Book of abstracts of the

18th International Conference on

Management and Innovative Technologies

Portorož, Slovenia
9th – 11th of September 2025

MIT 2025

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Editors:

Izidor Sabotin
Marko Jerman

Title:	Book of abstracts of the 18th International Conference on Management and Innovative Technologies, Portorož, Slovenia, 9th – 11th of September 2025 - MIT 2025
Editors:	**Izidor Sabotin**, University of Ljubljana, Slovenia **Marko Jerman**, University of Ljubljana, Slovenia
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Organizers:	**Laboratory for Alternative Technologies**, Uni. of Ljubljana, Slovenia **Centre for Research in Innovation Management**, Uni. of Brighton, UK
Design:	**I. Sabotin**, University of Ljubljana, Slovenia.
Publishers:	University of Ljubljana, Faculty of Mechanical Engineering, **LAT** - Laboratory for Alternative Technologies, Slovenia.
Note:	This is an electronic version of the conference proceedings published only in digital form (PDF format) and can be accessed over specified URL: https://mitconference.wordpress.com/conference-proceedings/ URL to the Laboratory of Alternative Technologies, Faculty of Mechanical Engineering, University of Ljubljana web page: http://lab.fs.uni-lj.si/lat/index.php?page=domov&hl=eng

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani COBISS.SI-ID 253209347

ISBN 978-961-7187-25-0 (PDF)

ISBN 978-961-7187-25-0

9789617187250

The Editors and the Conference Committee believe that the subject of the papers to be presented are in line with the objectives of the conference, but it is not responsible for any data or any other information dispensed in the Proceedings.
All papers have been peer reviewed by the members of Scientific Committee.

Publication year: 2025

Preface

The MIT Conference first began life in 1995. Since then, we have been a bi-annual international gathering of industrial practitioners and academics from different disciplines and from all over the world.

The conference based in Slovenia has brought together a unique dialogue in the fields of management and innovative technologies.

Previous MIT conferences have seen world economic boom and subsequent collapse. Our conferences have explored technological innovation and technology management from multi-disciplinary perspectives. That has been the unique contribution of our previous sixteen conferences – bringing together academics and practitioners from different fields to exchange ideas, knowledge and experience that can impact significantly on cross-disciplinary research and also stimulate innovation in practice.

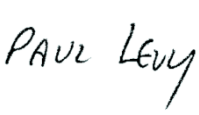
Human factors, "technosophy" (the wise application of technology) and sustainability have been key areas of interest for many of the conference's contributors. In a year of continuing but recovery from Covid pandemic, global recession due to energy crises, financial and environmental challenges, our conference seems as relevant and important as ever.

This year, "The rise of AI in technology, industry and education" was the title of the conference theme since only the application of AI technologies in a humane way will bring the world society to a higher and more sustainable level. In the beautiful setting of Portorož, Slovenia, close to borders with Croatia and Italy and within driving distance of many other countries, we are glad our conference sits as the borderland of different cultures, just as our programme sits at the border of different disciplines, interests and perspectives.

For the fourth time in a row our conference takes the form of a more interactive conference workshop. Based on feedback from participants who value the presentation of academic work but also seek further interaction around practical themes arising, our conference workshop is designed around dialogue and interaction, still very much rooted in academic research and industrial practice. It is a very compelling and potent mix!

It is our hope that the conference generated insights that will directly contribute to our emerge from economic crisis, in our respective sectors, industries, economies and as a world community. We welcome case studies and stories, as well as sessions which may lead to inter-disciplinary research.

Joško Valentinčič | Paul R. Levy | Izidor Sabotin | Marko Jerman

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Content

ORAL PRESENTATION SESSIONS – ABSTRACT TITLES:

1

Context matters. Why we cannot think, speak, design or compute without context

Authors: D. Popescu[1]

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Current large language models (LLMs) operate on tokens rather than meaning. Therefore, without explicit context they default to statistically, often irrelevant or unsafe outputs, or worse, hallucinations. Effective use of LLMs requires scaffolding, i.e. conversational state, declared goals and preferences, knowledge sources, uploaded documents, and, where helpful, custom configurations. These are valid aspects for all fields, but even more for engineering when when design constraints, safety and usability trade-offs, and regulatory expectations must be respected, and when decisions must be traceable from assumptions to geometry, materials, and process settings.

This paper applies explicit prompt engineering to AI-assisted design in a wrist–hand orthosis case, showing how making context in forms of goals, constraints, roles, and evidence explicit stabilises model behaviour and improves relevance. A volar-splint orthosis was prompted to ChatGPT and its image generator with constraints and user needs: one material (PLA), three Velcro straps (palm, wrist, forearm zones), fingers/thumb free (no coverage beyond the metacarpophalangeal joint), overall length at least two-thirds of the forearm, and ventilation holes for a lightweight geometry, requesting isometric and multi-view concepts. Two roles were applied to obtain different outputs: engineer (add Voronoi-like ventilation while preserving the single-material constraint) and occupational therapist (prioritise ease of donning, limit dorsal coverage). A configuration based on a context-defined documents (text and images) was then used: a custom GPT retrieved uploaded evidence before proposing changes. Iterative prompting produced different design variants that respected constraints and illustrated the trade-offs (ventilation vs. local stiffness, coverage vs. ease of placement on forearm-hand). Role proved GPT-4o ability to shift the focus frommanufacturability/topology to usability/placement. Context mattered a lot as it increased specificity and reduced the generic advice. Human critical review is still necessary to capture the blind spots and inconsistent assumptions. The approach does not confer human understanding, and outputs require expert judgement and downstream validation; visual ideation remains illustrative rather than production-ready, though future work will integrate quantitative fit/comfort/usability measures and automate retrieval to further stabilise context.

2

Localization and distributed formation control of multi-robot systems using mobile UWB nodes with position uncertainty

Authors: J. Dvoršak[1], R. Vrabič[1], T. Javornik[2]

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Multi-robot systems (MRS) are increasingly central to robotic exploration owing to their scalability, graceful degradation under individual failures, and capacity for parallel task execution. These capabilities are particularly advantageous in GNSS-denied environments, including subterranean settings and planetary surfaces. Missions in such domains must contend with intermittent communication links and substantial latency, making local inter-robot coordination and relative localization paramount. Ultra-wideband (UWB) radios are well suited to such missions, providing infrastructure-free, peer-to-peer time-of-flight ranging with centimeter-scale accuracy. This work leverage UWB ranging for decentralized relative localization and coordination, making two contributions: an extended Kalman filter (EKF) tailored to range-only state estimation, and a decentralized formation-control algorithm that assembles a target formation using only inter-robot UWB ranges and lightweight coordination.

We demonstrate a four-robot simulation using decentralized behavior trees controllers. In phase one, robots exchange pairwise UWB ranges; a designated leader bootstraps a common reference frame via trilateration and broadcasts initial peer poses to seed local estimates. In phase two, robots take turns navigating to their assigned formation slots using only inter-robot ranges, treating peers as mobile, uncertain anchors. This capability is enabled by an EKF that models anchor uncertainty. It estimates planar pose (x, y, θ) under a unicycle model, linearizes ranges with respect to both robot and anchor coordinates, and folds the believed anchor covariance into an adaptive measurement covariance that grows when geometry amplifies anchor errors. The resulting updates are conservative yet consistent, producing smooth transients even when anchor positions are imperfect. Because ranges do not directly observe heading, θ is inferred through motion-induced coupling.

Presented contributions yield a fully decentralized, range-only pipeline for assembling formations in GNSS-denied settings. Simulation results indicate stable convergence to the target geometry and bounded localization error despite anchor-position uncertainty. The approach is sensor- and communication-light, does not require global positioning, and degrades gracefully under imperfect geometry. Ongoing work targets hardware validation, extension to 3D space and larger fleets as well as tighter fusion with inertial/odometric cues.

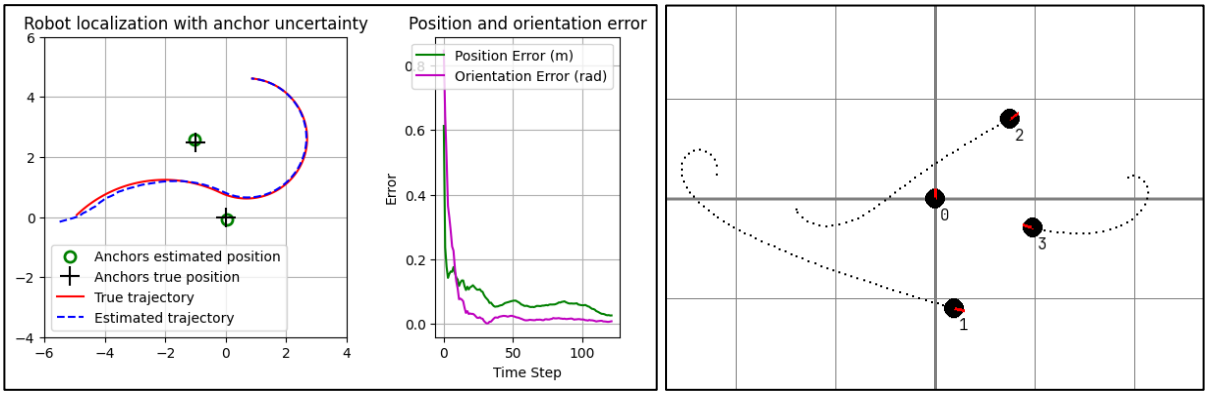

Figure 1. Ground truth and EKF position estimates along the trajectory with corresponding estimation error (left). Trajectories of four robots converging to a diamond-shaped formation (right).

3

The Transition to the Next-Generation Architecture of eCall System in the X_HeERO Project

Authors: G. Carutasu[1]

[1] Romanian-American University, Romania

Road safety remains a pressing strategic concern within the European Union, particularly for Vulnerable Road Users (VRUs) such as pedestrians, cyclists, and motorcyclists. To address this, the X_HeERO project (101175713) supports the transition from the legacy circuit-switched eCall system to the Next Generation eCall (NG eCall) based on all-IP packet-switched communication networks. NG eCall leverages technologies such as VoIP, IMS, and SIP to enable the rapid and reliable transmission of emergency data, significantly enhancing the response capabilities of Public Safety Answering Points (PSAPs). The project spans 11 countries with Romania as a key pilot site. The Romanian consortium—including public institutions, telecom operators, and software developers—focuses on infrastructure upgrades, mobile network modernization, and the development of end-to-end interoperability with European standards. One of the critical contributions from Romania is the implementation of a two-stage Cost-Benefit Analysis (CBA) by the Romanian-American University, assessing the socio-economic viability of Future eCall for both vehicles and VRUs.

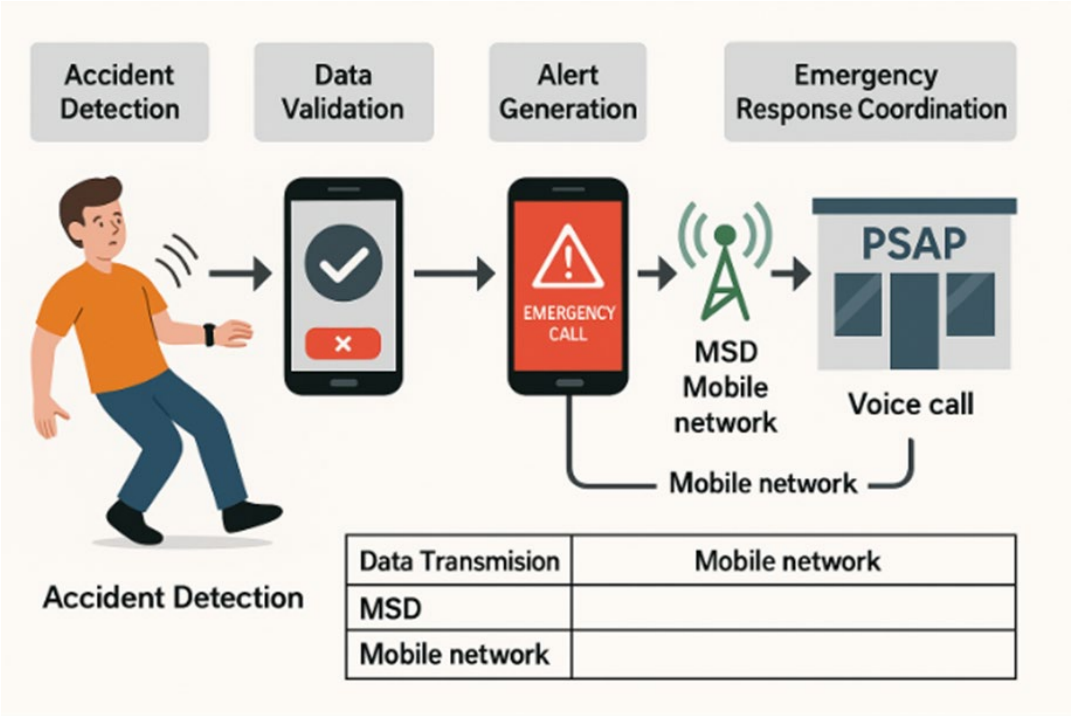

Figure 1. Pedestrian Future eCall chain of service

X_HeERO also explores integration with wearable devices for pedestrians, extending eCall benefits beyond vehicles. Three implementation scenarios—do nothing, do minimum, and do something—highlight the potential impact of technology adoption on reducing fatalities and improving emergency response times. The preliminary findings emphasize that NG eCall is not merely a technological upgrade but a vital component of Europe's Vision Zero strategy to eliminate road deaths by 2050.

4

Music as Memory: Human Influence Hidden in the Latent Space of AI

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National University of Science and Technology "Politehnica București"

Generative artificial intelligence is rapidly transforming digital music creation, enabling the automated synthesis of full compositions from text prompts, metadata, or audio inputs. This study investigates the extent to which the human creator's stylistic presence persists in AI-generated music, with particular focus on the latent space of the generative model. The central research question asks: *Does the human creator leave a measurable and recognizable signature within AI outputs, and if so, through what mechanisms?*

The research framework is built around the **YuE model**, a modular multi-layer architecture designed for lyrics-to-song generation, implemented on the experimental platform *suno.com*. The model separates the generation of vocal, harmonic, and rhythmic components, enabling fine-grained human influence. To examine the persistence of human imprint, we designed controlled experiments with three forms of human intervention: **text prompts** (poetic and technical inputs), **audio templates** (structural and harmonic guides), and **vocal recordings** (expressive guides). Each condition was evaluated using a combination of **computational metrics** (CLAP/MuLan similarity, Frechét Audio Distance, t-SNE/UMAP latent mapping) and **human perceptual assessments** (stylistic coherence, originality, vocal recognition by 10–20 participants).

The results confirm that human influence in the latent space is both **persistent and quantifiable**. Songs generated from the same author's text prompts clustered together with cosine similarity scores above 0.85, while audio templates consistently preserved harmonic and rhythmic identity across variations. Vocal guides exerted the strongest stylistic anchoring, with participants recognizing original timbre and expression across generated tracks. Human evaluation revealed over 80% recognition accuracy for authorial style, and nine out of ten listeners perceived template-based outputs as reinterpretations of the same creative core. These findings suggest that human contributions are not merely inputs but **stylistic markers** embedded in latent diffusion processes.Beyond technical validation, the implications are manifold. Artistically, frequent human–AI interaction fosters the emergence of an *AI-recognizable style*. Ethically and legally, the persistence of identifiable human signatures raises new considerations for copyright, potentially extending protection to prompts and templates as creative expressions under European case law (CJEU Cofemel, Infopaq). Conceptually, the study positions human–AI collaboration as a form of **hybrid authorship**, where the human role is not passive but an active act of direction, shaping computational creativity into recognizable artistic identity.To illustrate the applied impact, the paper discusses **RadioAI** (*https://radioai.pro*), the first fully AI-powered online radio station where every track is AI-composed yet guided by human artistry. RadioAI leverages transformer-based content generation, embedding-driven music curation, and adaptive playlist scheduling to create a continuously evolving soundscape. This platform demonstrates how the persistence of human style in latent spaces translates into large-scale cultural innovation, offering listeners an authentic hybrid experience of algorithmic generation and human creative direction.The study acknowledges limitations, including restricted access to proprietary latent architectures, small participant pools, and the influence of pre-trained model biases. Future research will extend the methodology across multiple platforms (MusicLM, MusicGen, Noise2Music) and track the evolution of authorial style in longitudinal AI collaborations.

In conclusion, this work demonstrates that **human creators significantly shape and persist within the latent space of music-generative AI**. Their influence is stylistically traceable, computationally measurable, and perceptually recognizable. With platforms such as RadioAI, these insights move beyond theory to practice, opening new perspectives on authorship, copyright, and artistic agency in the age of hybrid human–AI music creation.

5

Empowering Customer Relations Through IIoT in Smart Production Systems

Authors: L.F. Parpala*, R.C. Parpala, I.A. Mario, C.L. Popa, C.E. Cotet

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In modern production systems, customer relationships have become a central focus. For highly configurable products, IIoT technologies play a crucial role in enhancing the customer experience. By integrating advanced production systems with CRM platforms, customers gain real-time visibility into product manufacturing status, quality control metrics, and other essential data throughout the production cycle. The paper proposes a possible approach for the above hypothesis, transferring the customer needs and requirements to a production system in terms of data transfer and productivity enhancement.

Keywords: IIOT, customer relationship, production systems

6

Investigation of abrasives properties for use in accelerated hydro-abrasive-cavitation erosion modelling of rocks and concrete

Authors: P. Hlaváček[1], L. Sitek[1], L. Gurková[1], P. Martinec[1]

[1] Institute of Geonics of the Czech Academy of Sciences

Abrasive waterjet (AWJ) technology has become an effective tool for the accelerated simulation of erosive processes in various materials under controlled conditions. Its ability to combine high-velocity fluid flow with the mechanical action of abrasive particles makes it particularly suitable for modelling wear phenomena relevant to natural and engineered environments. One such application is the simulation of erosion wear caused by rapidly flowing liquids, which is important for evaluating the durability of materials used in hydraulic and civil engineering structures. Abrasives are a vital component of AWJ systems, as they directly influence the material removal mechanism. Their properties — such as grain size, shape, hardness and density — determine the intensity and nature of the erosion. A wide variety of abrasives are available, offering different performance characteristics and costs. Understanding how these properties affect the efficiency of material disintegration is essential for optimising erosion testing and simulation methods.

This study focuses on evaluating the erosion potential of various abrasive materials of different origins. As well as commonly used abrasives, the study considered alternative materials that have not yet been widely applied in AWJ technology. The aim was to assess their suitability for erosion testing and identify ways to improve their performance through material selection or treatment. The study demonstrated that the performance of certain abrasives can be improved using grain modification techniques, which could be beneficial for industrial and research applications.

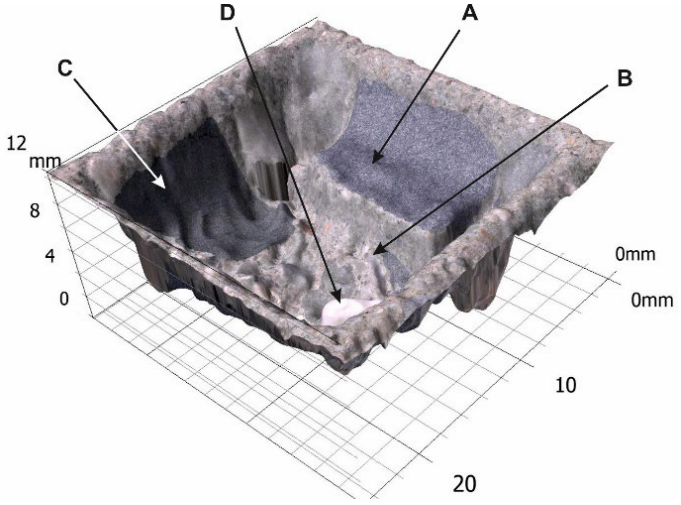

Figure 1. Example of eroded layers of concrete sample. The amputated part of the aggregate (A) prevents deeper erosion. The erosion (hardened cement paste and fine aggregates) is much deeper in the case of the absence of greater aggregates (B). Tangential scratches caused by the abrasive particles are well visible on the surface of some aggregates (C). Almost intact quartz aggregate (D).

Acknowledgment: The authors gratefully acknowledge financial support from the Czech Science Foundation, project number 23-07415S. The research was co-funded also by the European Union under the project INODIN, no. CZ.02.01.01/00/23_020/0008487. The authors are very thankful for the support.

7

Evaluation of material erosion in air and submerged conditions caused by self-excited water jets

Authors: Z. Říha[1], F.K. Miranda[1], M. Zeleňák[1], A. Nag[1], V. Foldyna[1], P. Hlaváček[1], L. Gurková[1]

[1] Institute of Geonics of the Czech Academy of Sciences

The study investigates the influence of frequency value of modulated high-speed water jet on material erosion. Modulated high speed water jets (with frequencies from 6 to 45 kHz) were generated by two specially developed prototypes (1×1 mm outlet) that induce self-excited flow oscillations. Erosion was caused by treating pure copper samples with the modulated water jets, both in the atmosphere and underwater. The stand-off distance ranges from 10 to 15 mm. Flow rates (19 and 24 litres per minute) and pressures (80 and 140 MPa) were continuously monitored. Erosion was done for two hydraulic power levels at 26 kW and 55 kW. The erosion grooves were created by moving the nozzle over the specimen surface at a velocity of 1 mm/s. The resulting ones were then visualized using the method of the optical profilometry. The volume of material removed, the morphology of grooves and the surface damage were recorded as primary parameters for the investigation the relationship between the value of the frequency of the modulated water jet and material erosion.

The results show that the increase in frequency of the modulated high-velocity water jets significantly improves the erosion efficiency in the atmosphere and underwater, too. However, in the submerged conditions, the energy of the water jet is significantly attenuated, resulting in reduced material removal. Further discussion and a more detailed interpretation of the obtained outcomes will be presented at the MIT conference.

Acknowledgment: The authors gratefully acknowledge financial support from the Czech Science Foundation, project number 23-07415S. The research was co-funded also by the European Union under the project INODIN, no. CZ.02.01.01/00/23_020/0008487. The authors are very thankful for the support.

8

Advanced 3D-Printed Soft Pneumatic Actuator for Single Axis Rotation

Authors: E. Kiani Harchegani[1]*, A. Lebar[1, 2], S. Castagne[3], I. Sabotin[1], M. Jerman[1], J.E. Koroth[1], J. Valentinčič[1]

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Soft pneumatic actuators have emerged as vital components in the development of adaptive and biomimetic robotic systems. This study introduces a newly engineered 3D-printed soft actuator optimized for improved bending performance and control accuracy. Through a validated computational framework, the actuator's geometry was optimized to reach a maximum bending angle of 209°, ensuring a balance between structural robustness and flexibility. The actuator was produced using material extrusion (MEX) additive manufacturing, enabling high design fidelity and repeatability. A series of systematic experiments were carried out under various pressure inputs to evaluate deformation behavior and actuation responses. In parallel, finite element analysis (FEA) conducted in Ansys 2023 R2 provided detailed insights into stress evolution, displacement patterns, and force output. The strong correlation between simulation and experimental data confirms the accuracy of the computational model and validates the actuator's enhanced mechanical and functional performance.

Acknowledgment

The authors acknowledge the support of the Slovenian Research Agency in the frame of Research program Innovative production systems and processes (Grant P2-0248) and CELSA fund (CELSA/005-1/2023).

9

Influence of lattice density and forced electrolyte flow on plasma electrolytic polishing of lattices

Authors: J. Edaklavan Koroth[1], E. Kiani Harchegani[1], M. Jerman[1], I. Sabotin[1], P. Drešar[1], A. Lebar[1], K.K. Saxena[2], M.H. Arshad[2], H. Zeidler[3], J. Valentinčič[1]

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Plasma electrolytic polishing (PEP) has emerged as a promising post-processing method for additively manufactured (AM) metals; however, its application to lattice architectures remains largely unexplored. Lattice structures, widely used in aerospace and biomedical components for their superior strength-to-weight ratios, present significant surface finishing challenges, particularly within confined internal regions of high-density designs. This study investigates the feasibility of PEP for polishing SS316L body-centred cubic lattice structures with varying densities under two conditions: natural convection and forced electrolyte flow. A custom-designed nozzle system was integrated into the electrolyte tank to direct flow toward the lattice interior, aiming to enhance electrolyte accessibility and uniformity of polishing. Surface morphology and polishing depth were characterized using optical and cross-sectional microscopy. Results demonstrate that forced electrolyte flow substantially improves internal surface quality in low- and medium-density lattices by promoting electrolyte exchange, while high-density lattices may require elevated flow rates for effective treatment. The findings establish forced-flow PEP as a viable and scalable finishing approach for complex AM lattice geometries.

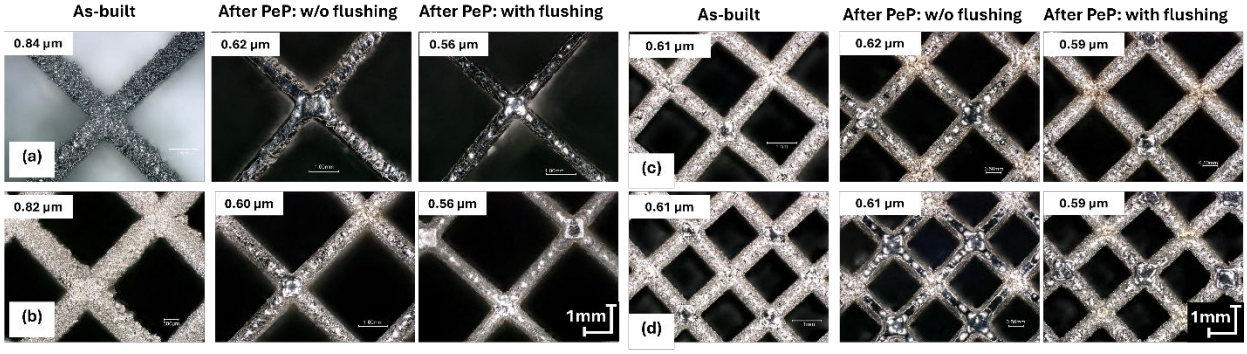

Figure 1. Images showing the effectiveness of PEP under both normal and forced flushing conditions for lattice structures with relative density (a) 1.57%, (b) 3.27%, (c) 8.37% and (d)13.62%.

Keywords: Plasma electrolytic polishing (PEP), Additive manufacturing (AM), Lattice structures, post-processing.

Acknowledgement: The authors would like to thank LASIN, Faculty of Mechanical Engineering, University of Ljubljana for providing the lattice structures needed for the study.
This work was supported by Horizon Europe Twinning project SEAMAC (Grant agreement ID: 101079481), CELSA fund (CELSA/24/015), and the Slovenian Research Agency (ARIS) (Grant No. P2-0248 (B)).