Special Session Proposal – INCOM 2024 Vienna

TITLE: Human-centric Digital Twins for Human-centred Manufacturing

KEYWORDS: Human Digital Twins, Human-centred Manufacturing, Human-Machine Interaction, Human-Robot Collaboration, Human-AI Collaboration.

ABSTRACT:

Industry 5.0 envisions a value-based industrial revolution that emphasizes human-centricity, sustainability, and resilience. In this context, automation and digital technologies aim to leverage human creativity, objective thinking, and decision-making alongside the repeatability, accuracy, and convenience of robots for repetitive, labour-intensive, and hazardous tasks. The concept of Operator 5.0 enhances human perception, cognition, and interaction through various enabling technologies. Among these ones, recently, the term Human Digital Twin (HDT) has emerged, extending the digital twin concept to integrate real-time sensing and feedback on human performance, behaviour, and environmental influences throughout product and process life cycle, thereby improving system design and performance. However, due to its novelty, a comprehensive and precise definition of this concept is lacking.

This special session focuses on the more general perspective of Human-Centric Digital Twin (HCDT), as a crucial concept to integrate human workers in Industry 5.0 environments, enabling communication, data aggregation, simulation, and planning. Recently, HDTs have emerged in the manufacturing industry, even if they are mostly application-oriented, while methods to support the HCDT creation lacks. This session aims to collect contributions focusing on the interdependencies between technologies and human capabilities, providing effective tools for development of HCDT in which human workers are simulated both in their physical and cognitive activities.

This special session calls for high-quality contributions investigating the main research challenges, reviews, case studies and applications related to the following topics (but not limited to):
- Human Digital Twins (HDTs)
- Simulation of human workers in manufacturing systems
- Human performance modelling in digital twins
- Physical and cognitive workload measurement models
- Intelligent collaborative manufacturing spaces
- Human-centred artificial intelligence
- Human-aware collaborative robotics
- Skills and learning approaches to HCDT development
- HDTs to enable sustainable manufacturing

Organizers:

- Chiara Cimini, University of Bergamo, Italy, chiara.cimini@unibg.it, 96645
- Alexandra Lagorio, University of Bergamo, Italy, alexandra.lagorio@unibg.it, 88294
- David Romero, Tecnológico de Monterrey, Mexico, dromero@tec.mx, 36561
- Antonio Padovano, University of Calabria, Italy, antonio.padovano@unical.it, 103288
- Marta Pinzone, Politecnico di Milano, [marta.pinzone@polimi.it,](mailto:marta.pinzone@polimi.it) 160795
- Vincenzo Cutrona, University of Applied Sciences and Arts of Southern Switzerland, [vincenzo.cutrona@supsi.ch,](mailto:vincenzo.cutrona@supsi.ch) 156343
- Peter Thorvald, University of Skövde, Sweden. [Peter.thorvald@his.se,](mailto:Peter.thorvald@his.se) 133515
- Tamás Ruppert, University of Pannonia, Hungary, [tamasruppert@gmail.com,](mailto:tamasruppert@gmail.com) 134754
- Rodolfo Haber, Center for Automation and Robotics (UPM-CSIC), [rodolfo.haber@car.upm-csic.es,](mailto:rodolfo.haber@car.upm-csic.es) 37682