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REGENERATIVE SUSPENSION SYSTEM

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Abstract

Today's world is full of modern technologies and automotive industry is one of the industry that is evolving to modern technology. Hybrid and electric car is under improvement for a better efficiency. This paper emphasizes the development and analysis of retrofit electromagnetic energy regenerative suspension system test rig. The test rig will be used for the testing of the system in the laboratory. The system functions as the harvesting system that generates power for vehicle usage. Complete design of the test rig is clearly discussed in the paper including the drafting, analysis and fabrication. It is get that the designed test rig can be used for the testing which has been assembled with the main component of the real vehicle suspension system with the regenerative system. The test rig can be useful for validating the real vehicle test with the laboratory test. Energy harvesting technology is one of the promising technologies that can be develop and used in the future vehicle. One of the energy harvesting technology is the energy regenerative suspension system. The suspension system of a vehicle consists of a spring, damper and linkage that connect the sprung and unsprung mass of the vehicle (Zhang et al., 2013). Mechanical control of vibrations is one of the active areas that has been researched several years in the past with wide range of applications. External power source is needed for the technology to be applied. Regenerative harvesting system is one of the technologies that interest the researcher around the world (Sabzehgar and Moallem, 2011). The most recent research interests are on the energy regenerative from vehicle suspension system that has been presented in several papers. This is due to the automotive industry that develops the hybrid and electric vehicle for future usage (Sabzehgar and Moallem, 2012). Primarily, the suspension system of a vehicle is used to isolate the vibration from the road from going inside the car cabin. The damper of the suspension produces heat and this energy comes from the

vibration absorbed from the road (Patil and Gawade, 2012). Passive shock absorber is commonly used on vehicle which functions by using the principle of fluid frictional effects (Abdullah et al., 2015a & 2015b). It is in fact that the suspension is designed for. The suspension produces vertical energy that comes from the road irregularities (Hedlund, 2010 & Abdullah et al., 2015c & 2015d). The suspension consists of spring and damper to maintain the vehicle contact to the ground (Abdullah et al., 2015a). There are several types of suspension system on vehicle which is passive, semi-active and active system (Abdullah et al., 2015a). Each type of the suspension system has their own advantages and disadvantages (Ebrahimi, 2011).The high dissipating energy from the suspension is wasted and it is believe that the energy can be harvested and use for other purpose. The vehicle speed and suspension stiffness are another variables that is related to the dissipation energy (Bart et al., 2011).

REGENERATIVE SHOCK ABSORBER

An innovative design of regenerative shock absorbers is proposed in this paper, with the advantage of significantly improving the energy harvesting efficiency and reducing the impact forces caused by oscillation. The key component is a unique motion mechanism, which we called “mechanical motion rectifier (MMR)”, to convert the oscillatory

Vibration into unidirectional rotation of the generator. An implementation of motion rectifier based harvester with high compactness is introduced and prototyped. A dynamic model is created to analyze the general properties of the motion rectifier by making analogy between mechanical systems and electrical circuits.

COMPONENTS

1.Rack and Pinion:

A rack and pinion arrangement to convert irregular vibrations intooscillatory motion. The rack and pinion arrangement drives two bevelgears which convert the bi-directional motion of the pinion intounidirectional motion of the bevel pinion. The bevel pinion is coupledto the motor shaft which will then generate electricity.

2.Casing:

It consists of a round and a hollow casing. This casing holds andsupports all the parts in it, the whole mechanism is mounted in the Casing and provision is given for electrical circuits to be connected tothe motor.

3.Bevel Gear:

There are two bevel gears used in the mechanism. The larger or driving bevel gear is mounted directly on the main shaft using dowel pins and plunger attachments. The larger bevel gear drives the bevel pinion and provides unidirectional motion.

ADVANTAGES OF REGENERATIVE SHOCK ABSORBER

It is highly efficient and energy saving

It produces less noise during operation

It has wide range for operation.

It has low operating cost.

It is highly reliable due to low failure rate and robust structure.

The “electricity generating suspension system” has a much higher energy yield than other known options available in market.

CONCLUSIONS

A considerable amount of natural resources are wasted as vehicle's vibrational energy is dissipated in form of heat by conventional shock absorber. This wasted energy can be recycled with the help of power seengenerating shock absorber. The potential in converting vibration energy into electrical energy through the shock absorber is promising and rewarding and can make the vehicle more sustainable by consuming less amount of fuel.

Depending upon the vehicle and driving conditions it is possible to obtain fuel saving upto 1.5% to 6%. Moreover, the researchers say that this system can improve the stability of the vehicle.

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