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Non-Destructive Testing of Wood by Wave Propagation

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In this paper the determination of the material properties of a rectangular wooden bar will be presented and the detection of defects in the bar will be discussed. Wood is modeled as an orthotropic material. The material properties of the bar are evaluated using dispersion curves. The dispersion curves of the bar are determined theoretically by the semi-analytical finite element method and experimentally from measurements. The material properties of the bar are determined using parametric model fitting. A numerical finite difference model with second- and fourth-order approache is developed. To detect a defect in the wooden bar a numerical time-reversal experiment using the finite difference model is discussed. By this method, structural waves in the bar are excited in an experiment and the displacements are recorded in several points. The determined material properties of the wooden bar are applied to the numerical model and the recorded signals are played back. The waves interfere just at the position of the defect.

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