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Power Generating Shock Absorber

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Abstract: *The main objective of the designed controller for a vehicle suspension system is to reduce the discomfort sensed by passengers which arises from road roughness and to increase the ride handling associated with the pitching and rolling movements. This necessitates a very fast and accurate controller to meet as much control objectives, as possible. Therefore, this paper deals with an artificial intelligence Neuro-Fuzzy (NF) technique to design a robust controller to meet the control objectives. The advantage of this controller is that it can handle the nonlinearities faster than other conventional controllers. The approach of the proposed controller is to minimize the vibrations on each corner of vehicle by supplying control forces to suspension system when travelling on rough road. The other purpose for using the NF controller for vehicle model is to reduce the body inclinations that are made during intensive manoeuvres including braking and cornering. A full vehicle nonlinear active suspension system is introduced and tested. The results show that the intelligent NF controller has improved the dynamic response measured by decreasing the cost function.*

Keywords: Full vehicle, nonlinear active suspension system, control design.

I. INTRODUCTION

It was described to develop electricity using the real-time motion of parts in a form of wheeler. After careful analysis of a various such parts it was decided to generated electricity using relational motion available in a suspension system of a two-wheeler.

In the new age of the electric bikes, almost everything has to be modified. In one hundred years, people will launch at today's hybrid and pure electric vehicles rather in the way we launch at motor vehicles from 1880 that looked like something dragged along by a horse because that was the starting point. Inside and out, today's electric vehicles look almost the same as what went before.

We have batteries and electrical and electronic controls in big lumps because that is what they had to look like in the past, together with masses of wiring. We have a big lump of noisy, dirty, shaking internal combustion engine in a hybrid because that is what an engine has looked like in the past. Bring in smart electronic surfaces, wireless links, laminar conformal batteries and mini turbine range extenders. Then we really will have moved on in cost, performance and passenger safety, comfort and space available.

However, until we figure out how to make comfortable vehicle bodies we shall need shock absorbers, so they might as well generate electricity.

In 2005, David Oxen Reider of Boiling Springs, PA, presented a design for an electricity generating shock absorber. Experimental Bosch suspension systems have generated electricity. Problems have included the devices being too large, too expensive, and too inefficient in converting electricity or just poor shock absorbers because they dispensed with the spring or had the wrong damping characteristics

II. LITERATURE REVIEW

2.1 Introduction: In order to perform this project literature review has been made for various sources like journal, books, articles and other. This chapter includes all important studies which have been done previously by other research work. It is important to do the literature review before doing the project because we can implement if there are information that related to this project. The most important thing before starting the project we must clearly understand about the topic that we want to do. So, by doing the literature review we can gain knowledge to make sure we fully understand and can complete the project. A review of the article was performing to identify studies that relevant to the topic.

2.2 Electromagnetic Suspension System The first method is, which works on the principle of Faraday's law of electromagnetic induction. The shock absorber consists of two tube-like components where a smaller magnetic tube slides

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inside a larger, hollow coil tube. The coil component is made of copper coils wound around a plastic tube, while the magnetic component is made of ring-shaped magnets separated by ring-shaped magnetically permeable spacers.

2.3 In a vehicle, shock absorbers reduce the effect of traveling over rough ground, leading to improved ride quality and increase in comfort. While shock absorbers serve the purpose of limiting excessive suspension movement, their intended sole purpose is to dampen spring oscillations. There are many types of shock absorbers: Conventional shock absorber, Hydraulic shock absorber, Electrical shock absorber (PGSA). When we consider the above shock absorbers, we can observe that there is wastage of free vibration energy which is already present in nature. This is one of the applications of the KERS which converts kinetic energy from the vibration of shock into electrical energy.

Now here's an invention that is truly shocking an energy-harvesting shock absorber that when installed in a vehicle's suspension system can absorb the energy from road bumps and covert that energy into electricity, we can store this energy using Liner Motion Electromagnetic System (LMES)These energy harvesting systems convert the vibrational energy of mechanical systems like engines, turbines, bridges, and other rotating or moving equipment into useful forms of energy. Different types of design are possible. You might think of converting the linear motions of the vibrations to the rotary motions and then couple it with a generator. Another possible option could be converting the linear vibratory motion directly to electric power by using magnets and coils. LMES technology is already finding its place in ocean power generating systems. Its introduction into the automotive world is the next logical step. This technology can be applied to any type of vehicle that employs movable suspension technology and uses electricity in some form as its fuel.

II. DESIGN DETAILS

Components

Sr. No.	Component	Details	Specifications	Quantity (Nos.)
1	DC Motor	6 Volts	-	04
2	Horizontal Plates	95mm x 95mm	10 mm Thick Iron Plate	02
3	Horizontal Plates	95mm x 95mm	10 mm Thick Wooden Plate	02
4	Vertical Plates	95mm x 45mm	10 mm Thick Wooden Plate	02
5	Flat Belt	35mm x 300mm	5 mm thick Rubber Belt	01
6	Rectifier	-	Full wave	01
7	Stud Rods	5 mm Diameter and 250 mm length	Stainless Steel	08
8	Pulleys	5mm Diameter	Plastic	08
9	Battery	6 Volt, 4.5 Ah sealed battery	-	01
10	Diode	-	-	01

Construction and Working

1. Construction

It consists of two plates of iron sheet, two plates of wooden sheet i.e., plywood, eight studs rod are used in it and four motors. First horizontal plate and fourth horizontal plate is made up iron sheet of 95mm x 95mm having 5mm thick is fabricated. The second horizontal plate and the third horizontal plate of 95mm x 95mm having 10mm thickness are made up of plywood sheet are fabricated. There are eight vertical stud rods of 5mm in diameter and 250mm length.

The first horizontal plate and third horizontal plates are connected to each other passing through second horizontal plate with the help of four stud rods and the fourth horizontal plate and second horizontal plate are connected to each other passing through third horizontal plate with the help of other four stud rods.

The rubber belt flat type is fixed on the second plate and forth plate with the help of nut and bolt. On the third horizontal plate two vertical plates are mounted of 95mm x 45mm having 10 mm thickness made up of plywood sheet. Four motors are mounted on the two vertical plywood plates. These motors are connected in series to each other with Full wave Rectifier Bridge.

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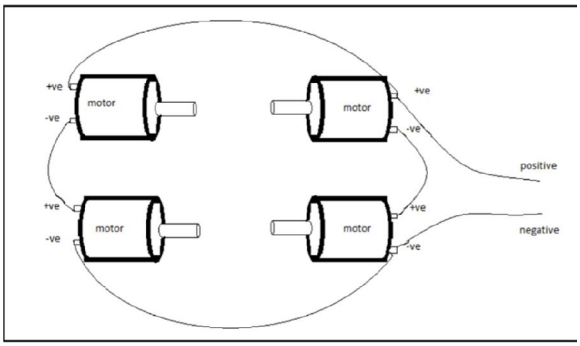
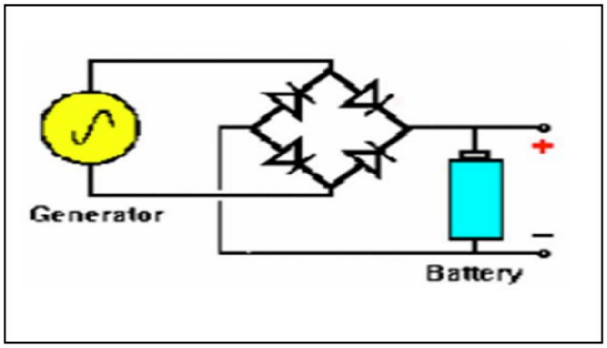


Motor connection in series



Circuit Diagram

Working of Project

In this project we have to develop a suspension energy generation unit by using belt and pulley. Here, when the vehicle suspension works, the linear motion of the suspension creates friction between the pulleys and the belt. Due to this, the pulley starts rotating. The pulleys are mounted on the shaft of the DC motors. As the pulleys get rotated the shaft of the motors also get rotated which generate electricity. The figure shows the implementation of the project and it's working therein. As the vehicle passes over an uneven road surface, there is relative motion of the individual wheels. As shown, the linear motion of the wheels causes the suspension to compress and this imparts motion to the belt which is attached to the wheel assembly. This in turn gives rotational motion to the pulley as shown in the highlighted area

The belt then transfers the rotary motion through pulley to the DC motors. The motors generate electricity which is the given to the various auxiliaries of the vehicle. The project assembly thus includes one front wheel, suspension and the designed units attached to it.

Model Calculations

Electrical Calculation

When a vehicle is running at a speed of 20 to 30 km/hr we observe 6 to 9 volts with the help of multi meter.

Voltage Generated (V) = 9 volt

Current Generated (I) = 3.2 amp

As Electrical Power (P) = V x I = 9 x 3.2 = 28.8 Watts

TO CALCULATE CHARGING TIME FOR 6 VOLT BATTERY

Charging time =battery current (Ah) / current generated (A)

=4.5 (Ah) /3.2(A)

= 1.40 hr

But it was noted that during charging 40% get loss

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=4.5 x 40 /100
=1.8 Ah
Charging time = 4.5 +1.8 /3.2
=1.9 hr

To charge a 6-volt battery with this suspension including 40% loss we can charge the battery with 1.9 hr.

To Calculate Charging Time for 12 Volt Battery

Consider that the suspension system is mounted on both side of the front suspension.
Total voltage produced by this suspension system in 18 volts, 64A.
Therefore, time required to charge a 12-volt, 33 Ah battery is,
Charging Time =Battery current (Ah) / current generated (A)
=33 (Ah)/ 6.4 (A)
=5.15 hr
But it was noted that 40% loss during battery charging
=33 x 40/100
=13.2 (Ah)
Charging time = 33 + 13.2 /6.4
=7.21 hr

III. ADVANTAGES AND DISADVANTAGES

Advantages:

- Shock absorbers have a great for performance, handling and stability.
- They are best choice for work and severe use vehicles.
- High pressure gas mono tube design- 360psi to prevent aeration and shock fade.
- Low pressure gas twin tube design- These units are good for average, everyday driving.

Disadvantages:

- Not applicable for all types of two wheelers.
- On smooth road power generation is less than 4 volts.
- Design of the suspension system not suitable for scooter.
- As whole system consists of electric wiring, so that chances of short circuits.

IV. CONCLUSION AND FUTURE SCOPE

4.1 Conclusion

Conventionally, the vibration energy of vehicle suspension is dissipated as heat by shock absorber, which wastes a considerable number of resources. Power Generating by Shock Absorber brings hope for recycling the wasted energy. All types of Power Generating Shock Absorber, especially electromagnetic suspension, and their properties are reviewed in this project. From the perspective of comprehensive performance including vibration control ability, regenerative efficiency and application reliability. With improvement of technology, Power Generating Shock Absorber may become one of promising trends of vehicle industry.

4.2 Future Scope

The scope for this project is that it is simple in construction and design and has low in price. It is easily mounted on the chassis of the vehicle and it produced 2 to 3 volts in even road and 6 to 9 volts on uneven rod which is sufficient for charging the vehicle battery when the vehicle is in a running position. This increases the efficiency of electric vehicles up to 10%. Further improvement in the suspension design makes it suitable for any two wheelers (electric). By increasing the no. of DC motor generation of power get increases which are used to charge high voltage battery. This system can be used on to the mono suspension system by making suitable design. By modifying this system, we can implement this on to the electric car.

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