

ADMISSION TO DOCTORAL STUDIES

Session September 2026

Field of doctoral studies: Forest Engineering

Doctoral supervisor: Prof. dr. eng. Mariana Domnica STANCIU

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: *Research on the utilization of fractal descriptors of woody species in the design and testing of biomimetic structures printed through additive manufacturing*

Contents / Main aspects to be considered

Characterization and digital extraction of the macro- and micro-structure of woody species across the three main sections (transverse, radial, tangential) (types of macroscopic and microscopic anatomical elements of wood, physical and mechanical properties, classification of wood based on pore arrangement)

Generation/design of CAD models with fractal geometries extracted from different wood species (identification of pore arrangement patterns, distribution density, scaling of geometric dimensions – distances between pore centers, diameters, etc.; design of representative volume elements)

Advanced Additive Manufacturing of biomimetic models

Mechanical, Dynamic, and Acoustic Characterization of biomimetic structures.

Recommended bibliography:

Ball, P. (2009) Shapes: Nature's Patterns: A Tapestry in Three Parts; OUP Oxford: Oxford, UK.

Vincent, J. F.V.; Bogatyreva, O. A.; et al (2006) Biomimetics: its practice and theory. J. R. Soc. Interface. 3471–482 <http://doi.org/10.1098/rsif.2006.0127>.

Mcnulty, T.; Bhate, D.; Zhang, A.; Kiser, M.A.; et al (2017) Framework for the Design of Biomimetic Cellular Materials for Additive Manufacturing. In Proceedings of the 28th Annual International Solid Freeform Fabrication Symposium, Austin, TX, USA, 7–9 August 2017; pp. 2188–2200.

Zhao, M.; Li, X.; Zhang, D. Z.; Zhai, W. (2023) Geometry effect on mechanical properties and elastic isotropy optimization of bamboo-inspired lattice structures, Additive Manufacturing, Vol.64:103438

Park, K-M.; Min, K-S.; Roh, Y-S. (2022) Design Optimization of Lattice Structures under Compression: Study of Unit Cell Types and Cell Arrangements. Materials. 15(1):97.

Prerequisites / Remarks: *knowledge of the anatomy, physical, mechanical and chemical properties of wood; knowledge of the anisotropic characteristics of wood; CAD design skills*

✓ **Scientific Doctorate**

✓ **Professional Doctorate**

✓ **without tuition fee (state budget funded)**

✓ **with tuition fee or with funding from other sources than the state budget**

TOPIC 2: *Research on the physical, mechanical and chemical properties of naturally coloured wood*

Contents / Main aspects to be considered

Types of natural wood discolorations (classification, inventory, woody species)

Chemical analysis of discolored zones compared to the control wood/sample

Mechanical testing of discolored wood samples

Applications of defective wood (high-value utilization)

Recommended bibliography:

Li, R.; Li, J.; Shi, J.; Zhang, Y.; Sun, Y.; Chen, Y.; Liu, Z. Fluorescence Properties of *Pterocarpus* Wood Extract. *Forests* **2023**, *14*, 1094. <https://doi.org/10.3390/f14061094>

Zhang, H.T.; Nesterov, E.E. Novel solid-state fluorescent chemosensors based on the photoexcitation energy migration: General design and applications. In *Abstracts of Papers of the American Chemical Society*; American Chemical Society: Washington, DC, USA, 2006; Volume 231

Krishnamoorthy, G. Fluorescence spectroscopy for revealing mechanisms in biology: Strengths and pitfalls. *J. Biosci.* 2018, *43*, 555–567.

Krishna S, Chowdhury KA (1935) Fluorescence of wood under ultraviolet light. *Indian Forster* 61: 221–228

Peters, F. B.; Rapp, A. O. (2021) Wavelength-dependent photodegradation of wood and its effects on fluorescence. *Holzforschung*, vol 76, no.1, pp. 60–67. DOI 10.1515/hf-2021-0102

Prerequisites / Remarks: *knowledge of the anatomy, physical, mechanical and chemical properties of wood; knowledge of the anisotropic characteristics of wood;*

✓ **Scientific Doctorate**

✓ **Professional Doctorate**

✓ **without tuition fee (state budget funded)**

✓ **with tuition fee or with funding from other sources than the state budget**

TOPIC 3: *Research on the multisensory effects of wood in correlation with the physical properties of woody species*

Contents / Main aspects to be considered

Characterization and digital extraction of the physical properties of woody species from the Romanian Xylotheque, types of macroscopic and microscopic anatomical elements of wood, and selection of woody species samples

Measurement of physical parameters (color, light), tactile parameters (roughness), and acoustic parameters (propagation velocities, natural frequencies)

Multisensory effects of woody species on human subjects (types of sensory perceptions – sensations, development of the testing/investigation methodology for different types of sensations, statistical analysis of perception questionnaires, and correlations between objective measurements [instrumental] and subjective assessments [survey-based])

Recommended bibliography: Ikei H, Song C, Miyazaki Y. Physiological Effects of Touching Wood. Int J Environ Res Public Health. 2017 Jul 18;14(7):801. doi: 10.3390/ijerph14070801. PMID: 28718814; PMCID: PMC5551239 Ikei H., Song C., Miyazaki Y. Physiological effects of wood on humans: A review. J. Wood Sci. 2017;63:1–23. doi: 10.1007/s10086-016-1597-9 Guest S, Dessirier JM, Mehrabyan A, Mcglone F, Essick G, Gescheider G, Fontana A, Xiong R, Ackerley R, Blot K (2011) The development and validation of sensory and emotional scales of touch perception. Attention, Perception & Psychophysics 73(2):531-550. doi: 10.3758/s13414-010-0037-y Lipovac D, Burnard MD (2020) Effects of visual exposure to wood on human affective states, physiological arousal and cognitive performance: A systematic review of randomized trials. Indoor Built Environ 0(0):1-21. doi: 10.1177/1420326X20927437 Zhang, Y., Xiong, W., Guo, Y., Wei, P., and Yi, S. (2025). "Multimodal evaluation of warmth perception in wood: An experimental study based on visual, tactile, and visual-tactile interactions," BioResources 20(3), 7495–7513.	
Prerequisites / Remarks: <i>Knowledge of the physical and structural properties of wood; Knowledge of the types of sensations and perceptions</i>	
✓ Scientific Doctorate	
✓ Professional Doctorate	
✓ without tuition fee (state budget funded)	
✓ with tuition fee or with funding from other sources than the state budget	

TOPIC 4: <i>Anatomical, physical and mechanical properties of Piptocoma Discolor (Pigüe) wood in relation to its potential applications</i>	
Contents / Main aspects to be considered <i>State of the art on Piptocoma discolor (Pigüe) wood</i> <i>Macroscopic and microscopic characterization of wood samples of Piptocoma discolor (Pigüe) wood</i> <i>Analysis of physical-mechanical and acoustic properties</i> <i>Applications of the use of Piptocoma discolor (Pigüe) wood</i>	
Recommended bibliography:	
Prerequisites / Remarks: <i>knowledge of the anatomy, physical, mechanical and chemical properties of wood; knowledge of the anisotropic characteristics of wood;</i>	
✓ Scientific Doctorate	
✓ Professional Doctorate	
✓ without tuition fee (state budget funded)	
✓ with tuition fee or with funding from other sources than the state budget	

Doctoral supervisor,

Prof. dr. ing. Mariana Domnica STANCIU

Signature

Coordinator of the field of doctoral studies,

Prof. dr. ing. Camelia COȘEREANU

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