Trondheim, Norway, 30 June - 3 July 2025

Invited session

Sustainable and Circular Manufacturing in the Digitized World

This proposal is endorsed by TC51 Manufacturing Plant Control and TC52 Management and Control in Manufacturing and Logistics

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Abstract:

Nowadays, manufacturing industries are addressing several challenges aimed at achieving sustainable production processes, which involve transforming resources into economically valuable goals by operating socially and environmentally responsible processes. On the other hand, recently, the concept of sustainable and circular manufacturing has been linked with the notion of closed-loop and circular economy as an approach to respond to the global challenges of resource scarcity, greenhouse gas emissions, and waste generation. Therefore, circular and sustainable manufacturing approaches are envisioned as a fundamental part of the strategies of many industries in order to practice a transition from linear manufacturing systems to circular manufacturing systems. This particularly aims to advance the capabilities of manufacturing firms to close the loop of materials, components, and products through multiple lifecycles, to ultimately promise several economic and environmental benefits for the manufacturing industry, and lead to a more sustainable-oriented system.

Industry 4.0 and digital technologies play a key facilitator role in enabling such advances. They are key enabler in reaching more sustainable industrial processes, as well as in the optimization of circular economy models, as they are expected to allow the management and optimization of product

and production for improved efficiency, efficacy and sustainable performances at the same time. Interesting challenges are posed to manufacturing research on how the new digital technology paradigms – such as Cyber-Physical Systems (CPSs), Internet of Things technologies (IoT), Digital Twins, Digital Threads, and Artificial Intelligence – will create a smart connected environment where resources (machines, operators…) are converted into intelligent objects and smart humans. Exploiting these capabilities in monitoring, decision-making, and communication allows obtaining a collaboration mechanism which leads to energy-efficient, low-impacting and closed-loop systems. Furthermore, the key benefit digitalization can bring to a circular industrial ecosystem is the possibility of controlling, analyzing and improving the life cycle of products in a more transparent way inside and outside the manufacturing systems. To that point, the role digitization plays in closing the loops to reduce the economic and ecological flow of resources accentuates more and more for truly sustainable and circular manufacturing. Meanwhile, the production system is also required to be stable and robust towards all kinds of disruptions, whether internal, like machine failures or random job arrivals, or external, such as dynamic variations in materials and energy availability. To that end, it is important to consider sustainable and circular manufacturing approaches in all lifecycle phases of the product and production system, and at different levels of analysis, from factories to supply and value chains, and back to factories.

Considering the above-mentioned, this session addresses sustainability and circularity as eminent challenges in manufacturing and logistics and comprises energy management, waste management, end-of-life strategies of products and many others. This session aims to bring together reflections and innovative ideas on methodologies and solutions to manage circular and sustainable manufacturing systems through the use of advanced industrial engineering approaches and the key enabler of digital technologies.

We welcome contributions to the following research topics, but not limited to:

- CPS and I4.0 technologies and their impact on circular and/or sustainable manufacturing.
- Digital twins and industrial metaverse for circular and/or sustainable manufacturing.
- Industrial systems engineering for a circular economy.
- Multi-agent and innovative architectures for sustainable and/or circular manufacturing.
- Scheduling and rescheduling methods with sustainable performances in manufacturing.
- Artificial intelligence techniques to analyze, predict, improve and optimize the sustainable performances and/or circularity within the manufacturing systems.
- Reverse logistics and end-of-life management
- Digital supply chain twins for circular manufacturing
- Digital collaboration through value chains for circular manufacturing
- Sustainable supply chain management for circular manufacturing

Keywords: sustainable manufacturing, circular manufacturing, cyber-physical systems, digital technologies, industry 4.0, digital twins, multi-agent systems, systems engineering, sustainable supply chain management, circular supply chain management.

Important dates:

- **30 November 2024**: Papers submission deadline
- **30 January 2025**: Notifications to authors; Registrations open
- **28 February 2025**: Camera-ready paper submission deadline