

MWP – Young Researcher Abstract 2025

Project title: Multi-level modelling of the mechanical properties of wood products	
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Abstract (approx. 200 words): The mechanical behavior of wood is shaped by its multiscale structure. This complexity presents a major challenge to accurate modeling and predicting the mechanical performance of wood, particularly in structural or engineered wood products. However, traditional single-scale modeling approaches fail to capture interactions across different structural scales of wood. My research develops a multiscale modeling framework that links wood's cellular and tissue-scale structure to the macroscale, enabling more accurate predictions of mechanical properties. Additionally, 4D X-ray micro-CT scanning is combined with in-situ mechanical testing to investigate how microstructural features influence bulk behavior and to validate the numerical model. This approach pinpoints anatomical features that are critical for strength and stiffness, enabling a more structure-informed approach to predicting wood performance. These structure-property relationships guide the development of stronger, more resource-efficient wood products and even sustainable biomimetic materials. The multi-scale models can be applied in the forestry and timber industries to better match wood resources with their optimal uses, thereby reducing over-engineering and waste of wood material.	
Key words: Fundamental research, Wood mechanics, Multi-level structure, 4D X-ray CT, Modelling	