Name(s)

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Project Number

S0304

Project Title

Time-Variant Damping Method to Reduce Vibration Damages to Civil Structures

Abstract

Objectives/Goals

The objective is to discover whether a time-variant damping coefficient in tuned mass dampers is more effective than constant damping coefficients at reducing
earthquake movements in civil structures. Adjustable damping coefficients could be more effective than constant damping coefficients at protecting buildings from
earthquake dangers.

Methods/Materials

The testing is performed mathematically using MATLAB. First, the performance of tuned mass dampers with a constant damping coefficient is studied. Then, the building's spring constant is increased 5%, and the damping coefficient is adjusted to see whether an adjustment can lead to reduced movements. Afterwards, a time-variant damping coefficient that varies throughout an earthquake is applied to the system to see whether it is effective at further reducing building movements.

Results

A 5% change in the building's spring constant can lead to a 30% increase in building displacements. Adjusting the damping coefficient in response to the increase in spring constant led to 18% reduced displacements. The time-variant damping algorithm led to 40% smaller building movements compared to the case of constant damping, and is very effective at minimizing building oscillations.

Conclusions/Discussion

The data from this study suggests that adjustable or time-variant friction coefficients are more effective than constant friction coefficients at decreasing earthquake-induced building movements.

Summary Statement

This projects studies time-variant friction coefficients in tuned mass dampers to see whether it is effective at reducing building movements.

Help Received