

IFAC TC 5.2

Manufacturing Modelling for Management and Control

Working group 3: Design and Control of Reconfigurable Manufacturing Systems

Report period: Apr 2012-May 2013

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Short presentation: The working group investigates and develops novel modelling approaches for designing and management of reconfigurable machining, assembly and disassembly systems. One of the main characteristics of these automated systems is that they use reconfigurable manufacturing technologies for fast adaptation to changes in the quantity and mix of products. Indeed, the industry's new requirements for manufacturing systems given the shorter and shorter product runs and the need for more customization. The production systems should be designed to be able to make changes in its physical configuration to answer market fluctuations in both volume and type of product. One of the principal characteristics of reconfigurable manufacturing systems (RMS) is modularity: in a reconfigurable manufacturing system, all the major components are modular (system, software, control, machines and process). Selection of basic modules and the way they can be connected provide systems that can be easily integrated, diagnosed, customized, and converted. An RMS is also supposed to quickly integrate new technologies to improve its efficiency. RMS is assumed to be the perfect tool for the new era of mass customization that requires simultaneously the productivity of dedicated system and the flexibility of agile manufacturing system. The aim of this working group is a review on this topic, more particularly on the challenges of flexibility and reconfigurability for assembly, disassembly and machining systems by study of several problems:

- Equipment selection and process planning;
- Production system dimensioning;
- Assembly and disassembly line design and balancing;
- Robotic cell design;
- Scheduling and planning;
- Operations management and flow analysis.

Keywords: RMS, Assembly, Machining, Flexibility, Design, Optimization

During the period of Jan. 2012-May 2013, working group members were very active to promote the IFAC, TC 5.2 and working group activities. Following are highlighted the main results:

Publication of book chapters:

- 1). X. Delorme, O. Battaïa, A. Dolgui. Multi-objective Approaches for Design of Assembly Lines, Chapter 2 in: Multi-Criteria and Game Theory Applications in Manufacturing and Logistics, L. Benyoucef, J.-C. Hennet and M.K. Tiwari (Eds.), Springer Series in Advanced Manufacturing, Springer, 2013, p. 29–55.
- 2) F. Makssoud, O. Battaïa, A. Dolgui. Reconfiguration of Machining Transfer Lines, Chapter 22 in: Service Orientation in Holonic and Multi-agent Manufacturing and Robotics, T. Borangiu, A. Thomas and D. Trentesaux (Eds.), Studies in Computational Intelligence, vol. 472, 2013, (ISBN 978-3-642-35851-7), Springer, p. 339–354.

Editors of special issues of international journals

- 3) X. Delorme, A. Dolgui, A.A. Kolokolov. Complex Optimisation Problems in Locational Analysis and Scheduling, Journal of Mathematical Modelling and Algorithms in Operations Research, (accepted, In Press, DOI: 10.1007/s10852-012-9197-1)

Organization of tracks and special sessions at international conferences

1. **MIM 2013**, Special Track: AUTOMOTIVE MANUFACTURING & SUPPLY CHAIN MANAGEMENT. IFAC 2013 Conference on Manufacturing Modelling, Management and Control (IFAC-MIM), June 19-21, Saint Petersburg, (Russia). Organized by A. Dolgui and O. Gusikhin.
2. **MIM 2013**, Special Session: BALANCING AND SEQUENCING OF ASSEMBLY AND MACHINING LINES. IFAC 2013 Conference on Manufacturing Modelling, Management and Control (IFAC-MIM), June 19-21, Saint Petersburg, (Russia). Organized by X. Delorme, A. Dolgui and O. Hazir.
3. **INCOM 2012**, Special Track: DESIGN OF RECONFIGURABLE MANUFACTURING SYSTEMS. Organized by A. Dolgui, B. Rimini and G. Levin.
4. **INCOM 2012**, Special session: COMBINATORIAL DESIGN OF RECONFIGURABLE PRODUCTION AND ASSEMBLY LINES. 14th IFAC Symposium on Information Control Problems in Manufacturing May 23 - 25, 2012, Bucharest, Romania, Organized by: A. Dolgui and R. Gamberini.
5. **INCOM 2012**, Special session: PERFORMANCE EVALUATION AND OPTIMIZATION IN ASSEMBLY AND PRODUCTION LINE DESIGN. 14th IFAC Symposium on Information Control Problems in Manufacturing May 23 - 25, 2012, Bucharest, Romania, Organized by: A. Dolgui, and H. Chehade.

Moreover, other tracks and special sessions were organized in prestigious international conferences such as IESM2013, EURO-INFORMS 2013, META2012, ROADEF'2013 and 2012.