery at the Buck side. The control of the system measures the battery voltage, the battery state-of-charge, the

car speed, the instantaneous currents in both the terminals (load and ultra capacitor), and the actual voltage of the ultra-capacitor. This last indication allows to know the amount of energy stored in the ultra-capacitor.

A microcomputer control manipulates all the variables and generates the PWM switching pattern of the IGBTs. When the car runs at high speeds, the control keeps the capacitor discharged. If the car is not running, the capacitor bank remains charged at full voltage. Medium speeds keep the ultra-capacitors at medium voltages, to allow future accelerations or decelerations. The battery voltage is an indication of the car instantaneous situation. When the vehicle is accelerating, the battery voltage goes down, which is an indication for the control to take energy from the ultra-capacitor. In the opposite situation(regenerative braking), the battery voltage goes up, and then the control needs to activate the Buck converter to store the kinetic energy of the vehicle inside the ultra-capacitor.

3. COMPONENTS & MATERIALS REQUIRED:

S. No	Name of the materials	Description	Quantity
1	Square Bar	20*20 mm Hallow Bar	5 mm
2	Solid Shaft	Outer Diameter 10mm	1 Piece
3	Robotic Break Wheel	Outer Diameter 7cm	1 Piece
4	Robotic Main Wheel	Outer Diameter 12cm	1 Piece
5	Motor	1000rpm	3 Piece
6	LED's	12V	1 Piece
7	Electric Wires	Copper Wire	5 m
8	Rechargeable Battery	12V, 1.35Amph	1 Piece
9	Multimeter	DT-830D	1 Piece
10	Motor Speed Controller	1.8V – 12V	1 Piece

Table -1: Components & Details

4. SCOPE OF THE PROJECT:

Regenerative system allows a vehicle to generate energy each time brakes are applied as well as track the amount of power generated. The stronger the brakes, the more power is generated. We use friction lining arrangement in a brake drum. In Future developments, however, such as ultra-capacitors, flywheels and hydraulic systems could have much higher power capacities, which could open up the possibility to rely more heavily on the regenerative braking system, even for high speed, high stops and the opportunity to down size or even eliminate the friction-braking system.

Regenerative braking systems require further research to develop a better system that captures more energy and stops faster. As the time passes, designers and engineers will perfect regenerative braking systems, so these systems will become more and more common. All vehicles in motion can benefit from these systems by recapturing energy that would have been lost during braking process. Future technologies in regenerative brakes will include new types of motors which will be more efficient as generators, new drive train designs which will be built with regenerative braking in mind, and electric systems which will be less prone to energy losses.

5. WORKING PRINCIPLE:

Regenerative braking is a braking method that utilizes the mechanical energy from the motor by converting kinetic energy into electrical energy and fed back into the battery source. Theoretically, the regenerative braking system can convert a good fraction of its kinetic energy to charge up the battery, using the same principle as an alternator. In regenerative braking mode, it uses the motor to slow down the car. When the driver applies force to the brake pedal, the electric motor works in reverse direction thus, slowing it.

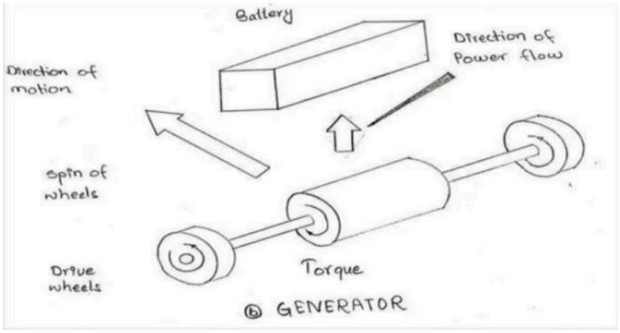

Fig -2: Regenerative Action during breaking

5.1 INTRODUCTION TO DESIGN:

Regenerative braking system may not suffice the basic requirement of braking system alone. This is because of limitation of energy dissipation at very high power. The storage and generation systems may not be capable to operate at those levels due to design limitations. Due to critical level of safety involved with the system, reliability becomes debatable and it necessitates a frictional braking system to co-exist with electrical regenerative braking system.

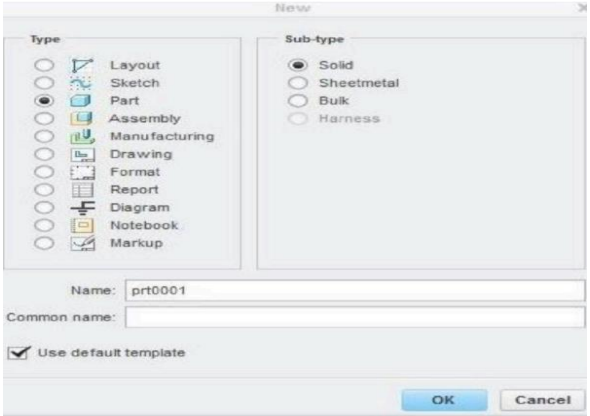

Fig -3: Initialization of Design

6. RESULTS:

A model of regenerative braking system is fabricated. After the successful testing, the system is able to stop the vehicle by producing energy in return and the results obtained in various loading condition are noted and tabulated below.It can be seen from the result tables that the efficiency of the regenerative braking systems using D.C Motors increases as the angular velocity of the motor increases and hence the regenerative braking systems are more efficient as higher angular velocities and the recoverable energy increases with increase in the motor speed.

S. No.	RPM BEFORE BREAK PEDDLE PRESSED	RPM AFTER BREAK PEDDLE PRESSED	VOLTAGE OUTPUT
1	500	470	9.23
2	900	850	10.58
3	1300	1260	11.81
4	1700	1620	12.88
5	2100	2040	13.49

Table -2: Result Table

7. DISCUSSIONS:

In summary, the analysis suggests that current, "first-generation" regenerative braking systems do not compromise braking safety. The tests carried out on one such system, fitted to a hybrid vehicle, did not raise any safety issues. The primary determinant of how powerful the regenerative braking system might be the power capacity of the battery or other energy storage device/system, that is its ability to quickly convert the kinetic energy of the vehicle into its stored form.

7. CONCLUSIONS:

The regenerative braking system used in vehicles satisfies the purpose of saving a part of the energy lost during braking. The energy is converted into heat by friction brakes which are dissipated to the environment. This Energy is utilized to rotate the rotor of generator converting mechanical energy of wheels into useful charge of battery. The regenerative braking system cannot be used as main braking system of vehicle as it cannot bring the vehicle to rest.

Regenerative braking system have significant room for improvement. Regenerative braking is still very limited and dependent on uncontrollable variables. Also, danger can arise if regenerative braking is applied to two-wheel-drive brake systems. However, regenerative braking does have various benefits. A proper implementation of regenerative braking system extends driving range, improves braking efficiency, reduces brake wear, and improves energy conservation.

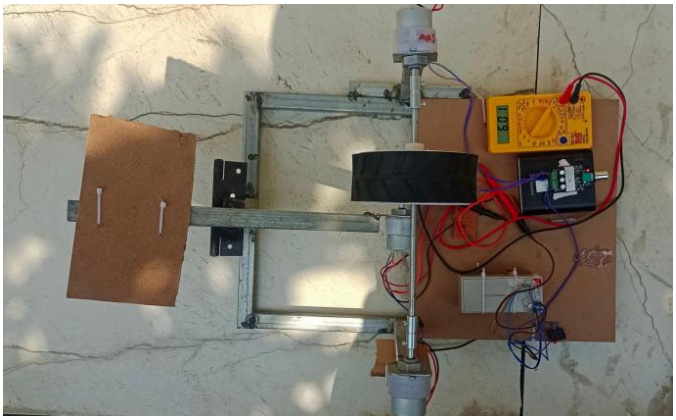

Fig -4: Final Fabrication

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BIOGRAPHIES

Dr. N. Satyanarayana[1],
Professor,
Dept. of Mechanical Eng.,
Lingayas Institute of Management
& Technology, Vijayawada.

K. Vikas[2],
UG Student,
Dept. of Mechanical Eng.,
Lingayas Institute of Management
& Technology, Vijayawada.

V. Naresh[3],
UG Student,
Dept. of Mechanical Eng.,
Lingayas Institute of Management
& Technology, Vijayawada.

R. Naveen Sai Teja[4],
UG Student,
Dept. of Mechanical Eng.,
Lingayas Institute of Management
& Technology, Vijayawada.

U. Suresh[5],
UG Student,
Dept. of Mechanical Eng.,
Lingayas Institute of Management
& Technology, Vijayawada