Angle-Beam Excitation Method for Selective Generation of Lamb Wave Modes in a Finite-Width Plate

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Lamb waves are elastic guided waves which have thickness modes confined by top and bottom boundaries of an infinitely wide plate and they have been widely used in various industrial fields such as non-destructive testing (NDT) and structural health monitoring (SHM). The modes of Lamb waves should be properly selected for application purposes. Fortunately, a single mode Lamb wave in an infinitely wide plate can be easily selected within the low frequency range. However, a finite-width plate often used for a waveguide geometry in industrial fields has additional width modes confined by both plate sides and there are numerous width modes in the low frequency range, which make it difficult to selectively generate a specific Lamb wave mode. In this paper, a specially designed angle-beam sensor for the selective generation of a specific Lamb wave mode in a finite-width plate was proposed. The proposed sensor has a groove pattern, which is designed based on the lateral wave structure of the targeted Lamb wave mode, on the bottom of the wedge unlike a conventional angle-beam sensor. In order to verify the effectiveness of the proposed method for the selective Lamb wave mode generation, the displacement distributions of Lamb waves propagated in a finite-width plate were measured using a laser scanning vibro-meter system. From the results, it was found that the proposed method could generates a targeted higher-order width mode Lamb wave well whereas a conventional angle-beam sensor employing a wedge with flat bottom surface completely could not generate the higher-order one.