



MASM: Multi-agent and holonic approaches in smart manufacturing

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Short presentation:

Competitive production enterprises must be cost efficient, robust to resource failures and unexpected events, and agile to rapid changes in product type and demand. Centralized control systems lack the operational flexibility to adapt as close as possible to such changes in real time. The solution consists in decentralizing the control and distributing intelligence among shop floor devices, while preserving optimized, reality-aware supervision at global production horizon.

The distribution of intelligence in the industrial control system, and the need for collaborative decisions of strongly coupled plant entities led to the adoption of a new modelling approach for robust and optimized process control with agent-based implementing frameworks and holonic organization. This approach is based on the virtualization of a set of abstract entities: products (reflecting the client’s needs), resources (reflecting the producer’s capabilities, skills) and orders (reflecting business solutions) modelled by autonomous holons collaborating in holarchies by means of their information counterparts - intelligent agents that are organized in dynamic clusters to reach a common, production-related goal.

Decentralized, semi-heterarchical control and distribution of intelligence are implemented in multi-agent frameworks that build up ‘smart’ manufacturing control systems. This type of control architecture is distributed in agent clusters at the edge of the shop floor for big data collecting, and then centralized at cloud computing layer platform for aggregation, machine learning and intelligent decision making: predictive production planning, real time batch optimization, dynamic resource reconfiguring, detecting anomalies and unexpected events.

The concept of Internet of Things (IoT) takes advantage of the new communication and decision mechanisms, and thus it can provide solutions both for industrial areas - Industrial IoT and also for many other application fields. The integration with IoT of intelligent techniques like holonic and multi-agent systems has a great potential, while it determines new challenges for research.

This special session seeks papers describing research in the area of smart control systems in manufacturing, logistics and supply chains that use multi-agent frameworks and holonic organizations integrated in specific informational and operational technologies:

- Multi-agent systems for manufacturing control and supply chain management
- Industrial control with distributed intelligence
- Holonic manufacturing control architectures



- Resource and product virtualization for edge computing implementing
- Virtualization of collaborative product and resource workloads
- MES virtualization in Cloud Manufacturing
- Smart manufacturing control architectures
- Agent-based data- and model-driven digital twins
- Intelligent agents and decision making technologies
- Industrial Internet of Things

Keywords: Multi-agent systems, holonic manufacturing organization, intelligence distribution, shop floor instrumenting, edge and fog computing, semi-heterarchical control, product-driven automation, smart manufacturing control system, Internet of Things

Important dates:

- Proposals of Special Sessions: 30 April 2021
- Full paper submission: 15 July 2021
- Notification of acceptance: 15 September 2021
- Final, camera-ready paper submission: 15 October 2021
- Early registration and fee payment: 1 November 2021
- Workshop: 18-19 November 2021