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Angle-Beam Shear Wave Scattering from Buried Crack-like Defects in Bonded Specimens

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Ultrasonic wavefield imaging, which refers to the measurement of wave motion on a 2-D rectilinear grid resulting from a fixed source, has been previously applied to angle-beam shear wave propagation in simple plates with through-holes and far-surface notches [1]. In this prior work scattered waves were analyzed using baseline subtraction of wavefields acquired before and after a notch was introduced [2]. In practice, however, defects of interest often occur between bonded layers and it is generally not possible to record data from the same specimen in both the undamaged and damaged states, making direct baseline subtraction infeasible. This present work considers measurement of angle-beam waves in several bonded specimens with and without buried defects originating from fastener holes. The experimental methodology is explained, which includes specimen fabrication details and wavefield measurement methods. Data from fastener holes with and without simulated damage in the form of notches are compared, and techniques used to analyze differences are discussed.
Despite unavoidable deviations from specimen-to-specimen caused by factors such as variations in bonding, transducer mounting, and fastener hole machining, it is shown that scattering from buried notches can be clearly visualized in the recorded wavefield data.

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