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Title: A low energy and slow timescale control device for the re-tuning of a suboptimal tuned mass damper

Author(s): Anass Mayou*[1], Vincent Denoël[2]

[1] Structural & Stochastic Dynamics (SSD), University of Liège, Liège, Belgium, anass.mayou@uliege.be
[2] Structural & Stochastic Dynamics (SSD), University of Liège, Liège, Belgium, v.denoel@uliege.be

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Abstract

Tuned mass dampers (TMDs) have been widely studied and used for mitigating the structural vibrations induced by environmental loads such as wind, earthquakes, and traffic. However, frequency mistuning of the TMD, which can occur due to uncertainties in the structural parameters or environmental loads, can significantly reduce the efficiency of the system. The *retuner*, a new concept in the field of structural dynamics, is an additional mass-spring system that can be incorporated into the TMD system to enhance its robustness against mistuning.

The retuner consists of a smaller mass-spring system that is connected in series with the primary structure and the TMD. By selecting appropriate parameters for the retuner system, it is possible to restore the original damping of the TMD system even in the presence of mistuning. The design of the retuner system is simple, and the parameters can be chosen based on a simple formula, making it easy to implement and widely applicable.

The application of the retuner system has several advantages. Firstly, it can be used to treat mistuning in existing structures without modifying the TMD system's mass or spring properties. Secondly, it can be used to create a semi-passive control system in newly constructed structures, which is energy-efficient and requires slow timescale retuning. The semi-passive control system operates most of the time in a passive mode, which reduces the energy consumption required for the control.

The results have shown that the retuner system can effectively improve the robustness of the TMD system against mistuning and reduce the structural vibrations induced by environmental loads.

Overall, the retuner system is a promising approach to enhance the robustness of TMDs against mistuning, offering an efficient and low-cost solution for structural vibration control.

References

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