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**Special Issue on Engineering and Operating Digital Twins for Automated Production or Construction Systems**

Since the emergence of initiatives such as Industry 4.0/5.0, the notion of digital twins\* has been promoted for improving the engineering and operation phases of automated production or construction systems and beyond, e.g., to tackle socio-technical concerns such as sustainability, energy efficiency, etc. Standardization efforts such as the Asset Administration Shell (AAS) aim to provide dedicated formats, protocols, and infrastructures for developing and operating digital twins for off-the-shelf production components. Such efforts cover both model representations of the design and runtime data views for reflecting the operation of the components. However, many open questions remain regarding the efficient and effective development and operation of digital twins for automated production or construction systems. Currently, the realization of digital twins is still associated with cost-intensive processes, repetitive work, and proprietary technologies. This special issue will focus on improved concepts, techniques, and methods for engineering and operating automated production systems with digital twins. To realize the true benefits of digital twins, dedicated support to manage the different life-cycle phases of digital twins in alignment with the system life-cycle phases is required. The central theme of the Special Issue will be ***emerging opportunities and future directions in enabling digital twin-based automated production or construction systems***, where modeling & analysis during the design of systems, the acquisition of runtime data during operation, and corresponding optimization and evolution of designs, e.g., with simulation or AI techniques, are the focus areas. The goals of the special issue are (1) to present the state-of-the-art research in science, engineering, and methodologies for digital twins of automated production or construction systems and (2) to provide a forum for experts to disseminate their recent advances and views on future perspectives in the field of digital twins for automated production or construction systems. Topics to be covered include, but are not limited to:

- Systematic approaches and formalisms for engineering and operating digital twins
- Smart manufacturing with AI-based digital twins, e.g., based on reinforcement, transfer, and federated learning
- Emerging technologies for digital twins such as IIoT, 5G, data lakes, ...
- Managing and optimizing properties of production or construction systems with digital twins such as energy efficiency, safety, security, customizability, maintainability, ...
- Integration of digital twins with existing automated production or construction system infrastructures and software systems, e.g., CAD, ERP, MES, PLM tools
- Distributed digital twins on Edge, Fog, and Cloud continuum
- Continuous evolution of production systems with evolving digital twins
- Coupling/Interfaces of digital twins from component level to machine level and checking of inconsistencies
- Human-machine interfaces for digital twins
- Architectures and platforms for engineering and operating digital twins
- Continuous learning for and with digital twins of production or construction systems
- Performance evaluation, continuous improvement, and scalability of production or construction systems based on digital twins
- Applications and case studies, including industrial use cases, evaluations, and comparisons

\*Automation Systems and Integration–Digital Twin Framework for Manufacturing,” ISO 23247 International Standard, October 2021.

**Important Dates**

- March 31<sup>st</sup>, 2024: paper submission deadline.
- August 1, 2024: completion of the first round review.
- December 1, 2024: completion of the second round review.
- April 1, 2025: final submission due.
- October 1, 2025: tentative publication date.

## Guest Editors

### **Dr. Birgit Vogel-Heuser**

Automation and Information Systems  
Department of Mechanical Engineering  
School of Engineering Design  
Technical University of Munich  
Munich, Germany  
[vogel-heuser@tum.de](mailto:vogel-heuser@tum.de)

### **Dr. Manuel Wimmer**

Institut für Wirtschaftsinformatik  
Software Engineering  
JKU Linz  
Austria  
[manuel.wimmer@jku.at](mailto:manuel.wimmer@jku.at)

### **Dr. Xun Xu**

Faculty of Engineering, Mechanical  
Engineering  
University of Auckland  
Auckland, New Zealand  
[x.xu@auckland.ac.nz](mailto:x.xu@auckland.ac.nz)

### **Dr. Min-Hsiung Hung**

Department of Computer Science and  
Information Engineering  
Chinese Culture University  
Intelligent Manufacturing Research  
Center (iMRC)  
National Cheng Kung University  
Taiwan, ROC  
[hmx4@ulive.pccu.edu.tw](mailto:hmx4@ulive.pccu.edu.tw)

### **Dr. Ilya Kovalenko**

Control and Automation for Intelligent  
Systems (CAIS) Lab  
Department of Mechanical Engineering  
Department of Industrial &  
Manufacturing Engineering  
Penn State University  
USA  
[ik5135@psu.edu](mailto:ik5135@psu.edu)

## Paper Submission

All papers are to be submitted through the IEEE's **Manuscript Central** for Transactions on Automation Science and Engineering <http://mc.manuscriptcentral.com/t-ase>. Please select "Special Issue" under Manuscript Category of your submission. All manuscripts must be prepared according to the IEEE Transactions on Automation Science and Engineering publication guidelines <http://www.engr.uconn.edu/~ieeetase/>.