Session title: "Cloud- and Cyber-Physical Systems for Smart Manufacturing" - CCPMS

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Short presentation:

Cloud manufacturing (CMfg), one of the new directions induced by digital transformation of manufacturing, allows moving from production-oriented manufacturing to customer- and service-oriented manufacturing networks, by modelling single assets as services in a similar way as SaaS or PaaS do. The CMfg paradigm moves the "Intelligent Manufacturing System" vision one step further towards **Smart manufacturing** through:

- Instrumentation of resources (machine, robot, storage, product carriers) and environment (workplace, material flow, access points) for product-driven automation, routing and traceability, production tracking, evaluation of resource status and quality of services;
- Interconnection of orders, products and resources in a service-oriented approach using multiple communication technologies: wireless, broadband Internet, mobile applications;
- Intelligent, distributed production control: i) new controls based on ICT convergence in automation, robotics, multi-agent and holonic organization; ii) new operations based on product and process modelling; ontologies for semantic description and knowledge representation of the manufacturing domain; iii) novel management of manufacturing value chains (production, supply, delivery, after-sale services) for networked factory.

An important research area concerns resource virtualization and sharing techniques in manufacturing environments. It is currently agreed that resource and resource capability virtualization and modelling represent the starting point for encapsulating manufacturing services in the cloud. The cloud adoption strategy results in an architecture that is robust enough to ensure that the information flow is in sync with the material flow at all times and at the same time flexible enough to allow dynamic reconfiguration and SOA governance.

In this context, MES virtualization involves migration of all MES workloads, traditionally executed on physical machines, to the data centre, and more specifically to the private cloud infrastructure as virtual workloads. The idea is to run all the control software in a virtualized environment and only keep the physical resources with their dedicated real time controllers on the shop floor. This separation between hardware resources and software that controls them provides a new level of flexibility and agility for the manufacturing control solution.

CMfg and MES virtualization were introduced as a networked and service-oriented model, focusing on new opportunities: pervasive resource and product instrumenting, feature-based

material flow description, product-driven automation, orchestration of agentified manufacturing services and integration of business and shop floor technical processes.

CMfg derives not only from cloud computing, but also from related concepts and technologies such as the Internet of Things – IoT (core enabling technology for materials tracking, product-centric control and manufacturing service management), 3D modelling, shape reconstruction and printing (core enabling technologies for digital manufacturing). In CMfg applications, various manufacturing resources and abilities can be intelligently sensed and connected into a wider Internet, and automatically managed and controlled using both (either) IoT and (or) Cloud solutions.

In the **Cyber-Physical System** (CPS) approach of manufacturing, a major challenge is to integrate the computational decisional components (i.e. cyber part) with the physical automation systems and devices (i.e. physical part) to create such network of smart cyber-physical components at MES and shop floor levels. Standardized interfaces for HMES can be used to access physical automation components by the cyber layer in CPS.

To achieve high levels of productivity growth and agility to market changes, manufacturers will need to leverage Big Data sets to drive efficiency across the networked enterprise. There is need for a framework allowing the development of Manufacturing Cyber-Physical Systems that include capabilities for complex event processing and Big Data analytics, which are expected to move the manufacturing domain closer towards digital- and cloud realm within the Contextual Enterprise.

The objective of this Special Session is to address the new CMfg and CPS technologies from collected papers that present innovative solutions for smart manufacturing. Of particular interest are contributions in the research areas:

- Cloud manufacturing models and solutions
- Computing and Service-oriented manufacturing
- Internet of Things for manufacturing
- Manufacturing Cyber-Physical Systems and Industrie 4.0
- Big Data analytics and the Contextual Enterprise
- Software-defined networking
- Direct Digital Manufacturing

Keywords: Cloud manufacturing, virtualization, IoT, Cyber-Physical Systems, SOA, MAS

Important dates:

- Proposals of Special Sessions: April 30
- Full paper submission: June 20
- Notification of acceptance: July 15
- Final, camera-ready paper submission: August 12
- Early registration and fee payment: August 31