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Development and Experimental Analysis of Magneto Rheological Fluid Based Suspension Model

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ABSTRACT

With the effectiveness in utilization of advance and recent research findings leads to improve the technological aspects. This causes easy and comfort way of doing work. Automobile industries adapting advanced research findings in their each and every part of work. Large number of recent research is going on in magneto rheological suspension system for reduce the vibration produced during the movement of vehicles. This paper is mainly concerned with the development of new class suspension system using magneto rheological fluid. The ordinary suspension fluid is replaced by the prepared Magneto Rheological fluid and electro magnet is placed in the external side of the piston rod. The developed model is tested in the shaker machine and analyzed the results using the Lab view software. The result obtained from the Lab view software includes time magnitude graph, velocity graph and Fast Fourier Transform graph. From the results indicate that there is a significant level of improvement in the suspension system with the application of magnetic field when compared with the suspension system without applied magnetic field.

KEY WORDS: Magneto Rheological Suspension System, Lab view, Magnetic Field.

1. INTRODUCTION

In the current period, large numbers of investigations are going on in the magneto rheological systems. It is one of the semi active systems. Magneto Rheological fluid contains a fluid with micron size of iron particles and additives. Normally three various numbers of carrier fluids like silicon oil, water and hydrocarbon based oils are used. With the magnetic field exposure the iron particles are arranged linearly. This linear arrangement causes variation in viscosity of the fluid. Thus the fluid becomes changes to glue type from liquid type with in a fraction of seconds. The rate of shear strain is changed by the applied magnetic field and the fluid becomes highly sensitive to shearing. This makes dramatic changes in the mechanical system. Because of this reason Magneto Rheological fluid place a good role in active control of vibration.

Review of literature: The information regarding magneto rheological fluid application and suspension model with different analysis are carried out by various researchers are mentioned in this current section. Butz (2002), was made a literature in different types of electro and magneto rheological fluid dampers and their simulations. This provides different information's about magneto rheological fluid dampers. Wu (2008), was performed a dynamic test in INSTRON 8800 machine of magneto rheological damper and fluid damper. The obtained result indicates that magnetic pattern lines directly influence the magneto rheological fluid thickness. Zekeriya (2012), has been designed the magneto rheological damper optimally to achieved the magnetic flux density maximum and damping force. The optimization of the parameters has been determined by using the computational fluid dynamics for magneto rheological fluid flow, finite element method and magnetic field by electromagnetic analysis. Debangshu (2014), was analysed the characteristics of the magneto rheological damper using COMSOL multi-physics software. Mukund (2012), was investigated the magneto rheological damper theoretically for designing. The thickness, volume and width of the annular magneto rheological fluid are derived. Min (2012), was studied the characteristics of the magneto rheological fluid and the obtained results indicate that the magneto rheological fluid yield stress increases by increasing the magnetic field. Ahmadian (2004), was studied the magneto rheological damper dynamic performance under impact and impulsive load. From the obtained result indicate that the influence of current cannot be control the damper performance. They designed and fabricated a compact MR damper for the protection of sensitive devices against high shock and impact by increasing the number of magnetically active volume using FEM analysis and, at the meantime, minimizing damper length. This literature survey gave information's about the research work carried out in magneto rheological suspension system in different ways. But there is no other studies carried out by applying the real time vibration in their proposed setup. The main objective of the current work is to develop a magneto rheological suspension system and analyzed the system by testing in shaker machine setup and plot the

time magnitude graph, velocity graph, Fast Fourier Transform graph and displacement graph using Lab view software.

2. EXPERIMENTAL

Experimental System: The experimental model is created by modifying the suspension system used in the four wheel automobiles. At first the magneto rheological fluid is prepared by three important materials like Silicone oil, Oleic acid and the iron particles. Here silicone oil is the main fluid used here and the oleic acid is used as an emulsifying agent. This surfactant restricts the iron particles to settle down in the fluid. The iron particles used here is 250meshsize. The oleic acid of 20 % is added initially to the silicone oil and stirred it for two hours. Then the iron particles with 40 % is added in to it and stirred continuously. The prepared magneto rheological fluid is shown in the below Fig. 1.

Fig.1.Prepared magneto rheological fluids

The fabrication of the proposed suspension system is shown in the below Fig. 2. Initially the copper coil is wound over the surface of the piston rod and which is directly connected to the power supply. Whenever the supply is given to the copper coil which acts as an electromagnet. Then the prepared magneto rheological fluid is filled in the cylinder of the suspension unit. Two cast iron plates are welded at the top and bottom of the suspension unit as a supporting part. From the top plate one push button switch is placed for power supply is given to the system. The current passed in to the electromagnet only when the load is acting on the suspension unit, otherwise it would cut-off. The parts used for the developed suspension model is tabulated in the below Table 1.

Table.1.Parts of the proposed suspension model

Components Used	Quantity	Material
Plates	2	Cast Iron
Electro Magnet	1	Copper Coil
Reserve Cylinder	1	Mild Steel
Cylinder	1	Aluminium
Spring	1	Spring Metal
Piston Rod	1	Stainless Steel
Mount	2	Cast Iron
Base Valve	1	Steel
Air Tight Seal	1	Rubber

Fig.2.Proposed Suspension model

3. TESTING AND RESULTS

The fabricated suspension model is tested in the shaker machine setup for analyzing the arresting of vibration produced by the shaker machine setup. Initially the fabricated suspension model is placed in the testing setup and then the test is conducted for both cases of with magnetic field as well as without magnetic field. One piezoelectric sensor is placed over the suspension model to identify the frequencies and amplitude produced in it. The testing of the model is carried out for 20 kilogram of weight. The list of graphs like time-magnitude graph, velocity graph, and FFT graph plotted for analysis are shown in the below Figs. 3-8. The graphs for with magnetic field and without magnetic field have some variations in it. The time-magnitude graph for the system with magnetic field produced low amplitude when compared with the termination of magnetic field.

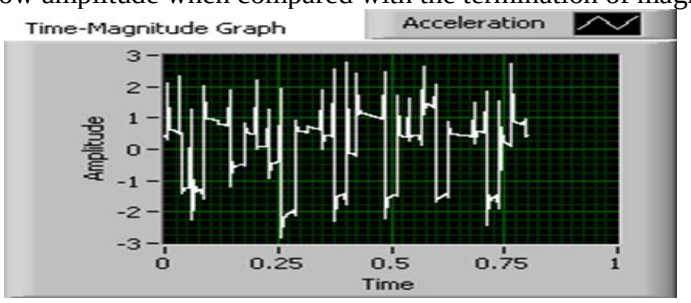

Fig.3.Time-magnitude graph (without magnetic field)

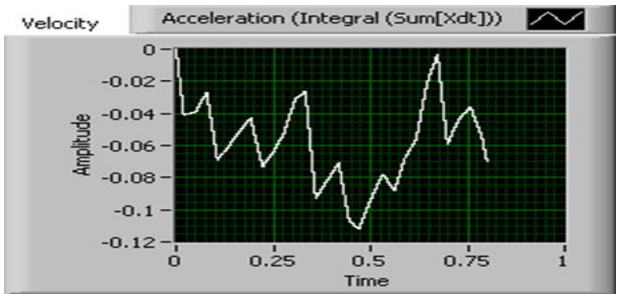

Fig.4.Velocity graph (without magnetic field)

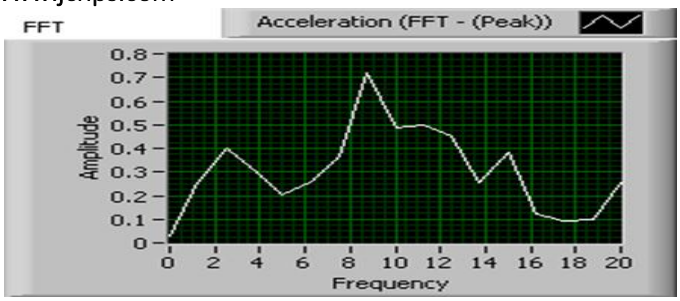

Fig. 5. velocity graph (without magnetic field)

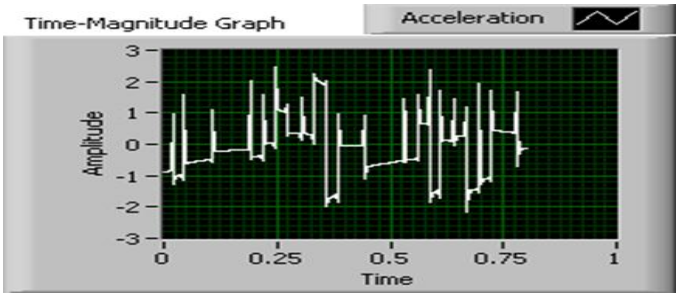

Fig. 6. Time-magnitude graph (with magnetic field)

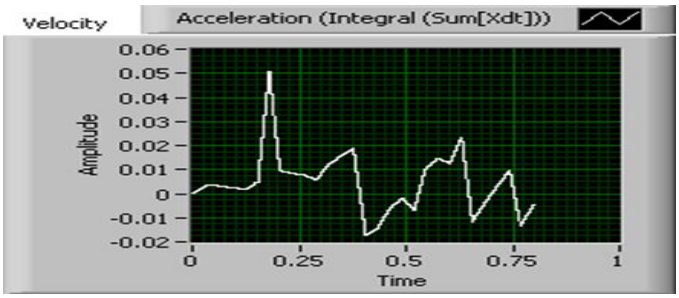

Fig. 7. Velocity graph (without magnetic field)

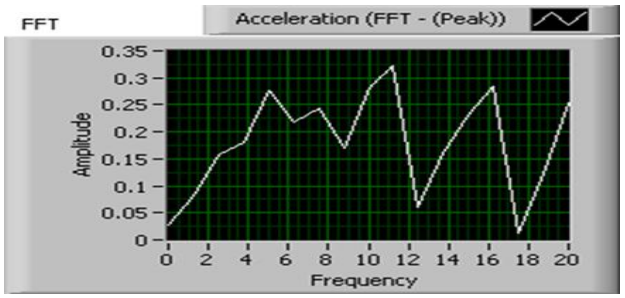

Fig. 8. Velocity graph (without magnetic field)

4. CONCLUSION

In this work an electromagnetic assisted magneto rheological fluid based suspension model is developed to arrest the vibration developed during the running of automobiles. The testing and analysis of the fabricated model is carried out in shaker machine set up for analyzing the arresting of vibration developed in it. With the help of Lab view software the amplitude of the vibrations produced are plotted and during the application of magnetic field there is an increase in arrest of vibration. Thus the result of the research finding suggests that the proposed model will help the future use of suspensions almost all kinds of vehicles for comfort ride.

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