

MSET – SIMPLE HARMONIC MOTION



Purpose

Evaluate the dynamic response of a cantilever beam equipped with a strain gage to determine the 1st mode damped natural frequency.

SHM

Simple harmonic motion occurs when a structure is excited by an external source causing it to vibrate. As an example of a structure vibrated at its resonant frequency and collapsed is the Tacoma Narrows Bridge



Theory

The natural frequency "Wn" of a structure is a function of stiffness "K" and mass "m".

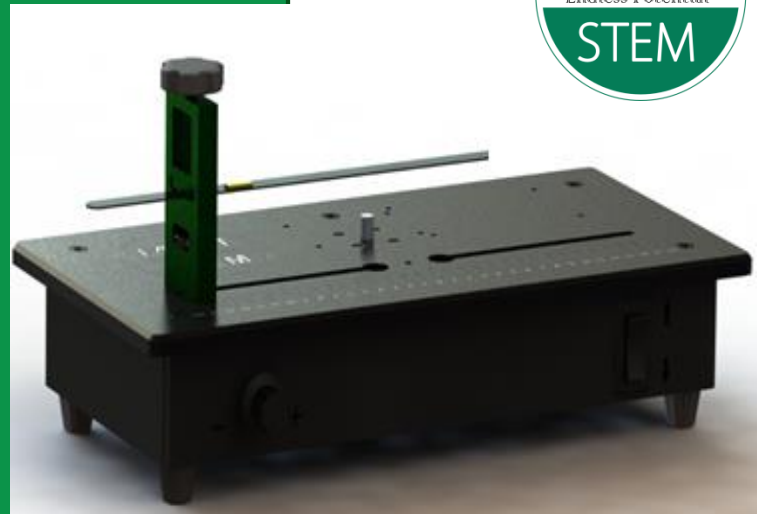
$$Wn = \sqrt{K/m}$$

The generalized expression can be specified for a cantilever beam as follows:

$$Wn = (An)^2 \sqrt{EIg/WL^4}$$

Where: E = stiffness
I = moment of inertia
g = gravity
W = weight / length
L = length
An = mode constant
An = 1.875 1st mode

Setup



Results

Data sets obtained from this experiment will allow post processing to be performed to determine the 1st mode damped natural frequency. Length, stiffness, moment of inertia, and variable lengths can also be concluded upon. Results of this experiment can serve as a base line for more complex studies of mass loading and free end tip modeling.

