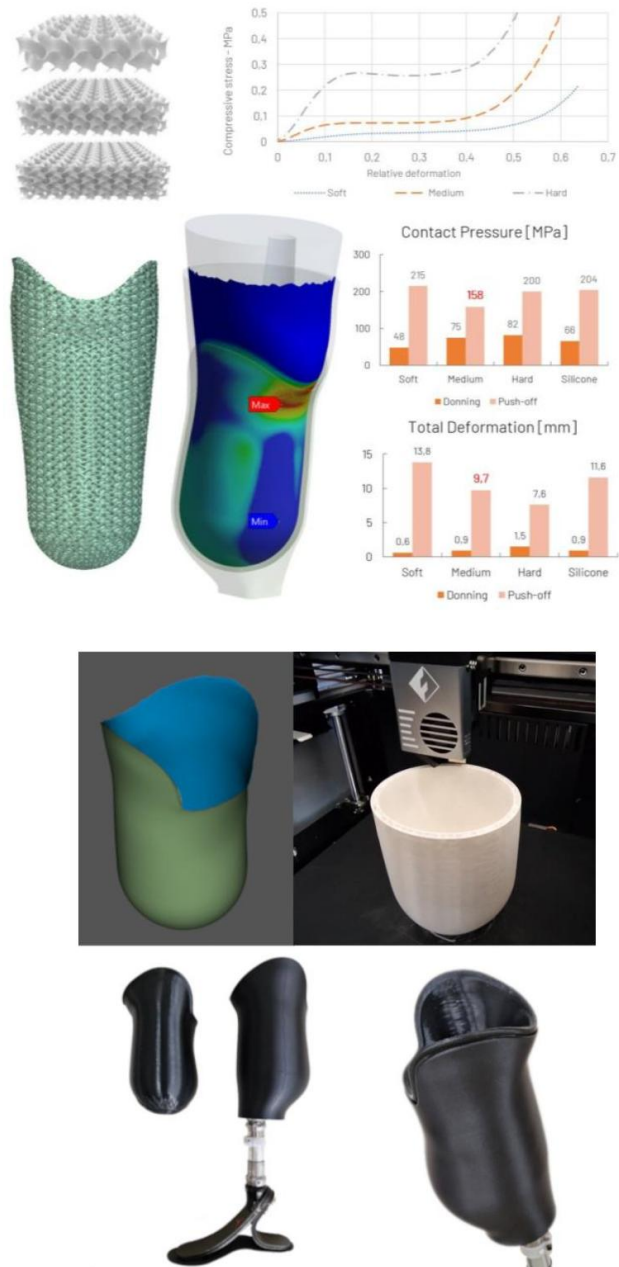


Advancing Prosthesis Design: Leveraging Integrated CAD/CAM/CAE Technologies and 3D Printing for Improved Fit, Safety, and Performance

Abstract

In this invite lecture, it will be discussed how recent advances in integrated design and computer-aided technologies (CAD/CAM/CAE) with 3D printing manufacturing technologies seem to offer promising solutions for improving the prostheses fit, safety, and performance. The development of numerical models has surged in the last decade, allowing for complex biomechanical evaluation and analysis of the limb-prosthesis system without producing physical prototypes, further enhancing the fit, comfort, stability, and performance of prostheses. Creating an accurate numerical model that includes all biological components using current technologies is not possible; therefore, simplifying the model's complexity is necessary. These limitations have led researchers to develop simplified models that are difficult to validate through experimental testing. Due to variations in geometry, measurement techniques, material models, and loading cases, both numerical analysis and experimental measurements still lack consistency in their results. Hence the workshop will focus on the proposed development of a target population transtibial dynamic numerical model, which would allow the improvement and innovation in prosthesis design and would transfer the trial-and-error workshop process of prosthesis development into the digital environment without the need for expensive prototypes. Invited lecture will also focus on incorporating novel 3D printing technologies to manufacture comfortable and safe prostheses using 3D printing with recyclable plastics and present the possibilities to experimentally test and validate the proposed designs using robotic systems.



Asist. Prof. dr. Gregor Harih – bio



Gregor Harih is an Assistant Professor of Biomechanics, Mechanical Design, Industrial Design, Ergonomics, and Reverse Engineering at the Faculty of Mechanical Engineering, University of Maribor, Slovenia. He holds a Ph.D. in Computer Modelling of Technical Systems from the same university, and his research interests lie in the field of ergonomics and biomechanics, where he focuses on the development of digital human models for ergonomic product design and the investigation of the various biomechanical systems using finite element analysis.

In addition to his current role, he has also held several other positions, including Visiting Researcher at the University Rehabilitation Institute Soča in Ljubljana, Slovenia, where he worked on the research and development of new intelligent materials for prosthetic liners and rehabilitation gait devices. He was also a Post-Doc Researcher at the Slovenian Research Agency (ARRS) and Faculty of Mechanical Engineering, University of Maribor, where he developed a

finite element digital human hand model for ergonomic product design. Furthermore, he spent time as a Visiting Researcher at the National Institute of Advanced Industrial Science and Technology in Tokyo, Japan, where he worked on the development of a full hand digital human hand model based on the finite element method.

Dr. Harih's research contributions have been recognized with numerous honors and awards, including the Danubius Young Researcher Award for Best Researcher of the Danube Region in 2019, a Recognition Award for Research, Artistic and Educational Work from the University of Maribor in 2019, and a Recognition Award for Early Career Researcher from the Faculty of Mechanical Engineering, University of Maribor in 2018. He is a member of several committees and editorial boards, including the Technical Committee for Digital Human Modeling and Simulation of the International Ergonomics Association, and he also mentors junior researchers and Ph.D. students.