

Innovations in Robotic Sanding and Polishing Systems

Advances in robotic sanding and polishing have led to significant improvements in surface finishing quality, consistency, and overall process efficiency. A key challenge in these operations is ensuring precise control over tool engagement while maintaining desired surface characteristics. To address this, recent developments have focused on process monitoring, real-time force control, and adaptive path planning techniques that enhance performance and reliability of sanding or polishing processes. This presentation will cover state-of-the-art methods in robotic sanding and polishing, focusing on force control, and direct and indirect process monitoring approaches aimed for tool condition and surface quality estimation in real-time. Automated path planning strategies, including pre-programmed and adaptive trajectory generation, will be discussed in the context of optimizing tool interaction and ensuring uniform surface quality. Presentation will also address the development of ARCOPS robotic cell, a specialized system for robotic sanding and polishing that integrates both direct and indirect process monitoring subsystems. Key system capabilities, case studies, and real-world applications will be presented. Attendees will gain insights into the latest technological advancements and practical implementations of robotic surface finishing.



Tomislav Staroveški was born on February 21, 1981, in Zagreb, where he completed his primary education and later attended the I. Technical School "Tesla". At the end of his secondary education, he won second place in the 41st Young Technicians Competition of the City of Zagreb and received a distinction for inventiveness at the 4th Inter-County Exhibition of Selected Graduation Projects of Secondary School Students in Electrical Engineering in the field of computer-controlled processes.

In 1999, he enrolled at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb (FSB), majoring in Mechanical Engineering. In 2005, he won a gold medal at the 30th Croatian Innovation Exhibition INOVA 2005. He graduated in May 2007, specializing in Automation and Robotics, with a thesis titled *Machine Vision in Industrial Robot Guidance*.

In November 2007, he enrolled in postgraduate studies in Mechanical Engineering at the Faculty of Mechanical Engineering and Naval Architecture, specializing in Robotics and Automation. That same year, he began working as a junior research assistant at the Chair of Machine Tools, Department of Technology, FSB. In 2009, he was awarded the FESTO Young Researchers and Scientists Support Scholarship. He earned his PhD at FSB in May 2013 with a dissertation titled *Wear Modelling of a Medical Drill*.

At the same Department, he also worked as a senior research assistant from May 2013 to May 2016, and assistant professor from May 2016 to December 2021. Since then, he has been employed as an associate professor. He actively participates in teaching multiple courses at the Faculty, focusing on the mechanical and control system design of machine tools, as well as machining process monitoring.

He is a member of the Croatian Association for Production Engineering (HUPS) and the organizing committee of the *International Scientific Conference on Production Engineering (CIM)*, organized by HUPS and the PTW Institute from Darmstadt. Since 2020, he has been a member of the editorial board of the journal *Transactions of FAMENA*.

His research focuses on production and medical engineering. To date, he has authored or co-authored 41 scientific and professional papers, as well as one EU/US patent. He has also participated in over 14 technological and scientific projects funded by the EU and the Government of the Republic of Croatia.