Adhesive Bonding of Structural Hardwood Elements

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	CLT (Cross-Laminated Timber)
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Summary:

The current research investigated the delamination process of adhesively bonded hardwood (European beech) elements subject to changing climatic conditions. For the study of the long-term fracture mechanical behavior of gluedlaminated components under varying moisture content, the role of moisture development, time- and moisture-dependent responses are absolutely crucial. For this purpose, a 3D orthotropic hygro-elastic, plastic, visco-elastic, mechano-sorptive wood constitutive model with moisture-dependent material constants was presented in this work. Such a comprehensive material model is capable to capture the true historydependent stress states and deformations which are essential to achieve reliable design of timber structures. Besides the solid wood substrates, the adhesive material also influences the interface performance considerably. Hence, to gain further insight into the stresses and deformations generated in the bond-line, a general hygro-elastic, plastic, visco-elastic creep material model for adhesive was introduced as well. The associated numerical algorithms developed on the basis of additive decomposition of the total strain were formulated and implemented within the Abaqus Finite Element (FE) package. Functionality and performance of the proposed approach were evaluated by performing multiple verification simulations of wood components, under different combinations of mechanical loading and moisture variation. Moreover, the generality and efficiency of the presented approach was further demonstrated by conducting an application example of a hybrid wood element.

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