STATIK DYNAMIK

RUB

Master Course: BI-W 35 & CE-W 04

Recent Advances in Numerical Modeling of Laminar Composites and Mass Timber Structures Using Layered Finite Elements

18. June 2024 – 2:00 PM – IC 6 156/90

Miroslav Marjanović, PhD Civil Eng.

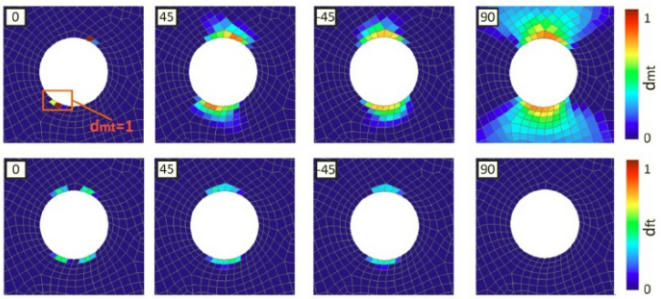
Assistant Professor, Vice-Dean for Science and Research, University of Belgrade (Serbia),
Faculty of Civil Engineering, Chair of Engineering Mechanics and Theory of Structures

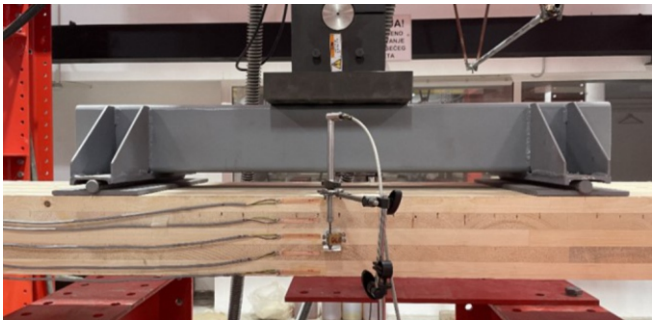
Due to their outstanding strength and stiffness, low maintenance costs and high corrosion resistance, fiber-reinforced composite materials have been widely used in the construction of mechanical, aerospace, marine and automotive structures, having a growing use in civil engineering, as well. Laminar composites may fail through various scenarios, such as fiber breakage and pull out, matrix yielding and cracking, among others, and their ultimate strength and failure mechanisms depend on geometrical factors and material properties.

Cross-laminated timber (CLT) panels have an increasing market share and extensive application in civil engineering, as full-size walls or light floor structures. Due to their low environmental impact, excellent thermal characteristics and high mechanical performance, they are being extensively applied instead of conventional mineral-based building materials.

Prof. Marjanović will present the original incorporation of the smeared crack band (SCB) damage model within the full layer-wise theory of laminar composites (FLWT), to contribute to the increase of the computational efficiency of the progressive failure analysis of open-hole laminar composites loaded in tension/compression. He will highlight some limitations of the current computational models for CLT and present the application of the FLWT-based layered finite elements. The computational framework to be presented can be used for structural design of mass timber according to Eurocode 5.

Finally, main steps involved in the development of an object-oriented computational framework (FLWTFEM), for the 3D bending and free vibration analysis of multilayer plates, will be presented. The framework is based on MATLAB, while the pre- and post-processing phases are performed using GiD. The proposed solver is characterized by a fast assembly procedure of sparse matrices using matrix vectorization, and a novel algorithm for the evaluation of interlaminar stresses satisfying continuity at layer interfaces.





Miroslav Marjanovic graduated in 2009 (Steel Structures), completed the MSc (Composite Structures of Steel & Concrete) in 2010 and PhD studies (Computational Mechanics of Composite Materials) in 2016, from the Faculty of Civil Engineering, University of Belgrade. He was the Scholar of the SEEFORM Program during 2012-2015 and spent 7 months during the PhD studies at RUB. Since 2016, he is Assistant Professor in Engineering Mechanics and Theory of Structures at the Faculty of Civil Engineering, University of Belgrade, while from 2021 he serves as a Vice-Dean for Science and Research. His research interests include: theory of laminar composites, nonlinear structural analysis, structural vibration, finite element and dynamic stiffness methods.

Miroslav Marjanovic coauthored more than 20 journal articles and 40 conference papers, with more than 300 SCOPUS citations and h=12.