Improving the Efficiency of Tuned Liquid Dampers by Determining the Optimal Specifications to Fit a Specific Structure

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Increasing demand for housing and the production of sustainable energy causes the construction of unstable structures, such as tall buildings and wind turbines. To ensure that oscillations created by wind and earthquakes do not damage these structures, the need for damping mechanisms is growing. This creates a problem because of the poor access to currently prevalent damping mechanisms, due to their high cost. Through our research we have studied how the tuned liquid damper (TLD) can be made more accessible by increasing its efficiency, thus making it more cost-effective. To improve the TLD we have studied the effect of changing various parameters. Our experiments have been conducted by oscillating different versions of our experimental setup, which simulates a slender structure equipped with a TLD. Data collected by an accelerometer is used to determine the difference in strain on the structure, the half-life of the oscillations, and more. This is done whilst altering factors like the liquid's kinematic viscosity and the structure's natural frequency. By changing a single factor, we have seen results of a magnitude large enough, to considerably increase the competitiveness of the TLD compared to its more expensive and formerly more efficient alternatives. From our research, we have shown, that the specifications for the most efficient TLD vary substantially with small changes in the structure's characteristics. However, our research shows that it, to some extent, is possible to describe the specifications of the most efficient TLD for a certain structure based on simple information about the structure's construction.

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