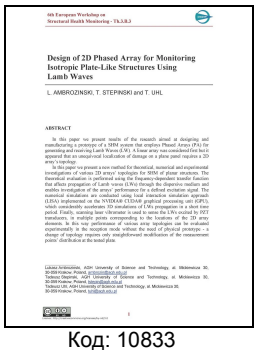

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Design of 2D Phased Array for Monitoring Isotropic Plate-Like Structures Using Lamb Waves

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In this paper we present results of the research aimed at designing and manufacturing a prototype of a SHM system that employs Phased Arrays (PA) for generating and receiving Lamb Waves (LW). A linear array was considered first but it appeared that an unequivocal localization of damage on a plane panel requires a 2D array's topology.

In this paper we present a new method for theoretical, numerical and experimental investigations of various 2D arrays' topologies for SHM of planar structures. The theoretical evaluation is performed using the frequency-dependent transfer function that affects propagation of Lamb waves (LWs) through the dispersive medium and enables investigation of the arrays' performance for a defined excitation signal. The numerical simulations are conducted using local interaction simulation approach (LISA) implemented on the NVIDIA® CUDA® graphical processing unit (GPU), which considerably accelerates 3D simulations of LWs propagation in a short time period. Finally, scanning laser vibrometer is used to sense the LWs excited by PZT transducers, in multiple points corresponding to the locations of the 2D array elements. In this way performance of various array topologies can be evaluated experimentally in the reception mode without the need of physical prototype - a change of topology requires only straightforward modification of the measurement points' distribution at the tested plate.

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Ключевые слова:

Содержание