

Investigating the benefit of magnetorheological fluids in shock absorbers

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Abstract

Magnetorheological Fluid was used inside a suspension system. The performance of this suspension system was tested and compared to conventional suspension system. The results shows the system under construction has many advantages.

Magnetorheological fluid

The viscosity of the fluid can be controlled by applied magnetic field to an MR fluid.

An MR fluid is a mixture of oil, iron powder and organoclay.

Application of MR fluid

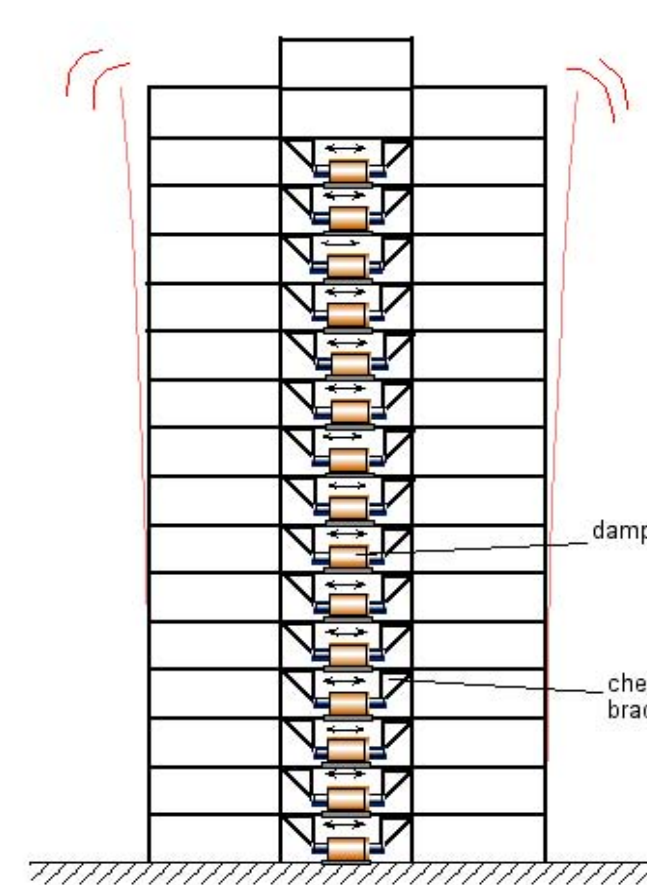
Damper for earthquake-proof



Franjo Tudjman Bridge, Croatia



Dongting Lake Bridge, China



During an earthquake, MR fluid inside the dampers will change phases between solid to liquid due to the changing of magnetic field inside the damper. Using these dampers in buildings and on bridges will create smart structures that automatically react to seismic activity.

Optical Stabilizer:



Hubble telescope: Advanced Camera for Surveys (ACS) has built-in MR fluid stabilizers to prevent vibrations in the main mirror.

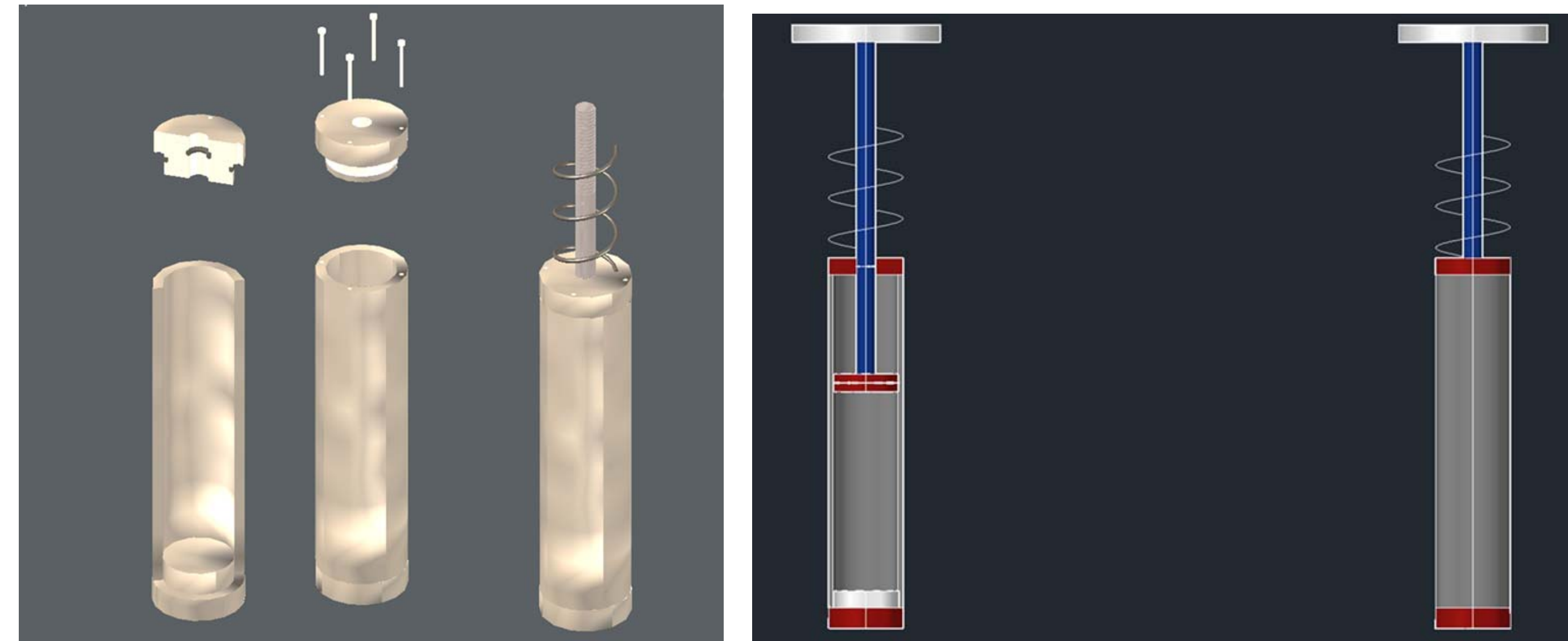
Brake system

Shock absorber system

Lord Corporation

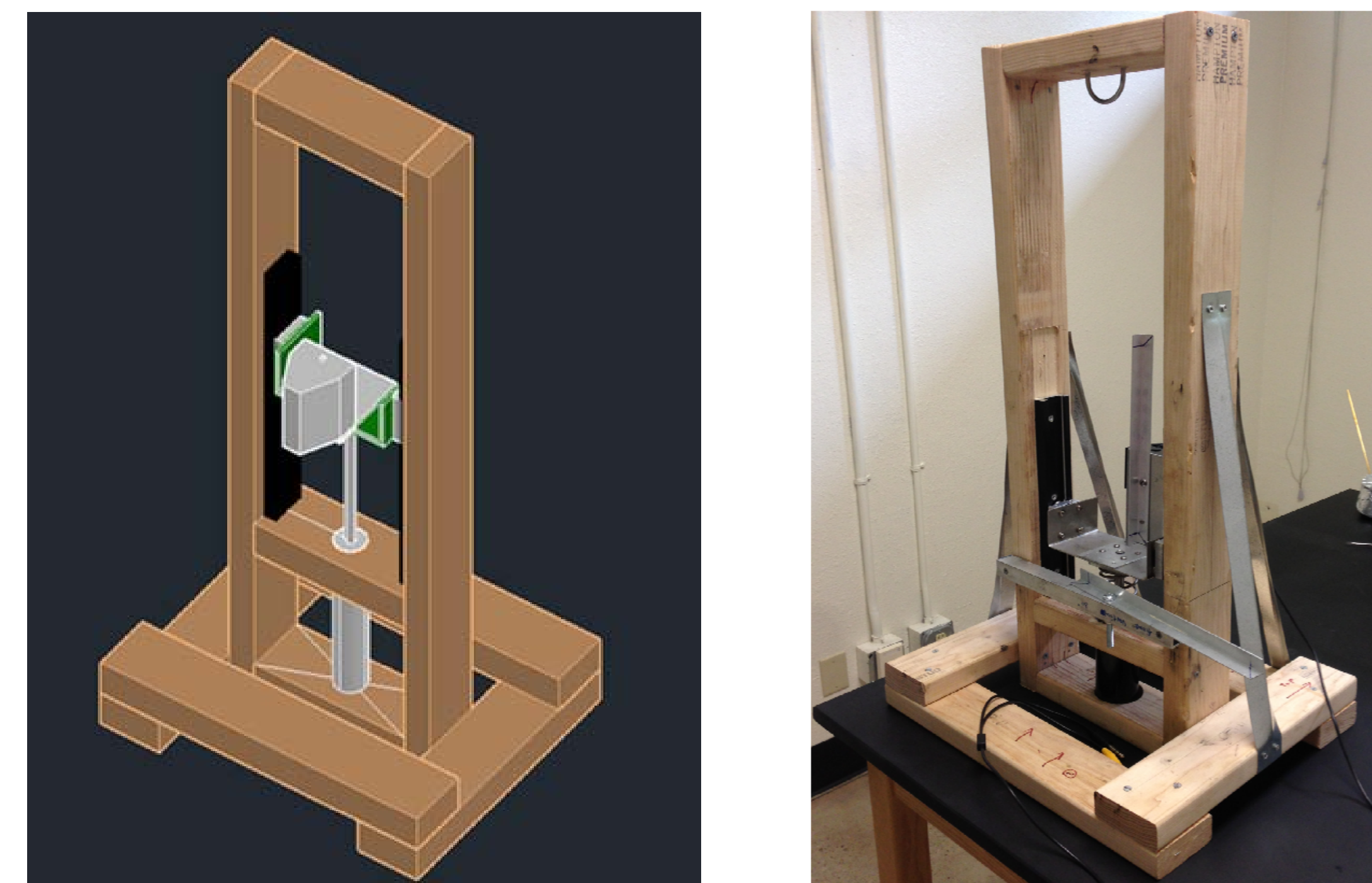
Experiment

Components:



A prototype of suspension was build of acrylic. And three different types of spring, 67 lbs./inch, 53 lbs./inch and 20 lbs./inch, were used in the shock system. The test platform was build in wood. Two rails with roller blocks were used to keep the shock move smoothly and straight. A motion sensor was mounted on the top of the shock absorber.

Test Platform:



Sensor:



The PASCO 750 interface and Motion Sensor II
Precision: 1.72×10^{-4} m
Accuracy: $\pm 0.2\%$

Material:



Air

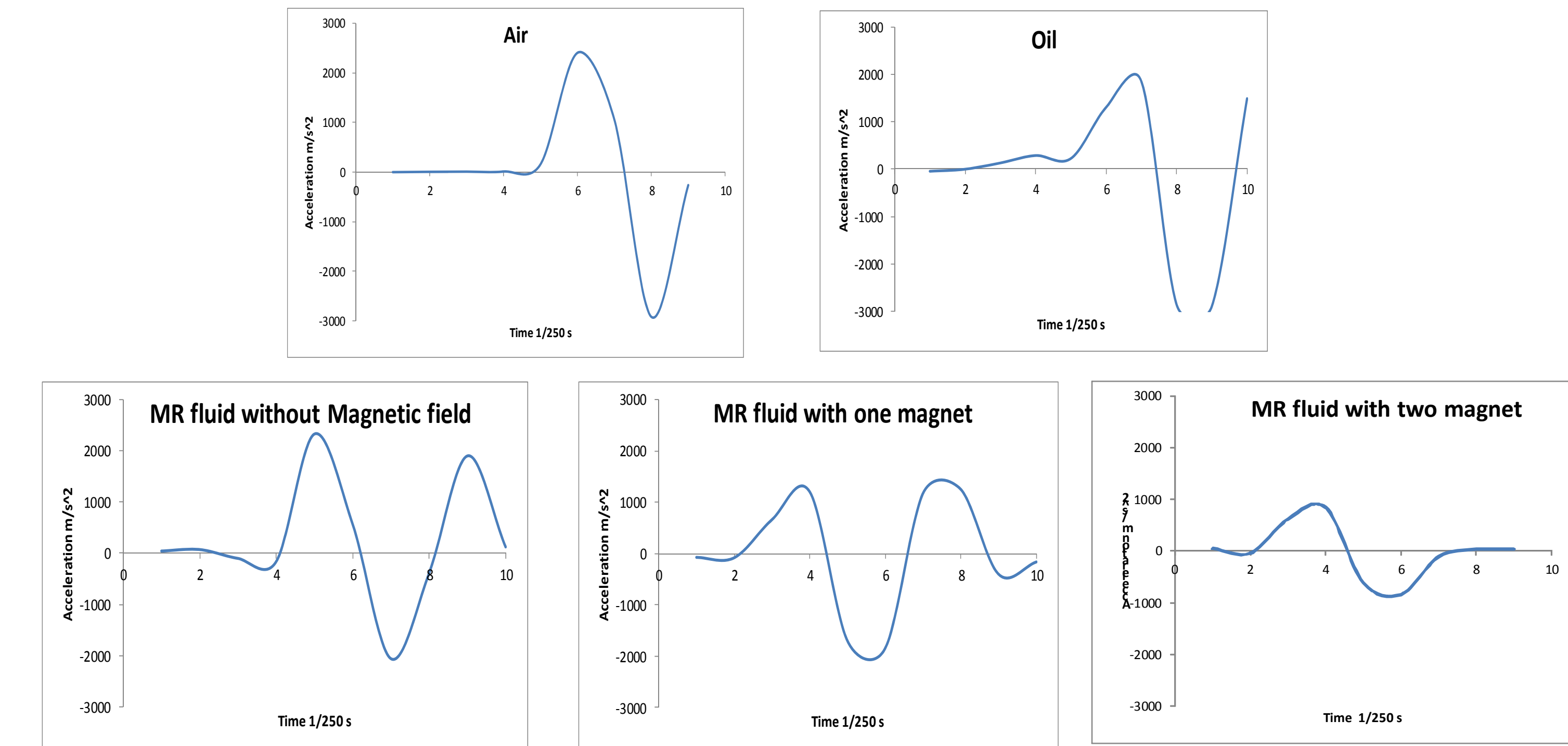


Oil(5W-30)



MR Fluid

Result & discussion



The above plots shows the result of acceleration from the test platform.

These graphs are plotted under the same scale. The viscosity of MR fluid has changed with magnet field.

The majority errors came from the result were misalignment in the test platform. Also connection between shock block and spring create errors. This error make the data look like a flat top rather than a peak.

Conclusion

The viscosity has changes when an MR fluid is added magnetic fluid. This benefit could support shock have ability to control the viscosity.

In the future, we will add electro magnet and a software controller to adjust the strength of the magnetic field. Also redesigning the plate to mount the roller bearing block and sensor is necessary to collect better data.

Acknowledgement

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Reference

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