Reliable Dynamic Analysis of an Uncertain Shear Beam

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Abstract

In structural engineering, shear beams and their dynamic behavior play an important role in modeling, analysis and design of various types of structures subjected to a system of dynamic loads such as wind or earthquake excitations. However, in current procedures of dynamic analysis of shear beams, the presence of uncertainty in the system's mechanical properties and/or applied forces is not considered.

In this work, a new method is developed for the dynamic modal analysis of continuous uncertain shear beams subjected to uncertain external loads. First, an interval formulation is used to quantify the uncertainty present in the system's mechanical characteristics and/or magnitude of dynamic forces. Then, having the interval parameters, the bounds on modal responses of the continuous system are obtained leading to determination of the upper-bounds of total response that may be used for design purposes.

An example problem that illustrates the behavior of the method and a comparison with Monte-Carlo simulations are presented. Using this new method, it has shown that obtaining the bounds on the dynamic response of a shear beam does not require an iterative procedure such as Monte-Carlo simulations.

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