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Analysis of single dowel type connection using cohesive zone modelling

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The paper focuses on strength analyses of dowel-type timber connections. The European Yield Model [1] assumes perfect plasticity and provides strength limits for the a priori assumed failure modes. This paper aims at prediction of failure modes based on detailed numerical analysis using ABAQUS software both with plane stress and solid continuum finite elements. The Tsai-Wu failure criterion is used for assessment of the strength of the connections while non-linear analysis of the failure propagation is introduced using cohesive zone modeling. Sensitivity analyses of the parameters of the model are performed andtThe results are validated against experimental data from [2]. Ranges of applicability of plane stress and solid element models are established (with respect to simulation) for different modes of failure.

The established criteria for the various failure modes show different localizations depending on the geometry and friction parameters among others. A parametric study for the best fitting of fracture propagation parameters were made and compared to literature data. The ability of the cohesive zone model to predict the behaviour of dowel-type connections was evaluated. The limitations of the reproduced failure modes obtained with cohesive zone [3] models combined with Tsai-Wu failure criterion are discussed.

The numerical simulations show the domain of geometrical parameters for which certain failure modes occur. Better understanding of the mutual influence of geometrical and material parameters can contribute to improve the current design guidelines and a new proposal is outlined.

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