HUNGARIAN JOURNAL OF
INDUSTRY AND CHEMISTRY
Vol. 54(SI) pp. 1–2 (2026)
hjic.mk.uni-pannon.hu

PREFACE OF THE SPECIAL ISSUE OF MANUFACTURING 2025 CONFERENCE

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The Hungarian Scientific Association for Mechanical Engineers (GTE) is proud and delighted to celebrate its 75th anniversary. Over the decades, this vibrant community has grown to encompass thousands of professionals, companies and educational institutions, all united by a shared passion for engineering and dedicated to exchanging knowledge and experiences for mutual benefit.

GTE's structure has evolved continuously over the years, growing alongside its membership, the technologies it supports and the business models that shape the industrial landscape. Members have formed dozens of departments and working groups, which have been complemented by the active involvement of industry leaders seeking new talent from universities and technical schools.

The scientific departments of GTE have adapted to the times by merging, separating and reorganizing in response to scientific progress and technological innovation. One of the most significant outcomes of this evolution is the current Manufacturing Systems Division, formed when smaller units focusing on automated production environments with minimal human input joined forces. As automation and computer-aided industrial processes became a key priority, the division became increasingly active, organizing national and international conferences, congresses and exhibitions on an annual or biennial basis.

We are proud to present the XXVI Manufacturing Conference in 2025. This year marks an exciting milestone as the Manufacturing Systems Division welcomes new sister divisions, which will bring fresh perspectives and opportunities for collaboration. One such division is OPERATOR, which is dedicated to human-centric manufacturing and reflects the global shift in how we envisage the factories of the future. Another is the recently formed Additive Manufacturing Division, which represents the nation's rapid adoption of 3D printing technologies. The recent re-establishment of the Logistics Division further demonstrates the wide range of disciplines that manufacturing encompasses, forming together a comprehensive ecosystem that drives economic and societal prosperity.

These developments encourage us to be ambitious for the future while honoring the legacy of the scientists, professors and experts who established our field. Today, GTE continues to bring together young and experienced engineers, universities, research institutions and companies of all sizes. At the heart of this lies the pivotal role of manufacturing companies in the machinery industry and their ongoing development. In order for this ecosystem to flourish, an appropriate social and scientific framework is essential — and this is precisely the role that GTE fulfils as a volunteer-based scientific association that connects people and ideas, fosters collaboration, and helps mechanical engineering enterprises to grow by providing them with access to strategic networks, funding, and innovation partnerships.

The presentations at the two-day conference in October 2025 covered the most relevant topics in the field. These were delivered by international and local experts, as well as those from overseas (Mexico, Australia and Vietnam), in addition to our European neighbors.

The papers included in this special edition reflect the diversity of contemporary manufacturing research and the evolving Industry 4.0 paradigm towards Industry 5.0. Several contributions focus on advanced manufacturing processes and materials. These include studies on the electrical discharge machining of difficult-to-cut alloys, the development of friction stir welding tools for aluminum alloys, the interpretation of cutting

Received: 20 Jan 2026; Revised: 16 Feb 2026;
Accepted: 16 Feb 2026
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ability and the analytical prediction of cutting tool wear. Other papers investigate monitoring and analysis methods in machining, such as using acoustic emission to study transient cutting phases and vibration analysis of tonewoods using finite element methods.

Several contributions address digitalization and intelligent manufacturing solutions. These include research into reinforcement learning for optimizing production cells, integrating artificial intelligence and large language models into PLC programming, and developing solutions to improve energy efficiency in CNC machining. Other works explore emerging technological and industrial applications, including the reverse engineering of jaw structures, producing the Ocelot rocket engine and implementing energy harvesting systems in production logistics. Finally, the issue highlights the importance of knowledge transfer and resilience in industrial ecosystems by examining how disaster event experiences can be applied in factory environments.

Finally, we would like to thank the authors for their contributions. We hope that the readers will find the selected papers from the XXVI Manufacturing Conference interesting, inspiring and motivating for their future work.

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