

## Session Title:

### **Sustainable and Circular Manufacturing in the Digitized World**

This proposal is endorsed by TC51 Manufacturing Plant Control

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#### **Short presentation:**

Nowadays, manufacturing industries are addressing several challenges aimed to achieve 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 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 part of the strategies of many industries to practice a transition from linear manufacturing systems to circular manufacturing systems, in order to close the loop of materials, components, and products through multiple lifecycles and consequently promise several economic and environmental benefits for the manufacturing industry, and lead to a more sustainable-oriented system.

The arrival of Industry 4.0 and digital technologies plays a key facilitator role in reaching more sustainable industrial processes, as well as in the optimization of circular economy models as they allow the parallel management and optimization of production for improved efficiency, efficacy and sustainable performances at the same time. Accordingly, it has been shown that Industry 4.0 can help achieve targets in the manufacturing, economic and environmental fields, and face social challenges based on the Triple Bottom Line of sustainability. 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 monitoring, decision-making, and communication capabilities allows to obtain a collaboration mechanism achieving energy-efficient, low-impacting and closed-loop systems. However, the key benefit digitalisation can bring to a circular industrial ecosystem is the possibility of controlling and analysing the life cycle of products in a more transparent way inside and outside the manufacturing systems. To that point, the role the digitization plays in closing the loops to reduce the economic and ecological flow of resources accentuates more and more for a truly sustainable and circular manufacturing. Meanwhile, the production system requires to be stable and robust towards all kinds of disruptions, whether internal, like machine failures or random jobs arrival, or external, such as dynamic variation in materials and energy availability. To that



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end, it is important to consider sustainable and circular manufacturing approaches in all lifecycle phases of the production system.

Considering the above-mentioned, this session addresses sustainability and circularity as eminent challenges in manufacturing and comprises energy management, waste management, end-of-life strategies of products and many others. This session aims at bringing 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 digital technologies.

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

- CPS and I4.0 technologies and their impact on circular and/or sustainable manufacturing.
- Digital twin and industrial metaverse for circular and/or sustainable manufacturing.
- Industrial systems engineering for circular economy and/or sustainable production.
- Multi-agent and innovative architectures for sustainable and/or circular manufacturing.
- Scheduling and rescheduling methods with sustainable performances in manufacturing.
- Artificial intelligence techniques to analyse and predict sustainable performances and/or circularity within the manufacturing systems.

**Keywords:** sustainable manufacturing, circular manufacturing, cyber-physical systems, digital technologies, industry 4.0, multi-agent systems, systems engineering.

**Important dates:**

- Full paper submission: 31 January 2024
- Notification of acceptance: 15 March 2024
- Final, camera-ready paper submission: 15 April 2024
- Conference days: 28-30 August 2024, Vienna, Austria