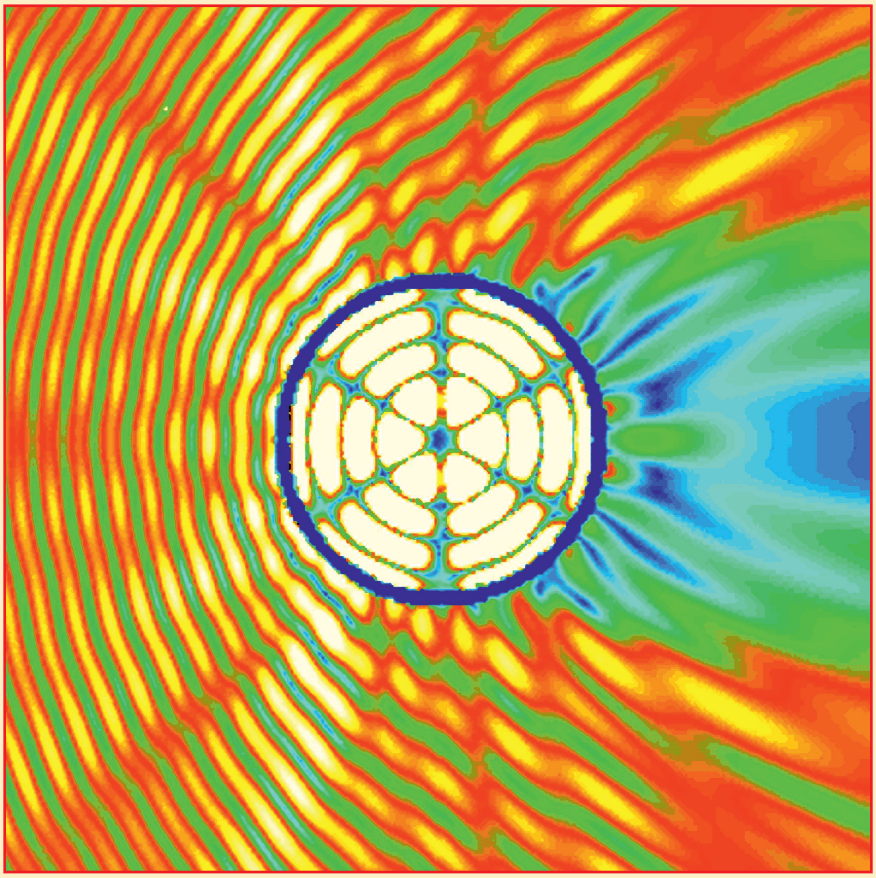
Abstract Booklet



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Quantitative ultrasound imaging under anisotropic conditions: application and perspectives for wood evaluation

Luis Espinosa[1], Loïc Brancheriau[2], Flavio Prieto[3] and Philippe Lasaygues[1]

[1] CNRS LMA Université Aix Marseille, France, [2]Research Unit BioWooEB, France, [3]Universidad Nacional de Colombia, Colombia

In order to manage urban trees in modern cities, operators need tools to evaluate their phytosanitary state [1]. Among the different evaluation protocols, acoustic and ultrasound non-destructive imaging methods have been recently used to analyze the inner structures of trees without altering their condition [2]. Here we are concerned about evaluating the influence of the anisotropic condition in wood on the tomography image reconstruction using ultrasonic waves, and more precisely, how the tomography image reconstruction process (inverse problem) should be adapted to the standing tree constraints. The aim of this study is to present strategies for the solution of the inverse problem in anisotropic media such as wood (and therefore adapt it to other analogous materials, such as bone for example). Considering ultrasonic time-of-flight tomography, ray paths are not known a priori, then the solution to the inverse problem requires an optimization procedure to adapt iteratively the trajectories, via a raytracing model, to minimize a function of the time-of-flight and the trajectories. Then, for each pixel in each trajectory, the corresponding slowness value can be used to calculate the inner wood mechanical parameters, using the Christoffel equation. Compared to the images obtained using the hypothesis of isotropic condition, the proposed method resulted in a more accurate defect identification, adapting the curved rays to the defect presence and delivering a parametric image more suitable for the diagnostic process (Fig. 1). In the longer term, the idea of considering all the physical phenomena involved could make it possible to achieve a much better characterization of the wood material. A potential method to address this strategy is the Full Waveform Imaging (FWI) method [3].