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ESTIMATION OF GLT BEAM STIFFNESS BASED ON HOMOGENIZED BOARD MECHANICAL PROPERTIES AND COMPOSITE BEAM THEORY

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Since wood is a naturally grown material, high variability of mechanical properties characterizes Glued Lamitated Timber (GLT) beams. Nowadays, enhanced and reliable grading technologies (like laser and X-ray scanners) allow the collection of high-resolution information on the local mechanical properties of wood [2] which can be exploited within advanced strategies for the prediction of GLT beam stiffness and strength. In particular, [1] exploits high resolution laser scanning data for the recognition of local fiber orientation on the boards surfaces, determines the mechanical properties of clear wood on the basis of a micro-mechanical model, and use the collected information within an accurate 2D Finite Element (FE) analysis that turns out being extremely effective in predicting the GLT beam stiffness, but computationally too expensive.

Aiming at bypassing the bottleneck of heavy computations, this contribution uses an enhanced composite beam theory for the estimation of the GLT beam bending stiffness. According to the procedure proposed in [1], the boards mechanical properties are determined on the basis of a micro-mechanical model and homogenization techniques take account of the local fiber orientation. An accurate reconstruction of stress distributions within the cross-section are applied and an energetically consistent evaluation of the shear correction factor is considered. The resulting composite beam theory has the capability to provide estimates with an accuracy similar to 2D FE and, since it needs negligible computational effort, it could represent a promising tool for the development of enhanced and fast grading methods for GLT beams.

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