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Propagation of Uncertainty in Structural Dynamics using Component Mode Synthesis Methods

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Abstract

Component mode synthesis (CMS) is a well-established substructuring technique for the vibration analysis of systems that are built-up by several components. CMS also offers an appealing framework for the analysis of the structural dynamics of uncertain structures, which will be presented. The benefits concern the numerical costs and the way uncertainty is quantified and propagated. Uncertainties in properties can be introduced at the component level, either in terms of the component physical or modal properties. The propagation of uncertainties can be treated in several independent steps using four different coordinate systems in CMS. Sources of inaccuracy and error are discussed that arise from neglecting various correlations and the variations in certain component modal properties. The application of perturbational techniques and the combination of qualitatively different uncertainty descriptions are considered. Advantages that arise from the structure of the CMS equations in the fixed-interface (Craig-Bampton) method are discussed. Numerical examples are presented.

Author details

Lars Hinke received a MEng in mechanical engineering from Rensselaer Polytechnic Institute (RPI), USA, in 2003 and graduated as Diplom-Ingenieur from Technische Universität Dresden, Germany, in September 2004.
Subsequently he registered for the PhD programme at the Institute of Sound and Vibration Research (ISVR) in Southampton, UK.

Gäste sind herzlich willkommen!