

# **Two-dimensional Analysis of Vibration Isolation of Rigid Bar Supported by Buckled or Pre-bent Struts**

by

Helen M. Favor

Dr. Raymond H. Plaut, Chairman

Charles E. Via, Jr. Department of Civil and Environmental Engineering

## (ABSTRACT)

The purpose of this research is to study a new type of vibration isolator, utilizing the post-buckled stiffness of elastic struts (or columns). The advantage of the post-buckled state is that ideally it can support more static load with a relatively small static deflection than traditional vibration isolators such as springs or rubber mounts, but can also exhibit a low axial stiffness when dynamic excitation is introduced. Three models consisting of buckled or pre-bent struts serving as vibration isolators which support a rigid bar are examined in this research. The three cases studied are 1) two buckled struts supporting a symmetric rigid bar, 2) two buckled struts supporting an asymmetric rigid bar, and 3) two pairs of buckled struts with a bonded filler supporting a symmetric rigid bar. The models are subjected to a harmonic excitation at the base, and external damping is included. The struts in all cases are modeled as an elastica, and the boundary conditions are clamped/clamped for all cases.

Because the purpose of the struts is to reduce unwanted vibrations, determining the displacement transmissibility of the system is the main goal of this research.

Transmissibility versus frequency plots are generated for all cases, with varying parameters such as stiffness, damping, and location of center of mass, to determine how they affect the behavior of the struts. Models that produce a large range of frequencies at which the transmissibility is well below unity are the most effective. Vibration shapes are also determined for certain frequencies so that the physical behavior of the system can be studied.