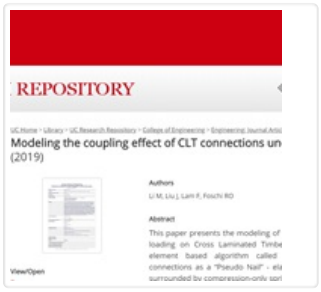

Modeling the Coupling Effect of CLT Connections Under Bi-Axial Loading

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Summary:

This paper presents the modeling of coupling effect of tension and shear loading on Cross Laminated Timber (CLT) connections using a finite element based algorithm called HYST. The model idealizes the connections as a “Pseudo Nail” - elastoplastic beam elements (the nail) surrounded by compression-only spring elements (steel sheath and wood embedment). A gap size factor and an unloading stiffness degradation index of the spring elements under cyclic loading were integrated into the optimized HYST algorithm to consider the coupling effect. The model was calibrated to compare with 32 configurations of CLT angle bracket and hold-down connections tests: in tension with co-existent constant shear force, and in shear with co-existent tension force. The results showed that the proposed model can fully capture the coupling effect of typical CLT connections, considering strength degradation, unloading and reloading stiffness degradation, and pinching effect. The model provided a useful tool for nailbased timber connections and a mechanism-based explanation to understand the hysteretic behaviour of CLT connections under bi-axial loading.

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