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IDENTIFICATION OF THE ELASTIC PROPERTIES OF PARTICLE BOARDS AND STOCHASTIC SIMULATION OF WOOD-BASED FURNITURE

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In furniture industry, the numerical simulation allows the design and optimization of wood-based structures, thus avoiding expensive experimental campaigns. Most of wood-based furniture present some particular features in terms of material properties and geometries. On the one hand, the properties of timber materials (such as particule boards) are strongly heterogeneous and anisotropic. On the other hand, the furniture are often made of simply-shaped elements and then can be represented by an assembly of plates and/or beams. The present work deals with those specific features and presents the identification of the elastic properties of particle boards from digital image correlation (DIC) [1] as well as the simulation of the mechanical behavior of furniture.

First, three-point bending tests based on Timoshenko's beam theory are performed on different samples cut from a prototype desk for the identification of the material properties using DIC techniques. Secondly, a probabilistic model for the uncertain material parameters is constructed by using the Maximum Entropy (MaxEnt) principle [2] combined with a Markov Chain Monte-Carlo (MCMC) method based on Metropolis-Hastings algorithm for generating realizations of the underlying random variables. Thirdly, numerical virtual tests are performed to propagate the uncertainties in the material properties through the model and assess the impact of such variabilities on the response of the structure. Lastly, several real tests were previously conducted on the desk in order to validate the proposed numerical approach. Quite good agreement is observed between the numerical computations and the experimental measurements.

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