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Optimal Stochastic Excitation for Linear Flaw Detection in a Solid Material.

N. HOUHAT, S. MENIGOT, T.BOUTKEDJIRT, R.Drai, JM. GIRAULT

Abstract: The field of ultrasonic nondestructive testing has known a great development during the recent years. In order to increase the faw detection sensitivity, many improvements have been made in the equipment and the sensors technology. In the present work, the optimal command which maximizes the flaw detection is investigated experimentally. A parametric optimization consisting of finding the optimal excitation frequency which maximizes the Euclidean distance between a reference medium and a medium with a linear faw has been obtained automatically by using the gradient descent algorithm. Moreover, the waveform excitation optimization has been considered. A set of stochastic signals have been transmitted to the medium. A closed loop optimization process based on a genetic algorithm allowed to find the optimal excitation without a priori knowledge on the shape of the signal. This optimal excitation converged to a sinusoidal pulse with the optimal frequency found by the parametric optimization.

Keywords : Optimal command, nondestructive testing, Gradient descent algorithm, Genetic algorithm, Ultrasound