Effective Properties of Wood

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Abstract

The present paper is concerned with the derivation of effective properties of both the softwood and hardwood while taking into account its microstructure on various scales. At the level of wood cell the analytical homogenization is adopted [1]. To address the influence of microfibril angle the theoretical approach is combined with experimental measurements in the solution of a certain inverse problem. To that end the measurements provided by nanoindentation at the level of wood cell as well as by indentation at the structural level are exploited. The influence of wood anisotropy on the prediction of microfibril angle is also examined by comparing the isotropic and anisotropic theory of indentation [2]. The complex structure of the porous phase is then explored in the next homogenization step. There, the data provided by X-ray microtomography are utilized. As for numerical analysis the extended finite element method is called to overcome the difficulty with meshing a highly irregular internal structure of the mesoscopic representative volume element. Samples of beech, pine and spruce wood are considered in the present study to promote applicability of the proposed hierarchical computational strategy for a variety of wood.

References

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