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Design and Evaluation of a Novel Low Acoustic Impedance-Based PZT Transducer for Detecting the Near-Surface Defects

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Abstract

Near-surface defects are one of the most common types of damage occurring in polymer composite materials. Conventional Non-Destructive Testing (NDT) techniques, especially ultrasonic testing, are not always suitable for detecting these types of defect, especially in thin plates. The proposed NDT method in this article employs Low Acoustic Impedance (LAI) characterization. The novelty of LAI technique lies in the transverse resonating of Lead-Zirconate-Titanate (PZT) transducer which shows significant lower effective acoustic impedance compared to thickness - extension mode. The LAI technique eliminates the need for the matching layers and reduces the manufacturing cost consequently. Briefly, the analytical model has been introduced and the fabrication procedure has been discussed in detail. The setup has been evaluated both numerically and experimentally to detect a debonding. The results proved the ability of LAI technique in the detection of defects and, moreover, the approximate geometry of the affected region as well.

Keywords: non-destructive testing, low acoustic impedance, self-sensing transducer

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