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Extracting the Coupled Dynamics in Thin-Walled Beams from Numerical Data Bases

Authors : Mohammad A. Bani-Khaled

Abstract : In this work we use the Discrete Proper Orthogonal Decomposition transform to characterize the properties of coupled dynamics in thin-walled beams by exploiting numerical simulations obtained from finite element simulations. The outcomes of the will improve our understanding of the linear and nonlinear coupled behavior of thin-walled beams structures. Thin-walled beams have widespread usage in modern engineering application in both large scale structures (aeronautical structures), as well as in nano-structures (nano-tubes). Therefore, detailed knowledge in regard to the properties of coupled vibrations and buckling in these structures are of great interest in the research community. Due to the geometric complexity in the overall structure and in particular in the cross-sections it is necessary to involve computational mechanics to numerically simulate the dynamics. In using numerical computational techniques, it is not necessary to over simplify a model in order to solve the equations of motions. Computational dynamics methods produce databases of controlled resolution in time and space. These numerical databases contain information on the properties of the coupled dynamics. In order to extract the system dynamic properties and strength of coupling among the various fields of the motion, processing techniques are required. Time-Proper Orthogonal Decomposition transform is a powerful tool for processing databases for the dynamics. It will be used to study the coupled dynamics of thin-walled basic structures. These structures are ideal to form a basis for a systematic study of coupled dynamics in structures of complex geometry.

Keywords : coupled dynamics, geometric complexity, proper orthogonal decomposition (POD), thin walled beams
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