S.Vasanthaseelan al. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 4, Issue 4, Dec 2017, pp. 244-247

Fabrication of Fuel Efficiency Improvement in A Petrol Engine By Using Water Injection

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Abstract- **Our project aims is to do magnetic suspension for two wheelers, without depending upon hydraulic & pneumatic suspension system. The neodymium magnet is used as a shock absorber in this magnetic suspension. The aim of this project is to study & investigate the response of the system, to give a good comfort even at irregularities of road surface. The neodymium magnet & spring as passive dampers, by using these things as dampers. We can absorb more number of shocks, displacement & acceleration of spring mass. It has many advantages from the conventional suspension systems like leakage of oil, less maintenance**

Keywords: Neodymium magnet, spring, cylinder.

I. INTRODUCTION

An idea of neodymium magnetic shock absorber makes use magnetic repulsion between like poles to achieve shock absorption. When riding a two wheeler we used to face some problems while riding a load distance & bumpy roads. It absorber like poles of two magnet and repulse each other and It keeps constant distance between both magnets each other. Because of their magnetic fields [3].A magnetic shock absorbers are made of magnets with different poles facing each other, it may give better performance and no maintenance. The two circular magnets and a rod and bottom of the rod and is base magnet. The other magnet is free with a float and has similar pole placed towards base magnet. The similar poles creates repulsion and certain distance is maintained [1]. As load condition, a floating magnet moves and closes a gap until the magnetic repulsion is strong enough to create the damping action. A shock absorber without springs. It works a basic law of magnets that opposite poles attract and similar poles repel.

[11]Chandan Kumar Jha stated a shock absorber in present scenario (or damper) is a mechanical device constructed to remove out unintended shock vibrations and disperse kinetic energy. This is similar to resistor in an electric circuit. Shock absorbers should collect or disperse energy. Magnetic shock absorber is modern equipment that can be substantially used to overcome massive unsettling load in vehicles. 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. [9]Babak Ebrahimia described the design, modeling, and analysis of a novel magnetic spring damper. This cost-effective, self-powered magnetic spring–damper utilizes two permanent magnets and a conductive aluminum plate to generate both spring and variable damping effects. Eddy currents are generated in the aluminum plate due to its relative motion with respect to the magnets. These eddy currents produce a repulsive force that is proportional to the velocity of the conductor such that the moving magnet and conductor act as a viscous damper.

The structure of the proposed passive magnetic spring–damper is simple, and does not require an external power supply or any other electronic device. An accurate, analytical model of the system is obtained by using the electromagnetic theory to estimate the magnetic forces, induced in the system. [12]Malunjkar N.G. Gives information about magnetic suspension system in two wheelers. When it is subjected to road surface irregularities with the hope that it would help automobile industry. This paper presents construction and working of magnetic suspension system. We can use the electromagnets as passive dampers, which is used to reduce displacement and acceleration of sprung mass in order to improve ride comfort. By using this type of absorber we can absorb the more number of shocks and variations are absorbed with the more accuracy. This type of Suspension has no problem of leakage of oil like hydraulic shock absorber [6]. Also this has less maintenance than other types of shock absorber that we can made this type of shock absorber for the efficient work of vehicle and for reducing the maintained cost of vehicle.

The neodymium magnetic suspension is used in this project. In current automobiles many suspension systems are used they are hydraulic, pneumatic suspension systems. A neodymium magnetic suspension magnets is used inside suspension system. When a vehicle moves in irregularity on road surface, magnet absorbs shock due to same poles expanding & contracting it repels. One end of moveable magnet is moved to its original position. To prevent spring is absorb little shocks to avoid a breakage of magnet by reducing from excessively motion is restrained by magnetic shock absorber, it also known as more descriptive term dumpers. The Magnetic suspension system are used in two wheeler system. Magnetic suspension system reduces vibrations, bouncing, noise on all road surfaces and various speed that vehicle could travel. The reduction of body may be

rolling is reduces the need for anti- roll bars. Another benefit is that dampers easily offers the best on both road conditions (rough & smooth) road surfaces. It is comfort while riding a long distance travel. Although this type of neodymium magnetic suspension offers a very comfortable ride.

METHODOLOGY:

A cylinder is made up of aluminum. An aluminum cylinder will not attract with magnetic field. It will withstand high temperature while magnet is moving from up and down motion. In a cylinder one end magnet of is fixed & other end of magnet will be movable. Cylinder is used to move magnets in a straight motion. Cylinder one end fixed in vehicle and other end connected to shaft.

Neodymium magnet is act as shock absorber. Magnet grade is N55. It is very powerful magnet & it have good comfort while riding in rough surfaces. Here, basic concept is used in suspension system when two magnets like poles is fixed in same direction while, magnet gap is decreases at some point magnet will repels & moves to its original position it's a simple concept used in suspension system.

Main Elements Within Ndfeb	**Percentage By Weight**
Neodymium (Nd)	29% - 32%
Iron (Fe)	65.3% – 69.4%
Boron (B)	1.1% - 1.4%
Aluminium (Al)	0.3% - 0.5%
Niobium (Nb)	0.6% -1.2%
Dysprosium (Dy)	0.7% -1.1%

Table 1comparison of Magnet, Neodymium Magnet, and Permanent Magnet:

Properties	**Magnet**	**Neodymium Magnet**	**Permanent Magnet**
Hardness	500	510	650
Flexural strength	200	270	150
Tensile strength	55	68	75
Density	6.8	7.1	7.5
Coercivity	0.87	1.9	1.59
Max energy absorb	260	287	340

Table 1 shows that the properties of Neodymium magnet are hardness as 500, Flexural strength as 260, Tensile strength as 67, the density of neodymium magnet is as 7.3, Coercivity is as 2.1, the maximum energy absorbed in the magnet is as 290.

Table 2 Elements of Neodymium Magnet:

Table 2 shows the main element of Neodymium magnet with the percentage by weight of neodymium as 29% - 322%. Iron as 65.3% - 69%. Boron with as 1.1% - 1.4%. Aluminium as 0.3% - 0.5%. Niobium as 0.6% - 1.2% of weight. Dysprosium as 0.7% - 1.1% of weight. This elements & percentages are important in neodymium magnet to identify the percentages by weight by using different materials.

Spring is important in every suspension system. It reduce shock & vibration. It Sends little amount to vehicle. Open coil spring is used in suspension while more shock & vibration is applied it will be reduced. And some is send through suspension system. It gives good cushioning effect to riders.

Magnetic suspension systems are used to prevent the road shocks from being transmitted to the vehicle frame, to preserve stability of the vehicle in pitching or rolling or yawing, while in motion, to provide good road grip and braking. Requirements of magnetic suspension systems are minimize deflection consistent with required stability, wheel hop and tire wear. It has low maintenance. A magnetic shock absorber in common parlance is a mechanical designed to

smooth out or damp sudden shock impulse and dissipate in motion. Magnetic shock absorbers must absorb energy. One design consideration, is choosing as neodymium magnetic shock absorber will have good comfort. Where neodymium magnetic Shock absorbers is an important part in automobiles.

DESIGN CALCULATION:

DESIGN FOR OUTER SPRING:

Material: Mild Steel

(Modulus of rigidity) G = 78600N/mm2

Mean diameter of a coil, D=33.3mm

Diameter of wire, d = 6.7mm

Total no of coils,

n1= 17

Height, h = 210mm

Outer diameter of spring coil,

D0 = D +d =40mm

No of active turns, n= 15

Weight of bike = 131kg

Let weight of 1person = 75Kg

Weight of 2 persons = 75×2=150Kg

Weight of bike + persons = 263Kg

Rear Suspension, 65% of 263 = 171Kg

Considering dynamic loads it will be double W = 342Kg = 3355N

For single shock absorber weight = w/2= 1677N = W

Compression of spring (δ) =WD3n/G.d4

C = spring index = D = 5

d (δ) = 46.91

Solid length, Ls =n1×d=17×6.7=113.9mm

Free length of spring, Lf = solid length + maximum compression + clearance between adjustable coils

=113.9 + 46.91 + (46.91 ×0.15)

= 167.8mm

Spring rate, **K = W/ δ** = 35.74

Pitch of coil, $\mathbf{P = \frac{Lf-Ls}{n1} + d}$

Stresses in helical spring: maximum shear stress induced in the wire

$\boldsymbol{\tau = Ks \times 8WD/\pi.d3}$

$\mathbf{Ks} = \frac{4C-1}{4C-4} + \frac{0.615}{C}$

= 1.3105

T = 619.62

Buckling of compression spring:

Crippling load under which a spring may buckle

KL = 0.1 (for hinged end spring)

The buckling factor for the hinged end and built -in end spring

Wcr = q × KL × Lf = 35.74 × 0.1× 167.8 = 599.71

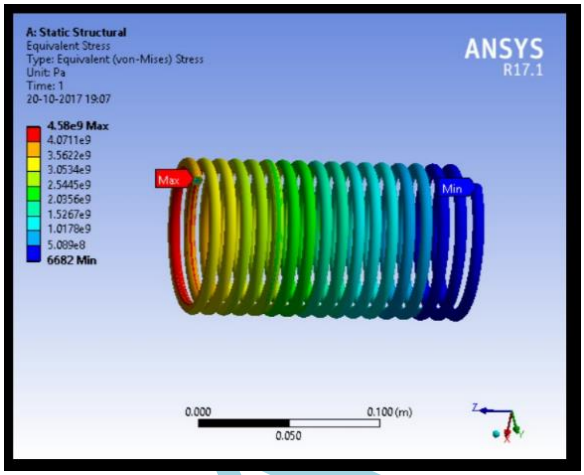

Figure 1 Design Analysis of Outer Spring

Figure 1 represents the material used for the spring is "Mild steel". The diameter of spring is 33.3mm. The outer spring is playing an important role in this suspension system. The weight distribution across the spring is calculated & Analysis in ANSYS software. There are totally 17coils it will be enough to carry the load.

DESIGN OF INNER SPRING:

Wire cross-section dimensions, 2a=3.34 mm

2b=2.68mm

Outside diameter, do = 21.30 mm

Inside diameter, di = 14.62 mm

Free length, Lf = 43.20 mm

Solid length, Ls= 21 mm

Total number of coils, n = 8

Coil direction Right Helix angle = 6 deg

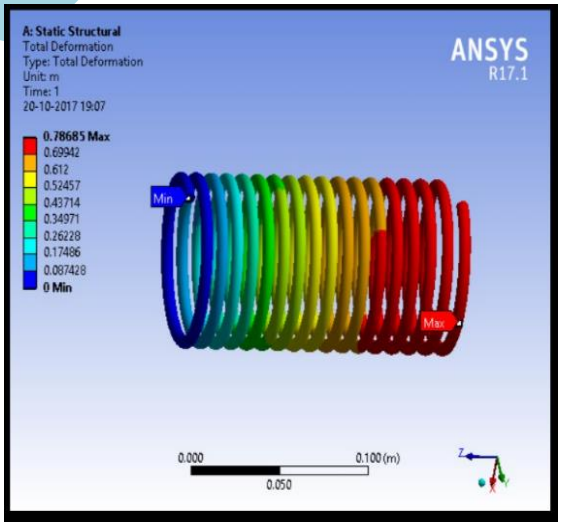

Figure 2 Design Analysis of Inner Spring

Figure 2 represents the spring used in between the magnet. It is smaller in size when compared with outer spring. The diameter of spring is 4.62mm. The length of spring has totally 8 coils. The end of spring is connected to the center of a magnetic point.

RESULTS AND DISCUSSION:

The project work has provided us an experience, in use our limited. We gained a lot of practical knowledge in planning, purchasing, assembling, welding and machining while doing this project. We feel that the project gives good solution in our automobile field.

We have completed our project work with the limited time successfully. The "NEODYMIUM MAGNETIC SHOCK ABSORBER" system is working with satisfy conditions. We have done to our ability and skill making maximum to use of available facilities.

Thus, we have developed completely in "NEODYMIUM MAGNETIC SHOCK ABSORBERS" which helps to know the operations of shock absorbers in a simple manner and this project helps to develop the operation of the shock absorbers more efficiently by using neodymium magnets. By using more techniques, they can be modified and developed according to the applications. For this magnetic shock absorber the load carrying capacity is 600N. This is used as double magnetic shock absorber. By using this project, we can get a less friction, noise-free, long life, quick return a shock absorber that work on the magnet.

CONCLUSION:

Neodymium magnet suspension is mainly used to overcome the disadvantage of conventional type suspension system.

Neodymium magnetic suspension is mainly used to overcome a disadvantage like less life, frequent maintenance & less durability of conventional suspension system. Here, in our project we designed a neodymium magnetic suspension system for two wheelers. The design of this magnetic suspension is mainly included few steps like selecting proper materials for the components of the system, then designing a dimension of component system will have stress & load. Our project would also allow to set the suspension stiffness as per requirement enhanced fatigue life would offer very stability in the use of the spring. Ride & comfort of the vehicle might be improved as outcome.

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