A SINGLE-SIDED ACCESS SIMULTANEOUS SOLUTION FOR ACOUSTIC WAVE SPEED AND SAMPLE THICKNESS FOR ISOTROPIC MATERIALS OF PLATE-TYPE GEOMETRY

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ABSTRACT

In ultrasonic nondestructive evaluation, acoustic waves are used to inspect and characterize materials. Two commonly measured parameters are material thickness and acoustic wave speed in the material. These parameters are related through the common relationship speed equals distance divided by time. The simultaneous wave speed and thickness estimation problem arises when neither the wave speed nor thickness (propagation distance) is known. This thesis presents the initial research completed to evaluate a new solution to the simultaneous acoustic wave speed and thickness estimation problem for isotropic materials of plate-type geometry. The approach is unique in that it is implemented using one single-element transducer with only single-sided access to the material. Models are developed which show that the problem can be solved by introducing a second equation related to field perturbation. The approach is implemented using non-classical ultrasonic measurements (made with existing equipment) along with original analysis software based on the model development. Experimental results are presented in time and frequency, for metallic and non-metallic materials, and for a layered geometry. Results show that wave speed and thickness estimates determined using the new approach compare favorably with classical estimates.