MSET – SHM & MASS LOADING

Purpose

Study the effects of mass loading on the dynamic response of a cantilever beam undergoing simple harmonic motion.

Mass Loading

An object or structure that is mass loaded will have an altered dynamic response. As an example consider the behavior of a vehicle that hits a bump in the road when it is loaded with cargo versus only carrying passengers

Setup

Results

Data sets acquired should show an inverse relationship between the damped natural frequency and equivalent beam mass once corrected for point loading. Results of this experiment will also serve as a base line for more complex free end tip modeling and the effects of using a contact sensor on relatively low mass structures for vibration studies.

Theory

Again with the basic natural frequency formula shown below it is clear that by increasing the mass in the denominator results in a decrease in the frequency of vibration.

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

The effects of mass loading on a cantilever beam are also a function of the magnitude of mass and also beam :

$$Wn = \sqrt{3EI/mL^3}$$

Where m is the equivalent mass
m = 0.2357 (beam mass)

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