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The Future of Work: Human-Robot Collaboration Driving Manufacturing and Logistics Excellence

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The advent of Industry 5.0 brought significant changes regarding manufacturing and logistics applications, prioritizing the operator's welfare at the core of its principles. Industry 5.0, complementing its predecessors, strongly emphasises the creation of production systems focused on people and human-technology interaction for system productivity, recognizing the value of human labour in the era of automation and digital transformation.

Collaborative robots (cobots) have become common resources in production and logistics settings due to the need to improve productivity and safety, particularly for applications requiring high levels of physical labour. The wide adoption of cobots, however, directly points to the three following research gaps, for which interdisciplinary knowledge is required. First, the close cooperation of workers with cobots has raised concerns about the security of operators when working around such automated systems. As a result, operators' confidence in working with cobots is still lacking, for which human-aware planning and control models and methods are needed. Second, despite the benefits of workforce assistance offered by cobots, research on task allocation and scheduling problems based on hybrid human-robot teams is scarce. This is crucial, as optimal task distribution between humans and cobots can significantly improve workflow efficiency and reduce operational constraints. Third, to ensure a human-centric workplace design, efforts are needed to study operators' emotions, trust and acceptance during their various types of interactions with cobots. Therefore, the issues of safety, efficiency and conformity during the human-robot collaboration present both challenges and opportunities in manufacturing and logistics processes, for which methods like field experiments with embedded and wearable sensors, simulation/analytical modelling and digital twin could offer insights into future system design with long-lasting and safe human-robot partnership.

Proposal 60 submitted to 11th IFAC Conference on Manufacturing Modelling, Management and Control. Received September 30, 2024.

The proposal focuses on bidirectional trust as the foundation for successful cooperation and symbiosis between humans and cobots. It will investigate the role of trust in facilitating seamless collaboration and explore cutting-edge technologies and concepts designed to assess operators' physical and cognitive states and anticipate their future intentions. Additionally, this session integrates the development of managerial strategies, frameworks, and guidelines to control cobots and optimize their deployment in industrial applications. It also aims to enhance the well-being and ergonomics of operators while maximizing production and logistics efficiency, relying on bidirectional trust between humans and cobots to shape the factory of the future and supply chains, characterized by efficiency, sustainability, resilience, and inclusion. In this vision, operators are central to every analysis, design, and optimization process with their needs and preferences, guiding the development of collaborative systems. Through intuitive and adaptive cooperation with cobots, this session explores new industrial standards where human-robot interaction is intuitive and adaptive, fostering mutual benefits for all actors.

Topics may include, but are not limited to:

- Human-Robot Collaboration and Human-Robot Interaction
- Human Modelling and Digital Twins of Collaborative Workplaces
- Industry 5.0, Human-in-the-Loop, Human Factors Engineering (HFE)
- Wearable Sensors and Cobots, Sensor Integration, Hybrid systems
- Human-aware planning and control, Assistive Technology, Adaptive Robotics
- Human-Robot Task Allocation and Scheduling Problems
- Ergonomic Design Principles, User-Centric Design, Participatory Ergonomics
- Emotional Interaction with Cobots, User Trust Assessment, Robot Acceptance
- Safety Protocols, Safety Assessment in Human-Robot Interaction
- Cognitive Robotics, User Experience (UX), Human-Robot Interface

INVITATION CODE: xxxx

Draft papers reporting original research (limited to 6 pages in IFAC format) and extended abstracts are welcome. When you submit your paper to the IFAC system, you will be required the **invitation code xxxx** to associate your paper to the invited track: **https://ifac.papercept.net**

IMPORTANT DATES:

- Draft papers/ extended abstract submission deadline: **30.11.2024**
- Final papers submission deadline: **28.02.2025**
- Early registration opens: **28.02.2025**

Conference website: https://conferences.ifac-control.org/mim2025/

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