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20th CIRP Conference on Modeling of Machining Operations

Editorial

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This volume of Procedia CIRP contains the proceedings of CIRP CMMO 2025, the 20th CIRP Conference on Modeling of Machining Operations.

Manufacturing and machining play a pivotal role in contributing to the GDP. In the era of Industry 4.0, the sector encounters both challenges and opportunities to enhance efficiency and productivity while progressing towards sustainable manufacturing. Modeling has become indispensable in the design, development, and production of goods, directly facilitating the sector's digital transformation by enabling virtual setup and process optimization. Despite the critical importance of analytical, numerical simulation and process improvement, experimental validation remains an essential step. The synergy between modeling and testing is vital, especially in countries with high labor costs, which underscore the need for increased efficiency and digitalization.

Founded in 1951, CIRP, the International Academy for Production Engineering, is the world's leading organization in production engineering research. It stands at the forefront of the design, optimization, control, and management of processes, machines, and systems. The academy comprises approximately 600 academic and industrial members from around the globe. Established in 1998 by Prof. I.S. Jawahir, CIRP CMMO is a prestigious conference dedicated to the modeling of machining operations. It provides an excellent platform for experts from both academia and industry to share knowledge, discuss, and present their latest developments and findings.

This occurrence of CIRP CMMO marks the 20th edition of the series, with the first ten editions being workshops. Previous conferences have been held successively in Atlanta, USA (1998); Nantes, France (1999); Delft, The Netherlands (2000); Sydney, Australia (2001); West Lafayette, USA (2002); Hamilton, Canada (2003); Cluny, France (2004); Chemnitz, Germany (2005); Bled, Slovenia (2006); Reggio Calabria, Italy (2007); Gaithersburg, USA (2008); San Sebastian, Spain (2009); Sintra, Portugal (2011); Torino, Italy (2013); Karlsruhe, Germany (2015); Cluny, France (2017); Sheffield, United Kingdom (2019); Ljubljana, Slovenia (2021); and Karlsruhe, Germany (2023). This year, the conference is being hosted for the first time in Belgium, in Mons, through a collaborative effort between the University of Mons (UMONS) and the Katholieke Universiteit Leuven (KU Leuven), exemplifying the unity of research across political and linguistic divides.

Out of the 204 abstracts submitted, the International Scientific Committee, comprising leading researchers in the field, many of whom are from CIRP, has accepted 125 papers following a rigorous review process involving at least two rounds of evaluation. The authors hail from approximately 20 different countries across the globe. This edition of CIRP CMMO has 13 hot topics, ranging from the foundations of modeling to more emerging topics: Numerical, analytical and empirical modeling; Multiphysics and multiscale modeling; Material behavior and tribological aspects in cutting; Artificial Intelligence and digital twins for machining; High performance and hard machining; Machining of additive-manufactured parts and non-metallic materials; Precision, ultra-precision and micro-machining; Grinding, non-conventional and hybrid processes; Dynamics and stability of machining and robotic machining; Monitoring, diagnostics and optimization of machining processes; Sustainable machining; Surface conditioning and surface integrity of machined components; Thermal effects and part distortion. Notably, a substantial number of papers address AI techniques, AM, Sustainability, Hybrid manufacturing or Robotic machining. The papers presented will undoubtedly introduce innovative ideas in the field of machining process modeling, which could provide fresh impetus for the advancement of machining processes.

The Editors extend their heartfelt gratitude to the authors of both accepted papers and submitted abstracts, as well as to the members of the International Scientific Committee, for their time and support in ensuring the high scientific standards of the conference. Special thanks are due to Prof. I.S. Jawahir and Dr. P.-J. Arrazola for their invaluable support and trust.

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