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Experimental Evaluation of a Wavelet-Based FEM and its Application to Load History Identification

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In the present paper, the applicability of a 2D Wavelet-based Spectral Finite Element Method (WSFEM) to Structural Health Monitoring (SHM) has been investigated from an experimental standpoint. The WSFEM resorts to the wavelet-Galerkin method to solve in-plane wave equations using finite element discretization of the space coordinates. In this research, the experimental evaluation resorts to the application of the inverse problem to load history identification. To this end, Time Reversal theory is employed, using a signal post-processing algorithm with multi-resolution wavelet analysis. Results experimentally acquired at specific sensor locations are windowed, denoised, and time-reversed; the impact load is reconstructed via the numerical model as the confluence of the signals emitted from the sensors. Furthermore, the performance of the model is verified for both 1D and 2D cases, rendering a complete analysis of the 2D WSFEM. Test results show that WSFEM accurately simulates wave propagation and the reliability of results establishes its applicability to SHM.

Ключевые слова:

Содержание.
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