

Characterization of the fluctuations of an ultrasonic wave passing through a complex environment in order to simplify the modeling

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Abstract

Ultrasonic nondestructive testing, also called ultrasonic NDT, is a method for characterizing the thickness or internal structure of material using high-frequency acoustic waves. This technic consists in emitting an ultrasound within the object and detecting the echoes produced by the possible defects. In complex environments, in particular for certain metals, composite materials and concretes, ultrasonic waves are strongly disturbed by the material through which they propagates, which can distort measurements. In order to enhance the contrast of the ultrasounding procedure, it is important to understand the defect echoes due to the noise. Because noise simulation using finite-element methods can be computationally prohibitive, it is important to develop alternative and lighter approaches. In this report, we model these fluctuations as dynamic speckle sequences. These dynamics are generated using stochastic processes. These methods have parameters that we fit with respect to the simulations generated by the CEA.

Keywords: Gaussian processes, speckles, noise, wave fluctuations...

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