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MULTI-SCALE STRUCTURAL MECHANICS FOR THE MODELLING OF CROSS-LAMINATED TIMBER BUILDINGS

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Over the last two decades, cross-laminated timber (CLT) has been gaining popularity in residential applications, mainly in Europe and North America. CLT is a relatively new building system based on structural panels made of several layers of boards stacked crosswise and glued together on their faces [1]. As CLT panels are light-weight structural elements with high stiffness and strength to bending, compression and shear, they are an economically competitive building system when compared to traditional options and therefore, are a suitable candidate for some applications which currently use concrete, masonry and steel.

In this work we review some recent applications of multi-scale modelling strategies adopted to capture the structural response of CLT. In order to determine the mechanical properties of CLT, a computational homogenisation scheme based on the volume averaging of the stress and strain fields over a representative volume element (RVE) of material is adopted. Periodic kinematical constraints are imposed on the RVE boundary domain. Here, the periodic repetition of the RVE generates the entire heterogeneous macro-continuum at each material scale. As we are interested in improving the predictions of our computational multi-scale simulations, we follow a Genetic Algorithm-based optimisation technique to calibrate the micro-mechanical parameters [1]. We analyse CLT walls subject to different loading conditions. In particular, we pay attention to the modelling of CLT buildings and their collapse. Some of our numerical predictions are compared with experimental results and are validated successfully.

REFERENCES

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