

Special issue on Human and Industry 4.0

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Industry 4.0, Factory of the Future, Operator 4.0, Intelligent Manufacturing Systems, Systems Engineering, Holonic and multi-agent systems, Cyber-Physical Systems, Robotics, Predictive maintenance, Reliability, Safety, Security, Human-Machine Cooperation, Human Factors, Human-centered design, Ethics Layers of cooperation, Modeling, Levels of Automation, Complex Adaptive systems, Decision support systems, Dynamic Function Allocation, Design and evaluation methodology

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Abstract:

Since the start of industrialization, machine capabilities have increased in such a way that human control of processes has evolved from simple (with mechanization) to complex (with computerization and automation) systems. The related processes have also evolved from simple to more complex systems. In addition to the traditional rational approach to human machine integration, this development might also change our emotional relationship to machines, and make it necessary to design, engineer and assess this.

Industry 4.0, in addition to a high physical complexity of our systems, especially the increasing of amount of software and networks, also leads to an increasing complexity of these cyber physical systems which leads to a high mental complexity for the humans involved. This requires tight integration and coordination between software, hardware and “human-ware” into meaningful social-cyber-physical systems.

Machines and processes might become so autonomous that humans might lose awareness and control. Besides all autonomy, human intervention may be still required e.g. to update the manufacturing plan, to modify the process configuration when a machine breaks down, or to assist process-intelligent entities when they fall in a deadlock.

In view of Industry 4.0 challenges, the human factor is more and more considered as a key element in addition to hardware and software, that should be addressed to ensure overall system safety and efficiency. Moreover, the human factor is also more and more taken into account for social aspects, e.g. for the integration of humans on different decisional levels. In order to reach safe, secure, robust, efficient, and well accepted industrial socio-technical systems, all decisional levels should be considered to support sufficient cooperation between Human and Systems, as well as between Humans.

Cooperational aspects have already been studied in other domains than manufacturing, especially in aeronautics, automotive and railway systems, and robotics for example. In these domains, the

paradigm of human-machine cooperation strives to balance the increase of machine capabilities for technical tasks with the abilities to communicate with Humans and to understand Humans, i.e. to cooperate not only with other machines but also with the human. The objective of this special issue is to extract the general results of these domains and bring them together with current manufacturing projects to highlight clues and good practices to design intelligent manufacturing systems for Industry 4.0.

Special attention is given to human involvements, to the connection of theory and practical applications, including engineering, operations, maintenance and training of Industry 4.0 systems.

This special issue is organized in collaboration of several research groups:

- GRAISyHM (Research Group on Integrated Automation and Human-Machine systems)
- GDR MACS (National Research Group on Modeling, Analysis and Control of dynamic Systems)
- IFAC TC HMS (Technical Committee of the International Federation of Automatic Control on Human-Machine Systems).

Contributions have to fulfill the aims and scope of Cognition Technology & Work.

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