

Earthquake Resistance Using MR Dampers

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Abstract— Earthquake-resistant structures are structures design to withstand earthquakes. While no structure can be entirely immune to damage from earthquakes, the goal of earthquake-resistant construction is to erect structures that fare better during seismic activity than their conventional counterparts. Our aim is to resist buildings from earthquake using MR dampers. MR fluid means magneto rheological fluid. This is a combination of iron particles and lubricant oil. The property of the fluid is that it can change to solid state to when it is in electromagnetic field. This liquid is filled in metal ball and the filled metal ball is fixed as half of it in footing and other half in column. By giving the magnetic field around the ball fluid is changed to ball shaped solid and vibrate as per the seismic waves. By using the piezoelectric effect the vibrations in the earth surface is converted to electric charges which are then supplied to the metallic ball. By this the vibrations from earth are arrested and prevented from reaching the column. Through this the structure can be made earthquake resistant.

Index Terms— MR Dampers, MR Fluids, Piezoelectric Crysta.

I. INTRODUCTION

An earthquake is a sudden release of energy in the earth's crust that creates seismic waves. seismic activity of an area refers to the frequency of vibration and earthquakes experienced over a period of time. there are two types of earthquakes. They are large earthquake and small earthquake. Large earthquake causes damage of buildings, death and injury. Though technology is growing the disasters are still happening in high amount. One of the major disaster is the earthquake. As the epicentre of a large earthquake is located at offshore, the sea bed may displace sufficiently to cause tsunami. It can also trigger landslides and volcanic activities. They are mostly caused by rupture of geological faults, mine blast and nuclear tests. To prevent buildings from severe damages caused by earthquakes. Various earthquake resistant techniques are introduced. This paper is about magneto rheological damper(MR dampers) which is one of the earthquake resistant technique. Here we are choosing two hemi-spherical ball shaped concrete or steel. one is placed at the bottom of the column and other at the top of the footing. They can be placed in all the columns. It comprises MR fluids, wires and piezo electric crystal.

REVIEW OF LITERATURE: Various dampers are used in all the activities like military, defence, automotive, optics and so on. Among all it is mostly used in seismic resistant activities. Seismic Dampers are used in place of structural elements, like diagonal braces, for controlling seismic damage in structures. It partly absorbs the seismic energy and controls the motion of buildings. There are three types of seismic dampers ,namely viscous dampers(energy is absorbed by silicone-based fluid passing between piston-cylinder arrangement),friction dampers(energy is absorbed by surfaces with friction between them rubbing against each other)and yielding dampers, (energy is absorbed by metallic components that yield). Tuned mass dampers are also used for preventing damages, shaking of buildings, discomfort or out-right structural failures and cracks. There are many dampers and techniques available in and around the world but still there is no complete resistance for the damages caused by earthquakes. They also use structure with hybrid control which consists of active and seismic semi active control devices. At last we have found the complete control of earthquake resistance by using this magneto rheological dampers.

II. SIGNIFICANCE/NEED OF THE STUDY

The MR dampers is nothing but the magneto rheological damper or MR absorber damper. This damper continuously controls the shock absorber by the variation of magnetic field using electro magnets. They have several applications. Most preferred in semi active vehicle suspensions. Actually, are three types of MR dampers such as twin tube, mono tube and double ended MR damper. They are used to control the yield point shear stress of this fluid with the help of electric current. When the magneto rheological fluid contacts with electric field, the particles in the fluid will be arranged in a yield line manner. It is a type of smart fluid and it is also known as a carrier. When it is subjected to a magnetic field, the viscosity of the fluid increases due to the variation of magnetic field intensity. The fluid will be in liquid state ie, low viscosity during the absence of magnetic field. As soon as it is connected with magnetic field it changes from liquid to solid state. MR fluids often contain surfactants including, but not limited to, oleic acid, tetraethyl-ammonium hydroxide, citric acid, soy lecithin. The MR fluid is the combination of iron particles and lubricant oil. These dampers are also used in human prosthetic legs. Most in military and commercial helicopters. For example when jumping a damper in the prosthetic leg decreases the shock delivered to the patient's leg .This results in an increased mobility and agility for the patient. The MR fluid particles when contacts with electric current makes the fluid stiff.

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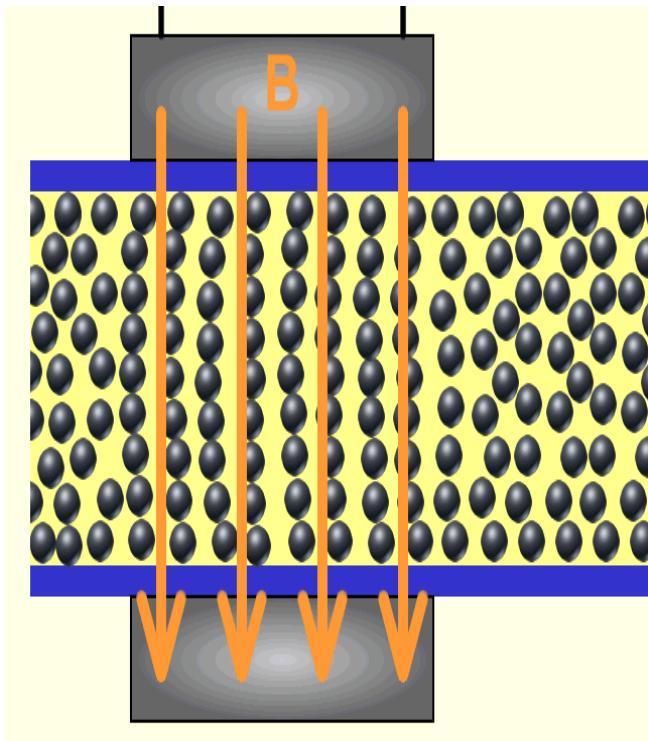


Fig-01



FIG-03



FIG-04

FIG-05

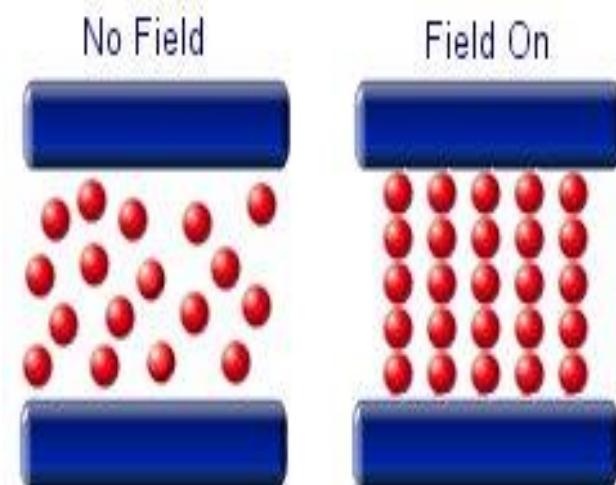


Fig-02

III. LIMITATION:

High density, due to presence of iron, makes them heavier, though operating volumes are small, still it is not insurmountable. High-quality fluids are expensive.

IV. OBJECTIVES:

The purpose of this project is to resist the earthquake. It protects the structures from damages and reduces human death. This process along with the construction is not expensive when compared with other techniques.

V. RESEARCH METHODOLOGY:

Here we have chosen the sphere shaped metal ball. It is divided into two parts. The two electro-magnets of opposite charges are placed inside two balls



FIG-06

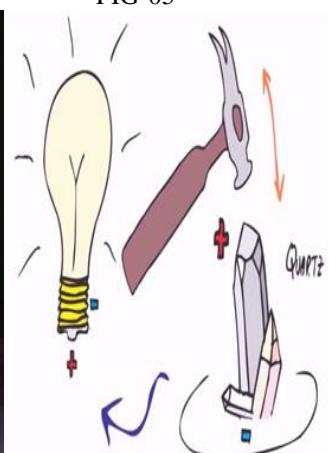


FIG-07

VI. RESULTS AND DISCUSSION:

Through this project we have found out that this can control the damages, shaking of structure and large amount of losses. The diameter of the ball is varies depending upon the foundation and column width. It decreases the failure of the structure, heavy installation work and labour skill. It can resist more when compared with other techniques. We can also use rubber instead of metal or concrete. After some years, the fluid is to be filled again. Actually it is under research. Heavy swaying in conventional anti earthquake building structures is reduced in seismic damping structures.

VII. CONCLUSION:

We conclude that the effects on buildings due to earthquakes can be minimized with the help of MR dampers. Even though they are expensive, they can be used for the prevention of demolition of tall buildings due to the impacts of high earthquakes. Thus the Magneto Rheological dampers act as a platform in order to reduce the adverse effects of earthquakes

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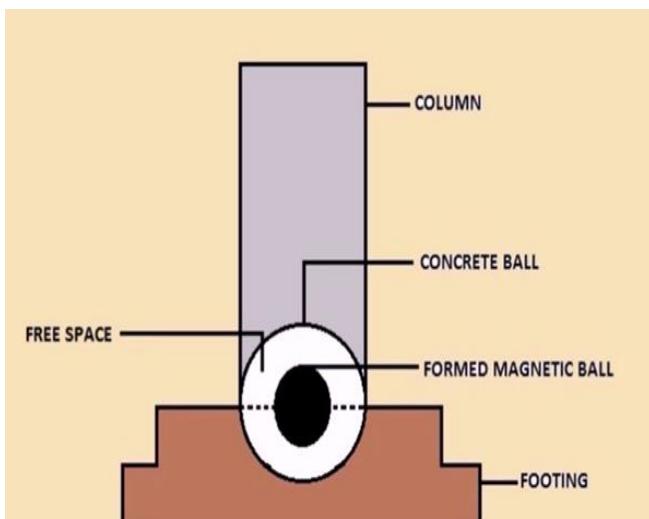


FIG-08

Then the liquid is formed by adding mixture of iron particles with lubricant oil as this gives properties as same as the MR fluid. It is filled in the metal ball .this ball is fixed in such a way that half of it lies at the top of the footing and the remaining at the bottom of the column..A wire is connected between the earth's crust and the centre of the ball. In between the wire piezo-electric crystal is placed. Which absorbs all the vibration from earth's crust and converts into current around the ball ie, the magnetic field is produced due to the presence of electro-magnetic forces acting with that current. Due to the magnetic field around the ball, fluid is changed from liquid to solid state and becomes stable at the centre without any support around the solid mass. By using the piezoelectric effect the vibrations in the earth surface is converted to electric charges which are then supplied to the metallic ball. so, the vibrations from earth is arrested and prevented from reaching the column. Through this the structure can be made earthquake resistant.

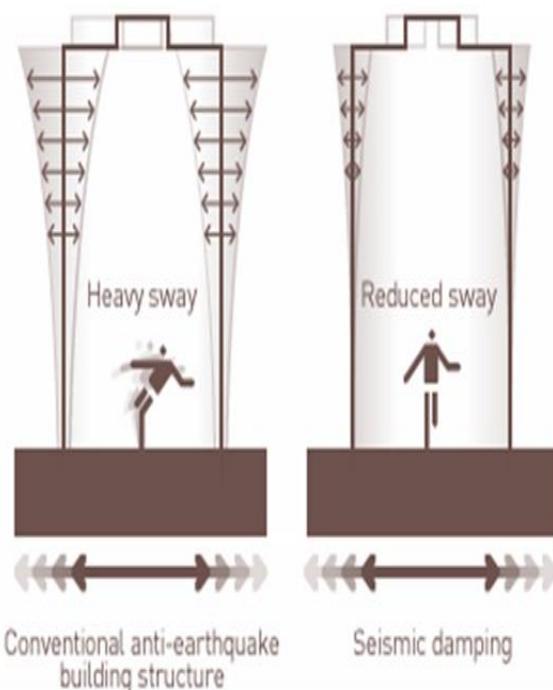


FIG-09