Design and management of Digital Manufacturing & Assembly Systems in the Industry 4.0 era

The manufacturing environment radically changed over the last decades. Breakthrough innovations as the ubiquitous use of cheap sensors and actuators communicating through a network, e.g. Internet, enables the real-time connection between systems, machines, tools, workers, customers and products defining the so-called Internet of Things (IoT) (Stankovic, 2014). The enormous quantity of data (e.g. Big Data) generated by these connect objects represent the raw material of 21st century. IoT allows to develop a novel production paradigm, called personalized production which enable the customer involvement since the product design phase (Bortolini et al., 2017a). The market demand evolution over the last decades requires high volumes of products individually personalized (Nee et al., 2012). This recent revolution of the industrial environment is named “Industry 4.0” (I40) which represents the comprehensive transformation of the entire industrial production through the merging of Internet and information & communication technologies (ICT) with traditional manufacturing processes (Davies, 2015).

Purpose of I40 is the development of a new generation of smart factories grounded on the manufacturing and assembly process digitalization (Yao and Lin, 2016). Smart factories of I40 era are distinguished by an increased production flexibility thought the use of real-time reconfigurable machines that allow the profitable personalized production of products in batches as small as the unique item (Ivanov et al., 2016; Koren and Shpitalni, 2010). A remarkable opportunity to target these goals is the development of a brand new generation of manufacturing and assembly systems implementing the I40 principles to production processes (Bortolini et al., 2017b).

“Digital Manufacturing & Assembly Systems” are modularly structured with cyber physical systems, as “convertible machines”, “smart assembly stations” and “smart part logistic”. These elements communicate and cooperate with each other in real time, integrating the physical processes with virtual information in an augmented reality fashion to eliminate errors and maximize the production process efficiency. Furthermore, aided assembly improves the duration and safety of fastening and picking activities through several technologies, as Cobots. CNC machines and reconfigurable tools are integrated through adequate controls in an open architecture environment to produce a particular family of customized parts ensuring a scalable, convertible and profitable manufacturing process.

This Special Issue seeks original manuscripts to investigate the design and management of “Digital Manufacturing & Assembly Systems” for an efficient, flexible and modular production of customized products exploiting the I40 enabling technologies. The sought contributions should target, but are not limited to, proper automation technologies, ICT infrastructures, control algorithms, optimization models, management and design methods as well as industrial case studies for the new generation of “Digital Manufacturing & Assembly Systems”. 
Possible topics of manuscripts for this Special Issue include but are not limited to:

- Machine Learning and Artificial Intelligence for manufacturing processes.
- Smart assembly station design and management.
- Big Data analytics for reconfigurable manufacturing systems.
- Control algorithms for smart part logistic.
- Self-optimization models for assembly line balancing and sequencing to quickly reconfigure the system.
- Self-configuration and self-diagnosis methods based on Internet of Things technologies.
- Predictive maintenance and condition monitoring of machining tools.
- Additive manufacturing technologies for on-demand production of personalized goods.
- Intelligent support systems and augmented reality technologies for operator assistance.
- Innovative automation and robotic technologies to enhance the human-robot co-working.
- Virtualization and simulation techniques for decision making in manufacturing and assembly processes.
- Novel industrial and real world case studies to test and spread the adoption of “Digital Manufacturing & Assembly System”.

References

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