3D Finite Element Model for Shear Stiffness of Wood-Wood Connections for Engineered Timber Panels

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With the development of automated design and fabrication tools, researchers have shown a growing interest for traditional timber joining techniques. Innovative wood-wood connections, referred to as integral mechanical attachments, have been developed and successfully applied to full-scale building structures. However, it has been shown that these connections highly influence the mechanical behavior of structures. The mechanical behavior of the connections themselves therefore needs to be investigated. Numerical modelling is largely used for complex structural analysis problems when analytical solutions are either cumbersome or non-existent. Furthermore, it has the potential to replace expensive and time-consuming experimental tests, for which a limited number of parameter combinations can be tested. For the numerical modelling of timber connections in particular, various studies have been carried out because of the difficulty to achieve analytical models. However, numerical modelling of timber remains arduous due to the anisotropy and inhomogeneity of timber, with largely different mechanical properties parallel and perpendicular-to-grain. In this paper, a 3D finite element model predicting the shear stiffness of wood-wood connections is presented. It is based on models developed by Sandhaas for timber joints [1] and Roche et al. for the study of the rotational stiffness of multiple tab-and-slot joints [2]. In this paper, instead of modelling each layer of engineered timber panels with its orientation (longitudinal layers at 0° and crosswise layers at 90°), a single material with the thickness of the timber panel was used, allowing to extend the model for a larger range of engineered timber panels. The model was compared to experimental tests performed on a shear testing setup. Promising results were obtained when comparing experimental tests to the numerical model. However, the model showed limitations for some configurations of joints.

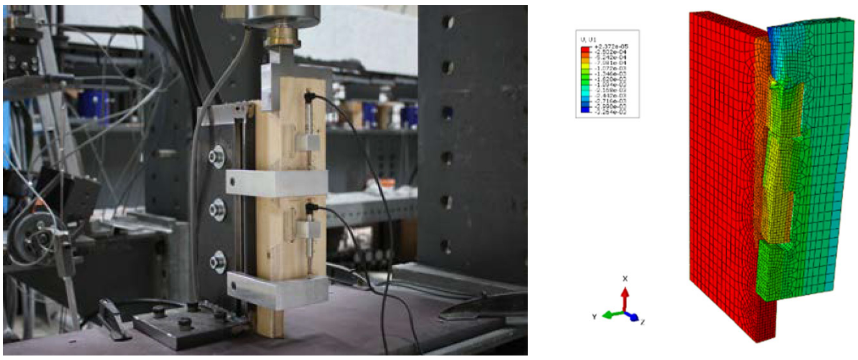

Figure 1: Shear testing setup [3] *(left)* and 3D finite element model of the tested configuration *(right)*

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References

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