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11th IFAC Conference on Manufacturing Modelling, Management and Control
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11th IFAC Conference on Manufacturing Modelling, Management and Control (MIM 2025)
http://conferences.ifac-control.org/mim2025/

Invited Session:

Digital Twin in Intelligent Manufacturing and Logistics Systems

INVITED SESSION CODE: XXX
c8223

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Digitalization in Manufacturing and Logistics (M&L) systems represents a crucial driver able to lead companies in achieving higher levels of productivity and flexibility. Digital technologies, such as Internet of Things, Cloud Computing, Artificial Intelligence, Virtual Reality, Augmented Reality, or the new generation of Information Technologies, allow an intelligent integration and interconnection among all actors involved in the M&L processes. Moreover, digital technologies enable real-time monitoring, control, and data collection, as well as the development of Cyber-Physical systems that are able to combine the physical and virtual environment. In this context, the Digital-Twin (DT) concept represents an emerging research topic in M&L systems. DT is defined in several ways according to the application field. However, in M&L systems, the DT consists in creating a virtual representation of the system aiming to evaluate, predict, and optimize their states and future behaviour. Moreover, the data flows between physical and virtual entities are integrated in both directions. It implies that a change in the physical entity could lead to a change in the virtual one and vice versa. In such a way, DT is designed to elaborate data from the past continuously, monitor the present in real-time, and, finally, support future operations management decision-making by combining past data with the real-time ones. According to the scientific literature, DT is applied in several M&L phases such as production planning and control, workpiece quality prediction, machine and human-robot collaboration, real-time M&L systems monitoring, product traceability, and performance prediction, supply chain resilience. However, there are some critical issues in implementing DT. For example, there are difficulties in sharing DT in multiple application systems involving several stakeholders, difficulties in ensuring efficient storage, processing, and analysis of a large amount of data. Moreover, there is a need to ensure reliability and robustness of the DT. Furthermore, due to the high degree of heterogeneity in digital technologies, there are some difficulties in making suitable decisions and investments in DT from a company perspective. Finally, some gaps are still present related, for example, to complex manufacturing systems, and external and internal factors that can affect the degradation of machine or worker skills.

For this reason, this session aims to investigate new trends and challenges in implementing DT concepts in M&L systems. Further, the evaluation of benefits and criticalities from a multi-disciplinary perspective represents another aim of the proposed session due to the different scientific research domains (e.g., statistics, artificial intelligence and computer science, operations management, etc.) involved in implementing DT.

Topics may include, but are not limited to:

- Using new emerging technologies for the DT implementation in M&L systems
- Conceptual Frameworks to Support DT Development in M&L Systems
- DT architectures in M&L systems
- Real-time-based models and algorithms for assembly line design, balancing, and rebalancing techniques
- Simulation and optimization models based on real-time data for production planning and control in flexible manufacturing systems
- Real-Time Job Scheduling and Sequencing for Complex M&L Systems
- DT models for improving M&L system layout
- DT models for analysing the Machine-to-Machine interaction and Human-Robot collaboration DT methods and models to improve human factors in M&L systems
- Human digital twin
- Using DT concepts to improve M&L systems reliability, availability, and efficiency
- DT as a tool to improve M&L system resilience
- DT in operations and supply chain management
- DT for supply chain resilience
- Quantitative and qualitative analysis of the implementation of DT in M&L systems
- DT applications from real M&L systems

Both theoretical and applied research contributions and real-world application feedback are welcome.

Submission

For author guidelines, please refer to www.ifac-control.org. All papers must be submitted electronically using https://ifac.papercept.net/ and must follow the two-column format in accordance with the IFAC manuscript style. Please use the official IFAC instructions and template to prepare your contribution as a full-length draft paper (6 pages). Submission details are available on the symposium website. There is the possibility to submit discussion papers (limited to 4 pages) that are published in the preprints only. All submissions must be written in English. All articles that comply with the submission guidelines will be peer-reviewed by IPC members. The corresponding author submits the paper online (pdf format) as an open-invitation session paper. **Submission as an invited paper requires the invited session code: XXXX. Special issues of MIM 2025 Conference are planned in IFAC and other high-ranking journals.**

IMPORTANT DATES:

Draft paper submission deadline: 30/11/2024

Notification of acceptance: 30/01/2025

Registration opening: 30/01/2025

Final papers submission deadline: 28/02/2025

Conference date: 30/06/2025-03/07/2025