# A Review of Regenerative Shock Absorber

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**Abstract:** *Energy-harvesting shock absorbers are able to recover the energy otherwise dissipated in the suspension vibration while simultaneously suppressing the vibration induced by road roughness. They can work as a controllable damper as well as an energy generator. An innovative design of regenerative shock absorbers will be proposing in this paper. Energy absorbed by shock absorber is dissipated in terms of heat. Thus in this work, attempt will be made to convert dissipated energy into electrical energy. In this design of motion rectifier gear train will be proposing for improving the energy harvesting efficiency. Emerging need in the automobile sector is to utilize the maximum energy that can be possible. Efforts will be taken to convert the energy wasting in suspensions by means of vibrations and heat. Energy generation can be made possible with the help of motion rectifier mechanism and dc motor generator. Linear vibrations from suspension will be converting into rotary which is used to store energy in the coil further with the help of gear arrangement, it is used to rotate generator which in turn produces electricity. The various gear ratios have been used to magnify the rotations. This compact system can be used in vehicle very efficiently.*

***Keywords: Generator,*** **Regenerative Shock Absorber, Mechanical Motion Rectifier etc.**

## Introduction

Passive suspension, active suspension and semi-active suspension these are the three categories of vehicle suspension system. Passive suspension system has damping characteristics and constant stiffness. It consists of spring to store the energy and damper to dissipate it. Active suspensions have force actuators which add and dissipate energy from the system. With proper control strategy it improves ride comfort and vehicle stability of the system as compared to passive suspension. But the active suspension requires high energy consumption and it has a reliability issues. Hence the semi-active suspension system is developed whose performance is compromised between passive and active suspension system performance. By making design modifications in passive suspension variable stiffness and damping force is achieved with use. In passive suspension system low damping has poor resonance control and high frequency isolation which gives comfortable ride on highways condition. Conversely large damping has good resonance control and low frequency isolation which give comfortable ride on rough road. Therefore, a semi-active suspension system that varies both the stiffness and damping could improve the ride quality along with more passenger comfort. Traveling on roads, vehicles are subjected to different disturbances such as road irregularities, braking forces, acceleration forces, and centrifugal forces on a curved road which cause discomfort to the driver and passengers and influence maneuverability. Passive suspensions, composed of viscous hydraulic shock absorbers and springs in parallel, have been widely used to suppress the vibration by dissipating the undesired mechanical energy into heat waste. The active and semi-active suspensions have been investigated extensively in the past 40 years showing improved vehicle dynamic performances at the cost of complexity and additional energy consumption. However, the passive suspension system is still dominating in the automotive industry because of its simple structure, high reliability, and low cost. Reducing vehicle energy losses is necessary for improving fuel economy, reducing emissions, and supplying other systems power demand. In addition to improving engine and power train efficiency, we may also harvest the energy wasted in vehicles including the recovery of wasted heat energy, regenerative braking energy and Vibrational energy on shock absorbers.

## Objectives:

- To harvest vibrational energy from an automotive suspension.
- To utilize the random movement in a vehicle suspension to store the vibrational energy in an elastic element .
- To ensure gradual release of the energy stored in the elastic element in order to rotate the elastic generator with torque and velocity.
- Miniature model will prepare so that it will be used for other applications.

**Relevance:**

One of the biggest issues faced today when it comes to sustainability is the energy crisis which has led to great challenges in the development of energy efficient and environmental friendly solutions of everyday life. One of the largest areas of concern is the transport sector which has already seen great improvement in recent years. When looking at road-bound vehicles only 14 -30 % [1] of the fuel energy is used for the mobility of the vehicles. A large amount of the consumed energy is dissipated into heat through vibrations. So a way of reducing the energy consumption would be to harvest some of the energy that is dissipated. Energy crisis and environmental problems such as oil shortage and atmospheric pollution have brought challenges for new development of an energy saving, efficient and environmentally friendly power transmission system in vehicles. In recent years, electric vehicles play a major role in attaining sustainability and reducing air pollution. The efficiency of EVs is low because they have a short driving range and a long charging time. Electricity consumption for air conditioning or cabin heating can also shorten the driving range in areas with hot/cold weather. Due to the unsolved problems, research efforts turn to developments of energy harvesting from the vehicle kinetic energy as a new driving source to increase the efficiency of vehicles and decrease their costs. In fact, only a small part of energy from the onboard source of vehicles is used for driving, while most of the energy dissipating during vibrations and motions. If vibrations of vehicles can be absorbed and reused fully, the utilization efficiency of onboard source could be improved notably. Research efforts on energy recovery from vehicle suspensions, first as an auxiliary power source for active suspension control, and later as energy regenerating devices in their own accord, have been developed during recent years. It is feasible to harvest this vibration energy from the vehicle suspension system to improve the efficiency of the vehicle. The suspension system used for the regeneration of vibration energy is called regenerative suspension system. Regenerative suspensions with the energy harvesting shock absorber have gained tremendous attention in the past two decades as promising directions in vehicle research because of its potential to enable the suspension system not only providing enhanced dynamic performance but also converting the wasted vibration energy to electricity [2]. Regenerative suspensions with the energy harvesting shock absorber have gained tremendous attention in the past two decades as promising directions in vehicle research because of its potential to enable the suspension system not only providing enhanced dynamic performance but also converting the wasted vibration energy to electricity. After the early trial in the middle of 1990s, the number of publications per year on regenerative energy suspensions has been exponentially increased over the last decade Energy harvesting potential based vehicle suspensions and its effect on fuel saving have been estimated extensively by several scholars.

**Conclusions**

The primary function of vehicle suspension system is to reduce the vibration transmitted from ground due to road irregularity. With the use of rack and pinion arrangement and a gear train to magnify the road bumps into unidirectional circular rotations of generator, power extraction is made possible. The 'motion rectifier' can transfer the oscillatory motion of a vehicle suspension into unidirectional motion of the electrical generator, thus enabling the generator to operate at a relatively steady speed with higher efficiency.

The main aim of this project is to determine the amount of power being extracted from the gear train arrangement. In future, attention will be given to produce the gear train on enlarged scale and how to implement the system in actual vehicle.

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