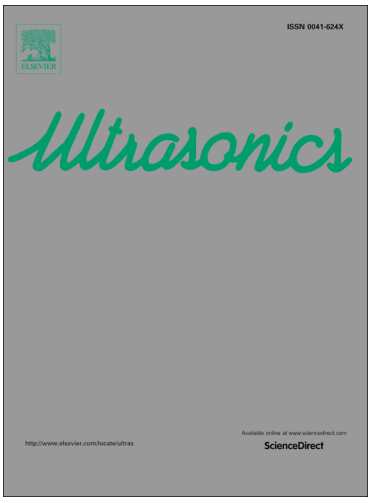

Generation and reception of shear horizontal waves using the synthetic face-shear mode of a thickness-poled piezoelectric wafer

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Generation and reception of shear horizontal waves using the synthetic face-shear mode of a thickness-poled piezoelectric wafer

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Abstract: The guided wave based inspection technique has been playing an important role in modern industries due to its capability in rapid detection of large structures. Among all the wave modes in plate-like structures, the fundamental shear horizontal wave (SH_0) is of great importance since it is the unique non-dispersive mode. However, the generation and reception of SH_0 wave using piezoelectrics is always a challenge. In this work, we synthesized face-shear deformation mode in a thickness-poled piezoelectric wafer and successfully excited/ received SH_0 wave in a thin aluminum plate. Firstly, the frequency response of the proposed wafer was analyzed using the finite element method (FEM) to show that the face-shear deformation can be synthesized via applying anti-parallel electric fields on different parts of the wafer. Subsequently, time-transient FEM simulations were carried out to predict its capacity in generation/ reception of SH_0 wave. Finally, experiments were conducted to examine the performance of the proposed wafer on SH_0 wave generation/reception. The obtained results indicate that the synthetic face-shear piezoelectric wafer can generate SH_0 wave along two principal directions (0° and 90°) with the amplitudes symmetric along the 45° direction. The amplitude of the generated SH_0 wave reached its maxima along the principal direction and decreased to nearly zero at 45° direction, which is in good agreement with the FEM results. Besides, the wafer can only receive SH_0 wave in a wide range of frequency, i.e., it can act as an inherent wave filter. Due to its compact size and easy fabrication, the proposed wafer has a great potential in promoting the applications of SH_0 wave in nondestructive testing and structural health monitoring.

Key words: guided wave, shear horizontal wave, piezoelectric wafer, face-shear

1. Introduction

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