7th Workshop on Service-Orientation in Holonic and Multi-agent Manufacturing
Nantes, October 19-20, 2017

Session title: **Cloud- and Cyber-Physical Systems for Smart and Sustainable 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 and sustainable manufacturing through:

- Instrumentation of resources and working environment in product centric approach, with the product directly requesting processing, assembly and control from available service providers while it is in execution (product-driven automation, routing and traceability);

- Interconnection of orders, products and resources in service-oriented approach based on 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 in manufacturing environments. CMfg moves from production-oriented processes to customer- and service-oriented process networks by: (i) modelling single manufacturing processes as services, (ii) accumulating big data for contextual decision making to deliver new client value, and (iii) integrating more tightly the business and production layers.

At shop-floor layer, the virtualization of Manufacturing Execution System (vMES) global functions is achieved by migration of MES workloads for batch management (planning, scheduling, resource allocation, QoS monitoring and task reconfiguring) traditionally executed on physical machines, 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.

The virtualization of shop floor devices provides sustainability by efficient balance between local computing in real time (close to manufacturing resources and intelligent embedded products) and global, high performance computing. Cloud manufacturing services can also provide high availability and recovery of production data in disaster situations (resource breakdown, cyber-attacks) locally or in networked sites.

This special session is also devoted to research in the area of Cyber-Physical Manufacturing Systems (CPMS) – new architectures of ICT systems embedded in physical objects, interconnected through several networks including the Internet, and providing businesses with a wide range of innovative applications based on digitalized data, information and services. This architectural model allows for Big Data processing for business sustainability in the contextual enterprise.

Implementing solutions for the new Industry 4.0 initiative for enterprise integration, networking, and digital engineering based on structural and behavioural models integrating the virtual word and the physical world in the Industrial Internet of Things (IIoT) are sought.

The objective of this Special Session is to address the new CMfg and CPMS technologies from authors' contributions. Of particular interest are contributions in the research areas:

- Cloud manufacturing models and services
- MES virtualization techniques
- Industrial Internet of Things for manufacturing
- Manufacturing Cyber-Physical Systems and Industry 4.0
- Big Data analytics and the Contextual Enterprise
- Software-defined networking
- Direct Digital Manufacturing

Keywords: CMfg, resource virtualization, vMES, IIoT, CPMS, Industry 4.0