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## Special Issue on Manufacturing Plant Control Challenges and Issues: Guest editorial

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## Guest Editorial of the Special Issue: *Manufacturing Plant Control Challenges and Issues*

We are pleased to introduce this special issue of the IFAC journal on *Control Engineering Practice* which contains improved selected papers of the 11<sup>th</sup> IFAC INCOM'04 Symposium on *Information Control Problems in Manufacturing* held in Brazil.

The main purpose of INCOM'04 has been to point up international research and developments dealing with all the applications of automation, information and communication technologies in order to control and to manage the manufacturing plant within the e-enterprise. This general scope involves all methodological and technological aspects to digitally control with more agility the entire manufacturing chain, from supply and design through manufacturing, to maintenance and service, over the whole product and processes life cycle.

The introductory paper by (Morel, Valckenaers, Faure, Pereira, Diedrich) presents current key problems/applications and the recent major accomplishments/trends addressed by the three working groups of the IFAC TC for *Manufacturing Plant Control* issues as well as by the main sponsor of two workshops on *Intelligent Manufacturing Systems* and *Intelligent Assembly & Disassembly* and a Symposium on *Information Control Problems in Manufacturing*.

Then, (Neumann) presents “*what is going on communication in industrial automation*” discussing how communication networks and the Internet are decisively impacting the manufacturing automation domain. This general problem of automation over and with networks leading to a distributed automation system is handled by the working group on *Networked Controlled Manufacturing Systems* which has contributed to making TC 5.1 proactive since 2001 in this important application field by investigating the following aspects:

- . Design, programming, operation and diagnosis of automation behaviour in a distributed environment,
- . Industrial informatics methods for automation device and system development,
- . System integration models and technologies for communication connected devices (e.g. for configuration and parameterisation),
- . Use of heterogeneous (industrial and private) networks, so called Virtual Automation Networks (VAN), to provide automation relevant Quality of Services,
- . Life cycle aspect for distributed automation systems.

A first rational issue of this networked automation is to put into question the Hierarchical/Integrated vision of Enterprise-wide control for a more Interoperable/Intelligent one by postulating that the customized product should be the ‘controller’ of the manufacturing enterprise resources. This is made possible by the related explosion of enabling information technologies among which we can cite infotonics technology such as RFID. (Parkilad and McFarlane) *investigate the role of this product information in end-of-life decision making* in order to ensure the coherence between the physical and information flows all along the product life cycle. These novel solutions for manufacturing control systems that merge know-how from control engineering, software engineering and complex systems/artificial life research are investigated by the working group on *Intelligent Manufacturing Systems*. This results in novel designs promising scale-ability, re-usability, integrate-ability and robustness. Recent efforts focus on the validation of these concepts through realistic testing campaigns on industrial test cases as stated by (Marik and Lazansky) for *industrial applications of agent technology*. To this end and in anticipation of the availability of a generic service as investigated by the European IMS Network of Excellence, *simulation-based benchmarking of production control schemes for complex manufacturing systems* addressed by (Mönch) remains the mean to prove the efficiency of solutions before their deployment for practical purposes. On a more fundamental level, the concepts of emergent and self-organizing systems,

often in designs inspired by biological systems, are posing new engineering perspectives, such as *the engineering perspective on the supply network control problem* addressed by (Saint Germain, Valckenaers, Verstraete, Hadeli, Van Brussel) by extending the HMS paradigm for inter and intra-enterprise logistics issues. On an organizational level, a continuing collaboration of this WG with the IFIP WG 5.7, the European IMS Network of Excellence and the Brazilian MANET Network of Research contributes to making TC 5.1 proactive to unite the scientific IMS community.

Another rational issue addressed by (Johnson) is to test the *role of formal methods for improving automation software dependability* in order to face the tolerance to faults of these networked and software-based control systems. As examples of formally checking their behaviour, (Flordal, Fabian, Akesson, Spensieri) deal with *the automatic model generation and PLC-code implementation for coordination of industrial robot cells* and (Kwiatkowska, Norman, Parker) with their *dependability analysis by probabilistic models*. This general problem of the dependability of manufacturing systems driven and supervised by hardware and software controllers that most of the time are communicating through networks is addressed by the working group on *Dependability of Manufacturing Systems* which has contributed to making TC 5.1 proactive since 2002 by investigating the following aspects:

- . Formal or formalized description techniques for design, implementation and validation of system components and communication systems,
- . Manufacturing systems formal design techniques,
- . Safe and secure middle ware based on COTS components,
- . Dependability in networked automation
- . Safety and security algorithms,
- . Modes management.

Finally, this advanced manufacturing plant-wide automation is posing new education and training challenges to develop system thinking in order to lead the stepwise abstraction and concretization of technical system complexity towards the emerging ambient intelligence world. (Bruns and Erbe) propose a *learning environment merging on-site and remote components* into a cooperative systems engineering process in order to bridge reality and virtuality over only idealized computer-simulation learning situations.

We would like to thank the authors for their contributions and the referees for the time they put in reviewing all the papers. Thanks to Professor Ian Craig, Editor-in-chef of the IFAC journal on Control Engineering practice for his strong support.

Pr. Gérard Morel  
Chair of International Program Committee

Pr. Carlos Eduardo Pereira  
General Scientific Chair

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