FAKULTÄT FÜR
BAU- UND UMWELTINGENIEURWESEN
INSTITUT FÜR MECHANIK DER
WERKSTOFFE UND STRUKTUREN

WoodComp3D

Master's Thesis

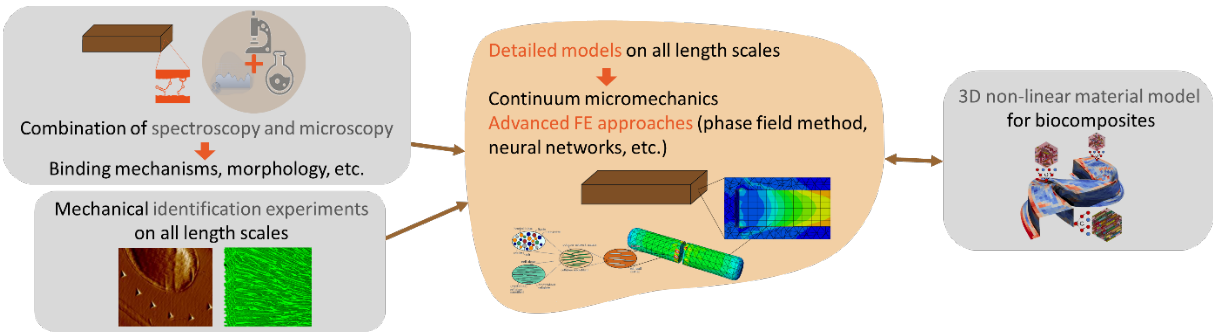
Advanced simulation approaches for wood-based biocomposites

The Christian Doppler Laboratory for Next-Generation Wood-Based Biocomposite (WoodComp3D) develops processes for producing and characterizing sustainable biocomposite materials based on sawmill by-products. Our goal is to create a biocomposite material using the main constituents of wood (wood fibers, lignin, extractives, etc.) with significant mechanical properties and, in parallel, a production and design concept for next-generation biocomposite elements.

Thus, the development of computational simulation tools in the early stages plays a crucial role, enabling the development and optimization of the new material in a targeted manner. Therefore, we investigate how to efficiently link continuum micromechanics and advanced FE approaches using artificial neural networks.

In this thesis, on the one hand, existing models will be used to investigate the limits of their applicability, and on the other hand, new building blocks will be implemented to represent different types of failure mechanisms (interface failure, brittle/ductile failure mechanisms, etc.). Several modeling approaches are already available in our research group (continuum micromechanics, non-linear FE implementations, phase-field method, artificial neural networks, etc.). The work will be embedded in an interdisciplinary team of civil engineers, process engineers, and chemists, building up the knowledge for such a new wood-based biocomposite material, both experimentally and by using simulation tools, to not only create a new material itself but also to develop material models for biocomposites. Such models can then be used to optimize the material and develop new types of biocomposite product designs.

A part of this thesis is implementing numerical simulation models. Therefore, a good knowledge of the finite element method and a programming language, such as Python, Julia, or MATLAB, is required.



This thesis will contribute to the advanced simulation approaches (middle), which use information from the interdisciplinary team of the CD laboratory (left) to develop detailed models on different length scales to obtain 3D non-linear material models for biocomposite materials (right).

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For more information on the CD laboratory, please see: https://woodcomp3d.at