4th Workshop on Service Orientation in Holonic and Multi-Agent Manufacturing

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Session title: **Distributed modeling for safety and security in industrial complex systems – DMSS**

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Short presentation: The introduction of distributed modelling approaches in complex industrial systems offers a technological advantage because their inherent characteristics of collaboration and autonomy can be very useful in detecting and preventing problematic situations. This special session aims at presenting the latest advances in the exploitation of distributed modelling approaches, for example: multi-agent systems and holonic systems for safety and security. Specifically, the session is focused on, but not limited to, new approaches for the development and exploitation of distributed solutions to prevent human and economic losses and damages.

Complex industrial facilities are characterized by their large size, complexity of their sub-processes and dynamics, and the massive information overload. For example, the maintenance and management of complex industrial process equipment and their integrated operation play a crucial role in ensuring the safety of plant personnel and environment as well as the timely delivery of quality products. Given the size, scope and complexity of the systems and interactions, it is becoming difficult for plant personnel to anticipate, diagnose and control serious abnormal events in a timely manner. This induces huge challenges on the design, development and deployment of a system to manage such facilities in different operating conditions. Multi-agent systems and distributed modelling issues are corner-stone frameworks allowing designing intelligent real-time systems for complex industrial facility management and control ensuring human and environment safety.

The development of distributed control for complex industrial system is very difficult and exhibits many challenges:

- Diversity of solution techniques, where several approaches are available to perform the main tasks of an industrial facility management system: For example, fault detection and isolation can be performed using model-based quantitative and qualitative fault diagnosis techniques as well as non-model-based methods. Similarly, supervisory control can be performed using several AI techniques such as rule-based expert systems and case-based reasoning. These techniques are diverse in nature and use certain assumptions about the process and performance requirements.
- Diverse sources of knowledge, which stem from the incomplete and scattered nature of process knowledge such as process manuals, operational expertise, process models, and historical data; techniques to integrate the knowledge sources into a form that can be used effectively in an intelligent system are of a great necessity.
- Uncertainty in process models and measurements, which may affect the performance of a complex industrial facility system; most of the system's tasks depend on accurate process

measurement and models. Noisy sensor measurements, process disturbances, and the highly non-linear dynamics of some processes can be a source of the system's failure.

- Widely varying time scales of the different system tasks and the operating situations which may happen in the plant; some operating situations might develop over a few minutes, while others might develop over hours and days.

This session is intended to be an intersection of industrial systems and control engineering, artificial intelligence, applied mathematics and statistics, and such application fields as chemical, electrical, mechanical and aerospace engineering. And the goal is protection of human life and health, of the environment, and of the vested economic value.

The main topics of this session include:

- New design for safe manufacturing systems;
- Intelligent distributed systems;
- Computer aided safety;
- Distributed system for diagnosis;
- Analysis and assessment distributed methods of industrial risks;
- Management of dangerous situations and implementation of emergency plans;
- Effective safety feedback;
- Distributed systems for maintenance;
- Computer-aided audit.

Keywords:
Complex system, distributed modelling, Artificial Intelligence, Safety and security

Important dates:

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