

ENGINEERING/TECHNOLOGY

Earthquake Damage Prevention: Semi-Active Structural Control of a Two-Story Shear Building

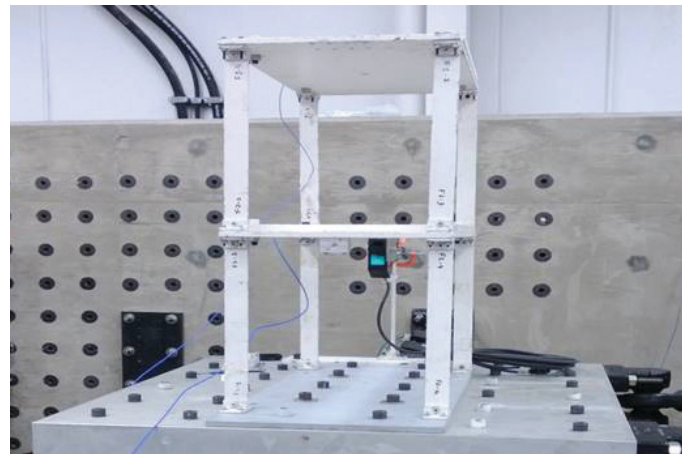
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With continuing urban development across the world, it is becoming ever more important to provide increased structural safety against events such as earthquakes and strong winds. The field of structural control has recently been growing to meet these challenges through the use of semi-active control methods, such as Magnetorheological (MR) Damping. However, due to the non-linearity of the MR Damper, the knowledge base surrounding the device and its various control algorithms still needs to be strengthened before large-scale implementation of this control method can occur.

To address these issues, an experimental regime was developed to analyze the efficacy of an MR Damper acting on the first floor of a benchmark structure under various control algorithms. Upon initial assessment in simulation, the Clipped Optimal, Lyapunov, and Viscous Damping Negative Stiffness (VDNS) control algorithms were chosen for analysis due to their proficiency in reducing vibrational effects over the passive damped and uncontrolled cases. Further precision in simulation was obtained through the numerical identification of the damper and structure to be used in small scale experimentation. These simulations again indicated consistent improvement from passive control, while also providing insight into the specialties of each algorithm. Lyapunov control produced the best absolute displacement

reduction, while VDNS control achieved the greatest reduction in acceleration. Clipped Optimal control was the median in both cases, but produced its effects for the least cost of force. With the physical experimentation to follow, this study strives to find solid information to add to the MR Damper knowledge base.

Research advisor Shirley Dyke writes, "Alana's research allowed her to develop a depth of understanding of the field which is not typical of undergraduate students at her level. The work done here extended her as a researcher and allowed the group to reaffirm and solidify conclusions drawn in prior studies."



Two-story small scale structure mounted on six degree of freedom shaketable.

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