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Self Focusing of 2D Arrays for SHM of Plate-Like Structures Using Time Reversal Operator

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Lamb waves have shown a great potential in structural health monitoring (SHM) of thin plates that are frequently used in engineering structures. Dense transducer networks or active ultrasonic arrays can be employed to generate and receive Lamb waves. Active arrays, however, enable beam steering and can work as spatial filters enabling assessment of large plate areas from a single fixed position.

In this paper a novel method for selective focusing of Lamb waves is presented. The algorithm is an extension of the DORT method (French acronym for decomposition of time-reversal operator) where the continuous wavelet transform (CWT) is used for the time-frequency representation (TFR) of nonstationary signals instead of the discrete Fourier transform.

An application of the proposed method to self focusing of Lamb waves in an aluminum plate is demonstrated both for a linear and a 2D star-shaped array. The 2D star-like array was designed to eliminate the effect of ambiguous mirrored images encountered for linear arrays. The results obtained with both arrays are presented and compared in the paper. It is shown that the decomposition of the time reversal operator obtained with the proposed method enabled separating point like scatters in the aluminum plate and allowed to focus Lamb waves at a desired point.

Ключевые слова:

Содержание.

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