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Design and Development of Electromagnetic Suspension Energy Harvesting Device

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ABSTRACT

Now a day power generation is the main consideration to meet the future load demand. Magnetic shock absorber is equipped with electro-magnets/ permanent magnets of same polarity generate repulsive force which is used to absorb high frequency shock load. Two magnets are placed in upper and lower half of the magnetic shock absorber. The reciprocating rod is equipped with another magnet. This magnet will reciprocate up and down longitudinally. Thus movement of magnet and cylinder helps to generate small amount of electricity and that we are going to store in the battery and we can utilize this for various automobile applications.

In this project we have tried to develop test set up to do analysis of power generation with the help spring suspension.

INTRODUCTION

A shock absorber is a common lingo (damper in mechanical and industrial use) is a device invented to smooth out or reduce sudden unsettling force and disperse kinetic energy. It is similar to a resistor in an electrical circuit. Shock absorber should absorb or disperse energy. They are a vital component of automobile and vehicle suspensions', critical machinery. Bigger Shock absorbers have been introduced in the field of engineering. Shock absorbers are designed to absorb shock and perfect retardation in vehicles. The application range vary from small scale to tremendous industrial and technical uses. Design consideration for shock absorber includes the width of the cylinder , diameter of the rod and material of the body. Various constraints for shock absorber may be locking and valve.

In the era of industrial revolution, man has always considered comfort as his first priority. This priority may vary from small neat full things to highly expensive automobiles. So, in order to provide him, his comfort and hence developing a technique to conserve energy during smooth drives to extreme off road drives. Thus, the need of the hour is to provide a comforting ride which ultimately led us to a splendid experimentation in the form of electromagnetic shock absorber. The design consideration involves two magnets are placed in upper and lower half of the magnetic shock absorber. The reciprocating rod is equipped with another magnet. This magnet will reciprocate up and down longitudinally.

The Vibration theory consists of three basic elements that is spring, inertia and damper. In some cases of mechanical elements, vibration means loss of energy, so by using elements of vibrations that is spring, inertia and damper, we can reduce vibration to some extent and remaining we can convert into an equivalent amount in other form of energy. In this project work we converted that wastage vibration energy into most needed electrical energy by using Energy Harvester. Basically there are two types of vibrations namely free vibration and forced vibration.

Free vibration occurs when a mechanical system is set off with an initial input and then allowed to vibrate freely. Forced vibrations are when a time-varying disturbance (load, displacement or velocity) is applied to a mechanical system.

There are four methods of harvest the vibrational energy:

1. Electromagnetic Energy harvesting
2. Piezoelectric vibrational energy harvesting
3. Electrostatic/capacitive vibrational energy harvesting
4. Magnetostrective vibrational energy harvesting.

LITERATURE REVIEW

1. D. Spreemann & Y. Manoli, writes about the basic analytics theory behind most of the presented devices is commonly known in the energy harvesting society. It is based on well understood linear second-order spring-mass-damper system with base excitation. The theory has been modified and described in various ways even though the basic finding are more or less the same. In most of these cases it is rather difficult even impossible to use the results of the analytical modelling directly for the design process of application oriented developments.
2. S P Beeby, M J Tudor and N M White [2] reviews the state of the art in vibration energy harvesting for wireless, self-powered microsystems. They presented the characteristic equations for inertial-based generators, along with the specific damping equations that relate to the three main transduction mechanisms employed to extract energy from the system. A review of existing piezoelectric, Electromagnetic and Electrostatic is presented. Electromagnetic generators presented in the literature and reviewed including large scale discrete devices and wafer-scale integrated versions. The coupling factor of each transduction mechanism is discussed and the respective devices are presented in the literature.
3. Garry Berkovic and Ehud Shafir review various noncontact optical sensing techniques that can be used to measure distances to objects and related parameters such as displacements, surface profiles, velocities and vibrations. Some techniques are discussed and compared with each other. The relationship between distance measurement and other parameters are mentioned. Optical techniques are the large variety of uses and applications are discussed.

I Literature Survey

A detailed literature survey will be carried out in the related area. Majorly the selected project is come under Industrial field influence, So In this phase we will do industrial visit where these type of bearings are using is involved

II: Concept Generation

In this phase, we are going to do schematic arrangement design and drawing of major component which we can use for completion of our project. In this phase we will generate the schematic drawing on the basis of problem statement and feedback and suggestion received from end customer and vendors.

III: Design calculations

In this phase we are going to do the design calculations by referring the standards, catalogue and reference books. In this work we will finalize the design and components dimensions. We are also select the material according to parts and components fuction and loading conditions. In this phase we will decide the size and shape of components and its position in the assembly. Also we will decide the limit and tolerance between components and also machining methods required to select to manufacture the components.

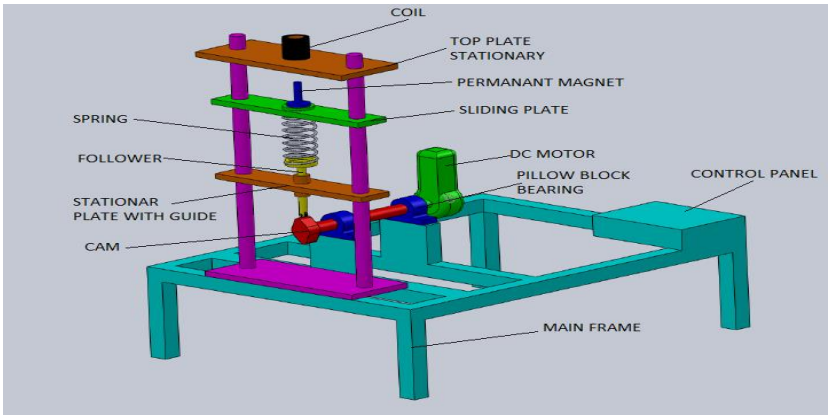
IV: Preparation of Drawings

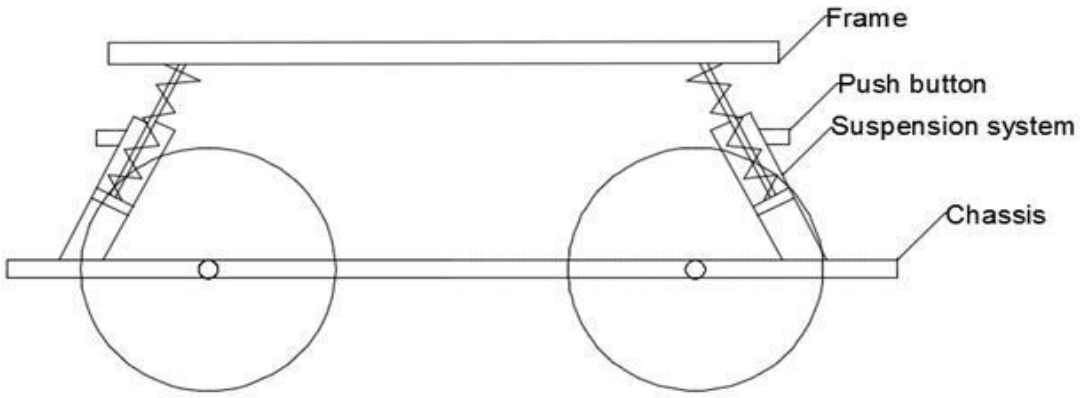
In this phase we are going to prepare the design. The suitable component and assembly drawings will be prepared which will help visualize the actual project set up. In this phase we will prepare the drawing as per industrial format.

V: Structural Analysis of the Critical Components

In this phase we will do analysis of one components which is under critical loading condition. And by doing analysis we can decide the final dimensions and material of the component.

FIGURES





Figure's shows the entire SDOF system and its components in general. The drive motor when operated will develop the system output for a system input.

CONCLUSION

In vehicles, a significant portion of fuel energy is wasted in heat, vibrations, and frictional losses. The vibration energy from vehicle suspension systems is always wasted in heat and can be utilized for useful purposes. Many researchers have designed various regenerative shock absorbers (RSA) to transform vibration energy into electrical energy that can charge electric vehicles' batteries and power low-wattage devices. In regenerative system the maximum energy harvesting, and ride comfort of the vehicle cannot be achieved simultaneously. 3 D model of energy harvesting setup prepared and analysis carried out. Analysis shows that the hybrid energy harvesting shock absorber can produce considerable electricity during vehicle in motion. With variables speed measured following results we get.

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