A Dynamic Inelastic Material Model for Wooden Structures at Finite Deformation

Supriatna. Dennie[†] and Kaliske. Michael[†]

[†] Institut für Statik und Dynamik der Tragwerke
Technische Universität Dresden
Georg-Schumann-Str. 7, 01062 Dresden, Germany
e-mail: michael.kaliske@tu-dresden.de, web page: https://tu-dresden.de/bu/bauingenieurwesen/sdt

ABSTRACT

The dynamic behaviour of wooden material is significantly different from the quasi-static case, especially in the range of finite deformations. During quasi-static loading, after reaching the yield plateau, the elastic unloading tangent undergoes stiffness reduction due to damage mechanisms of wood. For the dynamic case, besides this reduction, the increase of static characteristics like compressive strength, modulus of elasticity etc. is observed due to the strain rate effect, which in turn will cause yield surface shifting. This shifting process comes from two main factors: the micro-inertial effect and the strain rate dependency of the material. In this paper, an inelastic material model for wooden structures is proposed which is able to characterize not only the anisotropic behaviour of the material but also the dynamic behaviour in the finite deformation state. At the end of the paper, a numerical application of the proposed material model for the case of impact loading is presented. Therefore, a wave propagation in wooden structures will be simulated with an appropriate time integration method like the Bathe-Approach and the Three-Point-Backward-Euler-Method.