Design, Manufacturing and Prototype of Regenerative Suspension System

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Abstract: *In the past decade, regenerative braking systems became progressively in style, sick energy that may well be lost through braking. However, another energy recovery mechanism that's still within the analysis stages is regenerative suspension systems. This technology has the flexibility to unceasingly recover a vehicle's vibration energy dissipation that happens as a result of road irregularities, vehicle acceleration, and braking, and use the energy to scale back fuel consumption. A regenerative damper could be a kind of damper that converts linear motion and vibration into helpful energy, like electricity. Typical shock absorbers merely dissipate this energy as heat. When utilized in electrical vehicle or hybrid electric vehicle the electricity generated by the damper may be amused to its geartrain to extend battery life. In non-electric vehicles the electricity may be wont to power accessories like air con. Many totally different systems are developed recently, although they're still piecemeal of development and not put in on production vehicles. This could be used on electrical or hybrid vehicles (or traditional vehicles) to capture energy which might well be absorbed and wasted, then convert it into electricity. The regenerative shock absorbers will harvest the ability in a very continuous manner. On the graceful route road, the regenerative shock absorbers will improve the fuel potency by two, and on jolty roads up to six increases may be expected.*

1. INTRODUCTION

In our country due to increased paying capacity, advanced lifestyle and rapidly growing industrialization, the need & demand of transportation is increasing day-by-day. The number of vehicles rolling on the road is increasing daily. Hence chances of accidents are increasing while crossing the road especially by the children and old persons. So it became necessary to install the Speed breakers (in true sense speed reducers) at the school building or Hospital building-side road or highway. If these speed breakers Yes! In true sense it is speed and ultimately breaker the opposing impact energy supplied by the hard speed breaker will apply massive thrust impact on the suspension system of the vehicle. This impact force can be use for power generation using regenerative method and use to charge battery and release load of alternator or dynamo from engine.

2.LITERATURE REVIEW

Larry Weng et.al [1] has researched on energy storage system for regenerative dynamometers. In this paper, various types of dynamometers have been researched. One of this is regenerative dynamometer. In this mechanical power absorbed is converted to electricity rather than dissipating this in a resistive load bank as heat.

Zhang Jin-qiu et.al [2] has researched on energy conversion system in suspension system. The regenerative suspension systems have attracted much attention in recent years for the improvement of vibrating attenuating performance and reduction of energy dissipation.

Xinbo Chen Jianqin Li [3] have researched on how to design and analyze regenerative suspension system. From this paper we come to know that how to design the kinematics of this system. To achieve better suspension performance , the regenerative suspension system should be controlled in consider of the kinematics and dynamics of the system. The advantage of regenerative suspension system is demonstrated by comparison with suspension performance of passive suspension system.

Mohd Azman Abdullah et.al [4] have researched and developed a device to harvest vibrational energy. Based on the frequency and amplitude of potential vibrations a device is designed and developed. This device is further assembled in a passenger vehicle.

2.1 Survey for Selection of Vehicle / Shock Absorber

It is necessary to select the vehicle or the suspension system which should be fulfilling the input requirements of project.

Considerations for selection of vehicle / shock absorber

i. Space requirement
ii. Sufficient displacement of shock absorber

iii. Load acting on shock absorber i.e. Sprung weight of vehicle

iv. Response of suspension system to the hurdles in the road

2.2 Feasibility of different vehicles

a) Two Wheelers:

i. In the case of two wheelers load acting on the suspension system is less as compared to the heavy vehicles or four wheelers.

ii. Displacement received in the case of two wheelers is good but space available in the two wheelers for attachment of shock absorber regenerator is less.

iii. Considering above points this attachment is not so much efficient in two wheelers.

b) Three Wheelers:

i. Suspension system used in three wheelers is complicated; space available at shock absorber is less.

ii. Displacement in shock absorber is less therefore we cannot use this attachment.

c) **Four wheelers (light vehicles):**

i. Light vehicles like cars fulfill all input requirements of this attachment. Load acting on shock absorber is sufficient to produce output.

ii. Space available and displacement of shock absorber is good. efficient in case Of light vehicles.

d) Heavy Vehicles:

i. Heavy vehicles like mini buses, trucks, travels etc. are the best vehicles for the implementation of shock absorber regenerator.

ii. All requirements are fulfilled by the heavy vehicles such as space available, load acting on shock absorber in tons, displacement of shock absorber etc.

iii. A heavy vehicle is good category of vehicles for efficient output through shock absorber regenerator.

e) Railways:

i. In the case of railways we are able to get best efficiency and more energy can be created by attaching this system to suspension system of railways.

2.3 Energy Available At Shock Absorber

i. Potential Energy

P.E. = m×g×h

Where, m = Mass acting on the shock absorber i.e. sprung wt.

g = gravitational acceleration

h = displacement available at shock absorber

ii. Kinetic energy

K.E. = $1/2 \times m \times v^2$

Where, v = reciprocating velocity of shock absorber

iii. Total energy available

E = K.E. +P.E.

3. METHODOLOGY

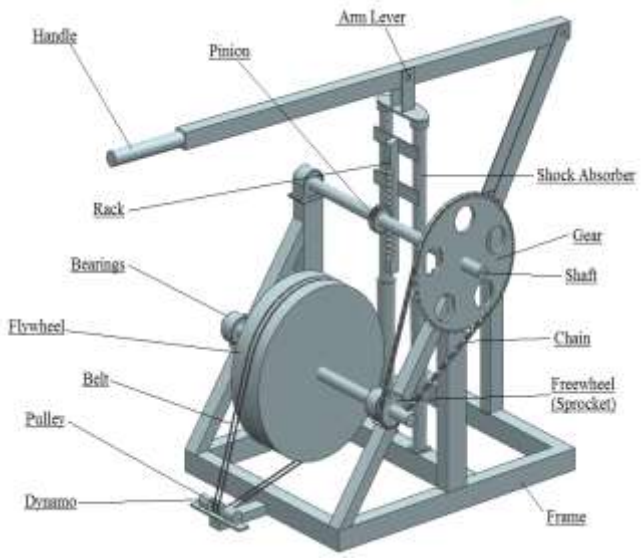

fig 1: Regenerative Suspension System Model

With the increasing emphasis on improved efficiency and reduced emission levels of vehicle drive trains more attention has been paid to the methods and test platforms which can accurately and effectively reflect the actual operational regime of the drive train. To effectively test a vehicle drive train, the test platform must be able to reproduce the actual load condition of a road to the drive train. A dynamometer that can control the load torque on a continuous basis. Both positive and negative torques is also required which implies a reversible power flow. Conventional water, friction or eddy-current brake dynamometers cannot mimic a road load because of their unidirectional power flow.

To test a vehicle drive train efficiently, the dynamometer must also be able to recover the energy from the system under test rather than dissipate that energy as heat. If an electric drivetrain is under the test, the dynamometer may be able to recirculate that energy back to the electric drivetrain. From these two main requirements, an electric motor is the most ideal loading machine (LM). The proposed system uses a DC motor/generator as the LM. The LM is mechanically coupled to the machine under test (MUT) and is electrically connected a power converter. The DC. machine is chosen, by the authors, as the LM, mainly because of the ease and accuracy of modelling, and the simplicity of control.

Dynamometers that meet these requirements have only rarely been investigated in the past however there are research conducted on dynamic dynamometers. Most previous research has dealt with only the dynamic emulation capability without considering the regenerative capability, which may cause some difficulties in analyzing and designing the system at a later stage. There are needs for a test system which can simulate both the dynamic emulation and the regenerative capability. This paper investigates the energy flow of a dynamometer that has both dynamic emulation and regenerative capability. A design configuration of a fully regenerative dynamic dynamometer optimized for testing electric drive trains is proposed in this paper. Power generated by the LM is recirculated to the MUT and its power converter. It incorporates an energy storage system to absorb the energy variation due to the dynamometer's transient conditions. This allows the minimum power electronics requirement at the grid to supply only the system losses. The outcome of this research provides an efficient and reliable way of determining the optimum size of the power electronics and buffer components of the dynamometer system.

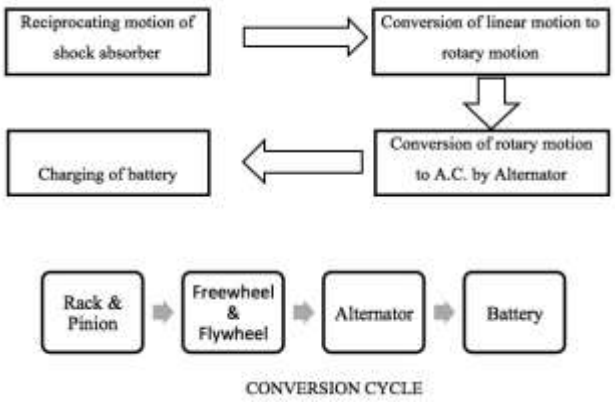

Fig 2: Flow of Energy Conversion

- Energy available at the shock absorber is totally wasted. By using this energy we can charge the battery which can be further used for running different applications in the vehicle. It helps to reduce load on the engine.
- Reciprocating motion of the shock absorber is converted into rotary motion by using freewheel and chain arrangement.
- Freewheel is unidirectional rotation motion but RPM is very low, this RPM is increased with the help of gear and flywheel.
- Flywheel is capable of convert low RPM of freewheel to the synchronization speed of the alternator.
- DC generator convers the rotary motion to DC output.

4. CONCLISION

Conventionally, the vibration energy of car suspension dissipated as heat by shock that wastes respectable variety of resources. Regenerative suspensions bring hope for employment the wasted energy. All types regenerative suspension, particularly electromagnetic suspension. From the angle of comprehensive performance as well as vibration management ability, regenerative efficiency and application reliability, the configuration of hydraulic transmission system and self-powered mister damper shows the simplest attraction. With improvement. of technology, regenerative suspension might become one in all promising trends of car business. We utilize of suspending mass of a vehicle through regeneration system with the assistance of shock. once vehicle can tolerate a dump or pit, that point high energy can -be generated through generator. Battery is connected to the generator, specified batteries are charged as a result of suspension. By freshly designed suspension regeneration system presently victimisation generator is detached from the engine and connected to the suspension. It helps to extend four-wheel drive potency of IC Engine. If we have a tendency to install this regeneration system for all four wheels then we are able to generate high quantity of electrical power. By solely providing

manual reciprocal we have a tendency to area unit ready to turn out 4-5 watt of energy once it'll truly attach to significant vehicles it'll turn out great deal of energy.

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