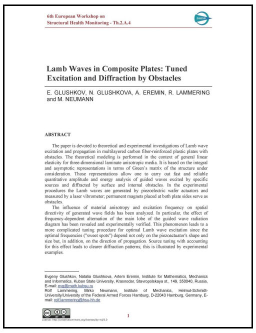

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Lamb Waves in Composite Plates: Tuned Excitation and Diffraction by Obstacles

E. GLUSHKOV, N. GLUSHKOVA, A. EREMIN, R. LAMMERING and M. NEUMANN

ABSTRACT

The paper is devoted to theoretical and experimental investigations of Lamb wave excitation and propagation in multilayered carbon fiber-reinforced plastic plates with obstacles. The theoretical modeling is performed in the context of general linear elasticity for three-dimensional laminate anisotropic media. It is based on the integral and asymptotic representations in terms of Green's matrix of the structure under consideration. Those representations allow one to carry out fast and reliable quantitative amplitude and energy analysis of guided waves excited by specific sources and diffracted by surface and internal obstacles. In the experimental procedures the Lamb waves are generated by piezoelectric wafer actuators and measured by a laser vibrometer; permanent magnets placed at both plate sides serve as obstacles.

The influence of material anisotropy and excitation frequency on spatial directivity of generated wave fields has been analyzed. In particular, the effect of frequency-dependent alternation of the main lobe of the guided wave radiation diagram has been revealed and experimentally verified. This phenomenon leads to a more complicated tuning procedure for optimal Lamb wave excitation since the optimal frequencies ("sweet spots") depend not only on the piezoactuator's shape and size but, in addition, on the direction of propagation. Source tuning with accounting for this effect leads to clearer diffraction patterns; this is illustrated by experimental examples.

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Ключевые слова:

Содержание