2-D inverse scattering analysis for a defect in authentic stainless steels

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Abstract

Authentic stainless steels are generally used as material of construction for nuclear power plants. The authentic stainless steels are known as one of anisotropic materials. The acoustic anisotropic property [1] sometimes makes it difficult for engineers in the field of ultrasonic nondestructive testing to evaluate a defect in the materials. Therefore, it is desirable to develop an accurate reconstruction method for a defect shape in the authentic stainless steels with acoustic anisotropic property.

In this research, a linearized inverse scattering technique with the aid of the convolution quadrature time-domain boundary element method (CQBEM) has been developed for the reconstruction of a defect shape in authentic stainless steels. The CQBEM is known as more practical numerical method better than the conventional time-domain BEM, because the CQBEM can produce stable numerical solutions [2][3]. The CQBEM is utilized to obtain scattered ultrasound wave data. The wave forms obtained by the CQBEM are adequately treated to implement the shape reconstruction of defects in authentic stainless steels. An inverse scattering [4][5] with the Born inversion is applied to the scattered wave forms. A far field approximation of the fundamental solution derived by Wang and Achenbach [6] is used for this inverse scattering formulation. Numerical examples for a defect in authentic stainless steels are shown to validate the proposed method.

Keywords: Inverse scattering analysis, Time-domain boundary integral equation method, Acoustic anisotropy, Convolution Quadrature Method (CQM)

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