



A Variational Mode Decomposition Approach for Modal Identification of Structures

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Abstract

Modal Identification describes the behaviour of the structure under dynamic loading conditions such as earthquake, wind etc. A newly developed variational mode decomposition (VMD) method identifies the modal parameter of structures based on dynamic responses. The VMD algorithm decomposes the acceleration response from the structure under the earthquake excitation into a series of a finite number of the mono-components. The decaying amplitude of the extracted modal responses is then utilized to find the natural frequencies by using a Fast Fourier Transform. Finally, the mode shape in the modal space for each decomposed modes in the structure is recognized from the obtained modal response data. This paper presents the applicability of the variational mode decomposition for modal identification purposes and its comparison with the earlier developed Hilbert Spectral Analysis (HSA) and Empirical Mode Decomposition (EMD) method. To demonstrate the efficiency of VMD algorithm, two case studies were considered. First, modal parameters of a numerical model of a three-story shear-beam type building are computed using VMD technique followed by an experimental study on multi-storey building model. The results demonstrate that the proposed VMD approach can be easily identified the modal parameter of building with better accuracy.

Keywords: Variational mode decomposition, Empirical mode decomposition, Modal identification