CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Vivien Y. Fang

Project Number
S0208

Project Title
How Damping Can Passively Control the Dynamic Behavior of a Structure

Abstract

Objectives/Goals
The objective of this study is to determine the dynamic behavior of a structure and how to passively control the vibrations. Or else stated as: how would damping affect the dynamic behavior of building structures when an outside force, e.g. earthquake, was to cause the structure to vibrate.

Methods/Materials
Two different types of metal beams (carpenter tape beams, and steel beams), each with three different amount of damping; forming a total of 6 different beams were tested with Photon II Dynamic Analysis System. Fundamental frequency and damping coefficient of every beam were experimentally determined by using the results found by the Analysis System.

Results
The fundamental frequency (f) and damping coefficient (d) of each beam are:
1. Carpenter tape beam without external damping: f=12Hz, d=0.0437.
2. Carpenter tape beam with medium external damping: f=14Hz, d=0.0825.
3. Carpenter tape beam with the highest external damping: f=20Hz, d=0.1341.
4. Steel beam without external damping: f=19Hz, d=0.0064.
5. Steel beam with a medium external damping: f=20Hz, d=0.1412.
6. Steel beam with the highest external damping: f=35Hz, d=0.1802.

Conclusions/Discussion
The results of this study indicated following conclusions:
1. The vibration magnitude of a beam with higher damping coefficient drops faster.
2. A beam with higher damping coefficient dissipates vibration energy faster.
3. Damping is helpful to reduce the vibration magnitude of a structure while it is shocked by an external force such as earthquake.
4. Damping is helpful to minimize the accumulated vibration energy of a structure during sever external excitation.

Summary Statement
Experimentally determine the dynamic behavior of a structure, and how damping can passively control the vibrations.

Help Received
Father helped to borrow the equipment.