

Application of a Reference-Free Damage Detection Technique To A Specimen with Through-The-Thickness Holes

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Summary

A reference-free damage detection technique based on Lamb wave signals and piezoceramic (PZT) transducers attached on the both sides of a thin and uniform metal specimen is recently developed to detect crack damage in a metallic plate. To identify defect, the polarization characteristics of PZTs and instantaneously measured Lamb wave signals are used without using previously obtained baseline data. If the propagating waves along a thin plate encounter a discontinuity point such as a crack, mode conversion of Lamb wave signal occurs and this mode conversion can be extracted using the proposed technique. In this study, the effect of through-the-thickness holes on the proposed technique is investigated. Multiple refractions and reflections of Lamb waves are observed due to the holes and analyzing responses of Lamb waves become complex because of the multiple modes. However, the mode conversion is not produced by the through-the-thickness holes, it is expected that the holes will not affect the performance of proposed technique. This study investigates if the crack damage can be still identified even at the presence of the holes. Numerical and experimental results are presented to examine the usefulness of the technique at the existence of the holes.

keywords: Lamb wave, mode conversion, reference-free damage detection, piezoelectric polarization, through-the-thickness holes.

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