# Non-linear analysis of dowelled timber connections: a new approach for embedding modelling

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## ABSTRACT

*A finite element modelling is developed to analyse the behaviour of timber connections taking into account the plastic behaviour of the timber beneath the fasteners. The local non linearities control the stiffness and the load-carrying capacity of the timber joints. It results in interaction effects on the stress states in the timber and the load distribution among the fasteners that can lead to brittle failure modes such as the block shear failure. This paper presents a new approach based on the development of a pseudo three-dimensional model for the timber in the vicinity of the fasteners. According to the observed behaviour, this finite element model was developed to describe the geometrical and mechanical non-linear behaviours at the micro-scale of the wood beneath the fasteners. Considering the orthotropic behaviour of the timber, the timber around the fasteners is modelled as a structure made up of elementary finite elements. The model accounts also for the friction, the contact and the various irreversible deformations which appear within the timber. An analysis of the embedding behaviour is carried out for three species: spruce, hem-fir and iroko. The comparison of experimental and simulated results shows that this new approach provides a good approximation. An additional sensibility analysis calibrates the model efficiency for coupling the fastener deformation and the timber stresses in the analysis of timber connections.*

## KEYWORDS

*Non linear analysis - Dowelled timber connection - Finite-element method - Contact.*