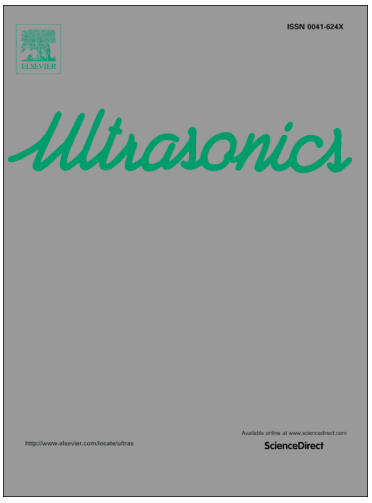

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Study on Effect of Laser-induced Ablation for Lamb Waves in a Thin Plate

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Abstract

In this paper, the effect of ablation on the shape of elastic waves generated by laser excitation is studied numerically and experimentally. Laser-induced ultrasound has been widely used in the nondestructive testing (NDT) field because it has the advantage that the sensor does not have to be directly attached to the target structure. In the safety assessment process, low energy excitation is used, and thus the structure is not damaged. Most studies related to laser ultrasound have focused on the method of detecting cracks within the elastic range, and there have been few studies on the effect of ablation. This research consists of experiments and numerical analyses. In experiments, elastic waves were generated in an aluminum plate by projecting laser pulses with different energy intensity. The velocities in the thickness direction were measured using a Laser Doppler velocimeter (LDV) at a point 135 mm away from the excitation point.

In the numerical study, two numerical simulations were carried out using heat flux and normal stress input to mimic laser pulse excitation. A thermo-mechanical simulation by heat flux was conducted to simulate thermal expansion by the laser pulse, and the normal stress was applied to reflect the effect of radiation pressure by ablation, respectively. Waveforms were synthesized by using different magnitude ratios of the obtained numerical responses and were compared with the experiment results. It is found that the effect of radiation pressure should not be neglected if the energy intensity is large although the effect of radiation pressure decreases as the energy intensity decreases. At the energy intensity with which