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Research Paper

REGENERATIVE BRAKING SYSTEM USING FLYWHEEL

Engineering

KEYWORDS : Conventional Braking System, Regenerative Braking, Electric Motor, Flywheel Energy Storage

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ABSTRACT

Usually in cars hydraulic brakes are used, which converts the excess of kinetic energy into heat, due to which there is energy lost. Regenerative braking technology focuses on converting this kinetic energy of the decelerating wheels back into electrical energy so we can use this energy again, for example during acceleration. Currently new hybrid vehicles are installed with such braking technology, which makes them particularly interesting for situations where there is frequent deceleration, like in traffic. However, the technology used in these vehicles has its limitations and therefore, we have to use this technology with conventional hydraulic brakes. This paper removes the limitation mentioned above and allows a vehicle to fully rely on regenerative braking technology to deal with all braking situation from slowing down a vehicle to stop a vehicle. To enable this, multiple generators are used which have different gear ratio. One more advantage of using this construction is , by introducing the appropriate control circuit, the generators can be used as electrical engine. As the motors are connected with different gear ratios so at any speed we can get a consistent acceleration. This paper shows us that the ,overall efficiency of the system is nearby to the efficiency of the generators used while achieving braking performance which is similar to conventional braking mechanisms.

INTRODUCTION

We can understand our concept of RBS by bicycle which is fitted with Dynamo. If our bicycle has a dynamo on it which powers the lights, when dynamo is engaged it is some what difficult to paddle than when it is shut down. That is because some of our peddling energy is being taken by the dynamo and turned into electrical energy in the lights. If we are moving at a speed and we suddenly stop peddling and turn on the dynamo, then it will stop more quickly than it take normally, for the same reason: it steals this kinetic energy. Now imagine a bicycle with a dynamo which is 100 times bigger and much more powerful. It could bring our bike to a stop quickly by converting our K.E. into electricity which we could store in battery and use again later. And this is the idea used behind regenerative brakes. When we are driving, energy flows from the batteries to the motors, turning the wheels and provides us with K.E. which we need to move. When we stop and apply brakes, the whole process is reversed.

As the law of conservation of energy says that we cannot create energy and nor we can destroyed . we can just change its form. And during this change of form ,huge amount of energy is lost to atmosphere as heat. It will be beneficial to store this energy and used it later instead of wasting it. Regenerative braking refers to a system in which the K.E. of the vehicle is temporarily stored, as an accumulative energy, during deceleration, and it is used again as kinetic energy during acceleration. Regenerative braking is small, but still it is very important, step toward use of alternate fuels. These kinds of brakes improves battery durability. When these brake are used in E.V. it's driving range increases. RBS can also be applied to hybrid vehicles to improve fuel economy. Car's without RBS is only about 20% efficient, meaning 80% of it's energy is wasted as heat due to friction.

Motor, Flywheel Energy Storage

WORKING PRINCIPLE

The Motor as a generator

Vehicles which are driven by electric motors they use motor as a generator when they are using regenerative braking, it is operated as a generator during braking and the output is supplied to an electrical load; the braking is done when there is transfer of energy to the load .Regenerative braking is used on automobiles like hybrid gas or electric car to regain some of the energy which was lost during stopping. This energy is stored in a battery and used later to power the motor whenever the car is in electric mode

• Vehicles with electric motors, primarily fully electric vehicles and hybrid electric vehicles there regenerative braking is used.

•When motor run in one direction, it converts electrical energy into mechanical energy.

• And when motor run's in opposite direction, a designed motor becomes an electric generator, converting mechanical energy into electrical energy. Then this electrical energy can be fed into a charging system for the car's batteries

ELEMENTS OF REGENERATIVE BRAKING SYSTEM

Energy Storage Unit (ESU) :

It performs two basic Functions:-Recovering & Store Braking Energy.

To absorb excess engine energy during light load operation.

The Selection Criteria for an effective energy Storage includes.

1) High specific energy storage density.

2) High energy transfer rate.

3) Small space requirement.

The Energy recaptured by regenerative braking might be stored in one of three devices , an Electrochemical battery, a Flywheel, & a Hydraulic Accumulator.

Regenerative braking System with Batteries:

Vehicles with electric motors, primarily fully electric vehicles and hybrid electric vehicles there regenerative braking is used.

•When motor run in one direction, it converts electrical energy into mechanical energy.

• And when motor run's in opposite direction,a designed motor becomes an electric generator, converting mechanical energy into electrical energy. Then this electrical energy can be fed into a charging system for the car's batteries

FLYWHEEL BASED REGENERATIVE BRAKING:

In this system, translational energy is converted into rotational energy in the flywheel, that energy is stored until it is needed to accelerate the vehicle.

One of the benefit of using flywheel is that it regains energy even for very short interval but with use of motor as a generator there will be so much lost of energy by friction.

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❖ WORKING OF REGENERATIVE BRAKING SYS.

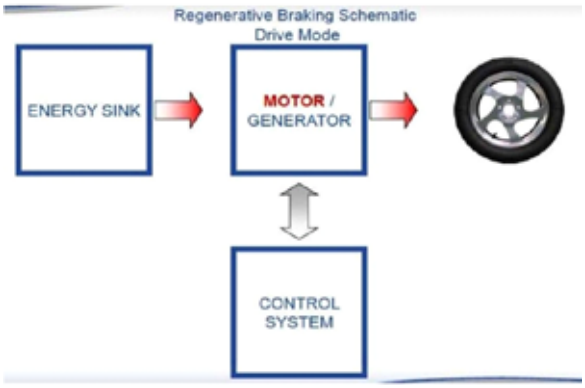

Fig1:- Block diagram for regerative braking schematic drive mode

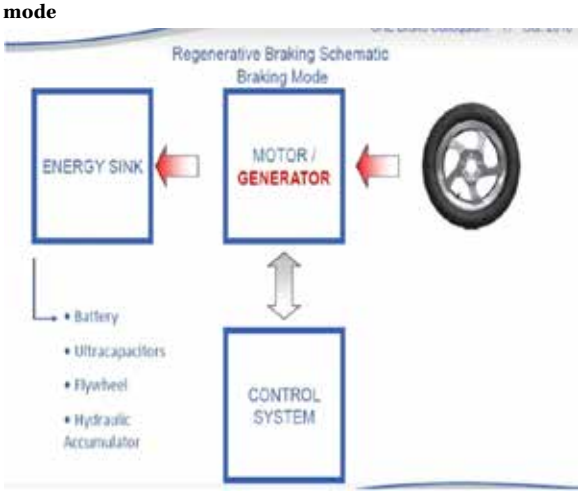

Fig.2:- Block diagram for regerative braking schematic braking mode

Advantages

1) Overall energy saving efficiency of vehicle increases.
2) Engine wear reduction.
3) Lifespan of frictional braking system increases.
4) Pollution control related to electricity.
5) When RBS is used over traditional brakes, there will be less wear over time.

Future Scope

1) It can also be used in all metro suburban or mainline services.
2) It can be used in pure electric or semi electric vehicles.
3) In hybrid power cars
4) Used where negligible losses are required like gear transmission system.

If we want to increase efficiency of wind turbines then fly wheel will be attached along with that.

CONCLUSION

Vehicle efficiency and longevity can be improved by regenerative braking. It is already in use in many EVs, regenerative technology already exists and it's worth to installed it.

Regenerative braking is a small, yet very important step toward use of alternating energy. These kinds of brakes improves battery durability and performance. This technology has already being installed on cars like the Tesla Roadster, which runs entirely on battery power. These cars also uses fossil fuels during recharging stage -- that is, they may use fossil fuel such as coal for the source of electricity-- but when they're out there on the road, they eliminate the use of fossil fuels, which makes a major difference. When you think about the different energy losses due to electric hybrid systems, therefore the use of flywheel hybrids comes into picture. But of course it is not so advantageous, hence on further analysis it shows a combination of battery-electric and probably flywheel energy storage is the ideal solution for hybrid vehicles.

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