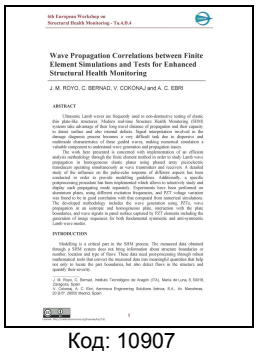

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Wave Propagation Correlations between Finite Element Simulations and Tests for Enhanced Structural Health Monitoring

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Ultrasonic Lamb waves are frequently used in non-destructive testing of elastic thin plate-like structures. Modern real-time Structure Health Monitoring (SHM) systems take advantage of their long travel distance of propagation and their capacity to detect surface and also internal defects. Signal interpretation involved in the damage diagnosis process becomes a very difficult task due to dispersive and multimode characteristics of these guided waves, making numerical simulation a valuable component to understand wave generation and propagation issues.

The work here presented is concerned with implementation of an efficient analysis methodology through the finite element method in order to study Lamb wave propagation in homogeneous elastic plates using phased array piezoelectric transducers operating simultaneously as wave transmitters and receivers. A detailed study of the influence on the pulse-echo response of different aspects has been conducted in order to provide modelling guidelines. Additionally, a specific postprocessing procedure has been implemented which allows to selectively study and display each propagating mode separately. Experiments have been performed on aluminium plates, using different excitation frequencies, and PZT voltage variation was found to be in good correlation with that computed from numerical simulations. The developed methodology includes the wave generation using PZTs, wave propagation in an isotropic and homogeneous plate, interaction with the plate boundaries, and wave signals in panel surface captured by PZT elements including the generation of image sequences for both fundamental symmetric and antisymmetric Lamb wave modes.

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Ключевые слова:

Содержание