

IFAC TECHNICAL COMMITTEE (TC) ANNUAL REPORT

Report covering period

(This report is provided in addition to the event list and statistics derived from the IFAC event data base, it addresses the workings of the TC, as provided by the TC Chair on recommendation of the TC)

TC Name **Manufacturing Modeling, Management and Control**
 TC Number **5.2**
 TC Chair **Dmitry Ivanov**
 e-mail: **divanov@hwr-berlin.de**

TC Report (in 1 st year of triennium)	yes	no
Have you nominated your TC vice-chair(s)?	x	<input type="checkbox"/>

(list all)

Prof. Nathalia Bakhtadze (Institute of Control Sciences, Russia)
 E-mail: Sung7@yandex.ru

Prof. Alexandre Dolgui (IMT Atlantique, France)
 E-mail: alexandre.dolgui@imt-atlantique.fr
 URL: www.emse.fr/~dolgui

Prof. Farouk Yalaoui (University of Technology of Troyes, France)
 E-mail: Farouk.Yalaoui@utt.fr

Vice-chair for Education: Prof. Daria Battini (University of Padova, Italy)
 E-mail: daria.battini@unipd.it

Vice-chair for Industry: Dr. Oleg Gusikhin (Ford, USA)
 E-mail: ogusikhi@ford.com

Vice-chair for Publication: Prof. Dr. Enzo Morosini Frazzon (Federal University of Santa Catarina, Brazil)
 E-mail: enzo.frazzon@ufsc.br

Vice-chair for Social Media: Dr. Eric Grosse (TU Darmstadt)
 E-mail: grosse@pscm.tu-darmstadt.de

Have you updated your membership roster? - Number of TC members 86	x	<input type="checkbox"/>
-----------------------------------------------------------------------	---	--------------------------

Have you sent your membership roster to the Secretariat?	x	<input type="checkbox"/>
----------------------------------------------------------	---	--------------------------

Have you updated your TC scope?	x	<input type="checkbox"/>
---------------------------------	---	--------------------------

scope: The activities of the Manufacturing Modelling for Management and Control Technical Committee are devoted to promote the development of formal descriptive or prescriptive models of manufacturing systems. Models range from optimization and knowledge-based models to simulation models (discrete-event and continuous), all of them oriented to design of production systems and supply networks, production and supply chain management.

Technical areas of interest in this committee include:

- (a) Models of manufacturing tasks in production as well as assembly units, with the aim of designing architectures of workstations, cells and production lines, quality assurance and maintenance;
- (b) Models of manufacturing processes aiming at the design of procedures for process planning, production planning and control, job and activity scheduling, inventory control and logistics;
- (c) Models of supply networks aiming at the design, planning and control of coordinated production-logistics systems;
- (d) Models of Industry 4.0, cyber-physical systems, computer-aided, communication-based and Internet-based procedures and processes with the aim of accomplishing the functions listed in (a) - (c).

Have you created/amended your TC website? x
- Address <https://tc.ifac-control.org/5/2/>

List of Working Groups - 7 Working Groups

- Name: WG 1 "Supply Network Engineering"
- Chairs: Prof. Dr. Alexandre Dolgui (France), Prof. Dr. Dmitry Ivanov (Germany)

- Focus: The working group explores and generates novel solutions for supply chain design and management. Indeed, Supply chains are emblematic examples of the renewal of production systems in the last decades. Supply Chains Engineering is an emerging field for Automatic Control applications based on analysis and comprehension of essential principles of production and distribution systems. This scientific domain concerns the methodical evaluation and optimization of production systems, logistics networks, and their management policies to increase the effectiveness of multifaceted demand and supply chains. The major industrial problems and various effective approaches of inventory control in Supply chains, use of Radio Frequency IDentification (RFID) and Internet applications or intelligent storage facilities are being examined. Radical changes in the criteria that express the new objectives of production systems and logistics are on-going: Just-In-Time (JIT) requirements, dynamic scheduling, dynamic pricing, etc. In addition, the main concerns of outsourcing are being detailed. In particular, a vendor selection and evaluation models are being developed. Certainly, warehouses are critical components of supply chains. In this WG, their usefulness is highlighted and their various functions and equipment are being analysed. The design stage is also being extensively considered via developing storage algorithms as well as examining warehouse sizing static and dynamic models.

- Timeline: WG was created in 2009

- Deliverables in 2018:

Organization of international conferences, tracks and special sessions:

INCOM 2018:

Invited session: System identification for manufacturing control applications

Invited session: Supply Chain and Operations Simulation

POMS 2018: Invited Session "New methods and models in supply chain disruption management" (Dmitry Ivanov)

GSC'2018, 4th International Conference on Green Supply Chain, Thessaloniki, Greece
(Alexandre Dolgui is IPC Chair)

- Name: WG 2 "Advanced multi-criteria applications in manufacturing and logistics"
- Chairs : Prof. Dr. Lyes Benyoucef (France), Dr. Aguirre Hernan (Japan) and Prof. Dr. Farouk Yalaoui (France)
- Focus: Multi-criteria approaches have been put to use in multiple segments of manufacturing and logistics. They have taken a prominent role to integrate people, information and products across integrated supply chain boundaries including management of various manufacturing, logistics and retailing operations such as in manufacturing, warehousing and distribution of goods and services. Decisions involving customer profiling, new product development, retail marketing, and sales patterns are immensely refined using innovative multi-criteria approaches. Also, as such decisions have an impact on the overall integrated logistic network processes, it is important that innovative multi-criteria-based tools also be linked to integrated supply chain management applications. The working group aims to align latest practice, innovation and case studies with academic frameworks and theories. It will cover the latest research results and efforts at different levels including quick-response system, theoretical performance analysis, performance and capability demonstration, hoping to cover the role of multi-criteria approaches in optimizing manufacturing and logistics.

- Timeline: WG was created in 2011

- Deliverables in 2018:

INCOM 2018:

Invited session: Modeling and optimization approaches for the next generation

Invited session: Operations research techniques for modeling and optimizing logistics

Invited session: Optimization of design and planning problems in health care systems

Open Track: Scheduling problems

Co-General Chair, ICSMO 2018, 6th International Conference on System Modeling and Optimization (ICSMO 2017), February 7-11, Valenciennes France <http://icsmo.org/> (Farouk Yalaoui)

- Name: WG 3 "Design and Control of Reconfigurable Manufacturing Systems"
- Chairs : Dr. Olga Battaia, Dr. Xavier Delorme (France), Dr. Rita Gamberini (Italy) and Prof. Manoj Kumar Tiwari (India)

- Focus: 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.

- Timeline: WG was created in 2009 by Alexandre Dolgui, managed by new team of co-chairs since May 2015

- Deliverables in 2018:

Special session (jointly with WG2): Advanced fuzzy logic applications in manufacturing and logistics

- Name: WG 4 "Advances in Integrated Maintenance Management"

- Chairs : Prof. Dr. Anis Chelbi (Tunisia), Prof. Dr. Ali Gharbi (Canada) and Prof. Dr. Nidhal Rezg (France)

- Focus:

Ameliorating the situation of an industry requires certainly reducing costs and maximizing the customer satisfaction. These two aims cannot be achieved without good management and a good know how while making decisions. These decisions are generally associated, at least, with three levels of the hierarchical planning process: strategic, tactical and operational levels. Generally, manufacturing industries aims at determining the most adequate integrated maintenance production strategies which helps them to optimize the system exploitation and to reduce several costs. Releasing such an efficient planning urges firms to have a global vision on their production and maintenance process which may be looked upon as an inter-dependent set of sub systems performing various functions including ordering raw materials, assembling pieces, controlling quality, repairing machines, storage, etc. One of the key issues in up-to-date research in integrated maintenance production strategies is to develop a set of new intelligent integrated maintenance policies which integrate maintenance and production aspects with taking into account several environment constraints. The real goal is to face the various contemporary industrial constraints in order to optimize the system exploitation and to reduce several costs. The WG aims to present and analyze new methods and tools of new integrated maintenance strategies, in order to increase service level, system availability with reducing several costs. This objective can be realized by new organization of combined maintenance tasks, production planning, and resources of several activities.

- Timeline: WG was created in 2012

- Deliverables in 2018:

- Name: WG 5 "Risk, analytics and operations"

- Chairs : Prof. Dr. Desheng Dash Wu (Sweden) and Prof. Dr. Charles S. Tapiero (USA)

- Focus:

Operations Risk Analytics will enable the growth and understanding of best practices in operations, e.g., pricing functions. Banks are processing millions of transactions everyday in order to protect against fraud and terrorist financing. Energy companies monitor operations process and customer activities to protect again abnormal and predict spikes in demand. Risk analytics in business intelligence represents data-oriented techniques to

supplement business systems for better risk-based decision making. Risk performance analysis in manufacturing intelligence uses advanced data analytics, modeling and simulation to produce a fundamental transformation to new product-based economics through internet-based service enterprises and demand-driven supply chains. Risk evaluation plays key roles in emerging areas such as bio-manufacturing, nanotechnology, and energy. We see a dramatic increase in the use of predictive analytics in these and many other areas. This working group will bring together scientists who have different backgrounds and disciplines, and provide a set of opportunities to discuss these open issues.

- Timeline: WG was created in June 2015

- Deliverables in 2018:

2018 Service Engineering Society Annual Conference & IEEE ARTC Symposium, (Qidi Wu, Shanlin Yang, Shouy Wang, Desheng Dash Wu and Feiqiao)

2018 Workshop on Service Innovation in Big Era, Haikou, Hainan University (Qiang Guo, Desheng Dash Wu and Wolfgang Hardle)

- Name: WG 6 "Intelligent methods and systems supporting supply chain decision making"

- Chairs: Prof. Michael Freitag (Germany) and Prof. Enzo Morosini Frazzon (Brazil)

- Focus:

The activities of the working group cover the technology-based integration of different supply chain tasks, such as: production planning, scheduling and control, transportation and logistics planning, scheduling and control, inventory planning and warehouse management and operations, manufacturing systems operations as well as coupled services and technologies which can lead to improved supply chains. It includes such topics such as modeling, simulation, analysis, and control of manufacturing processes; Monitoring, diagnosis and maintenance of manufacturing systems; Smart manufacturing systems and Industry 4.0 technologies. Special attention will be directed towards practical relevance and approaches that can foster innovation in manufacturing supply chains.

- Timeline: WG was created in 2017

- Deliverables in 2018:

INCOM 2018:

Open Track: Intelligent Methods and Systems supporting Supply Chains Decision Making

Invited session (jointly with WG1): Supply Chain and Operations Simulation

LDIC 2018: Organisation of international conference LDIC 2018 in Bremen (Michael Freitag); Proceedings published with Springer

- Name: WG 7 "Human factors and ergonomics in industrial and logistic system design and management"

- Chairs: Prof. Daria Battini (Italy), Prof. Fabio Sgarbossa (Italy), Prof. Christoph Glock (Germany)

- Focus:

Generally, human factors (perceptual, mental, physical and psychosocial aspects) determine the performance of industrial and logistic systems to a large extent if human operators are employed. This aspect becomes more challenging in light of demographic changes, which

will likely put human factor-related issues in logistics – such as the risk of developing musculoskeletal disorders in labor-intensive work environments, for example – on top of the agendas in many companies. In addition, the consequences of using innovative technical solutions to support industrial and logistics processes, such as augmented reality or motion capturing, is not yet fully understood in light of human performance and errors.

This working group aims at investigating the development of innovative approaches for the integration of human factors in industrial and logistic system design. Topics may include, but are not limited to:

- Ergonomics in operations and logistics management
- Learning and forgetting aspects in industrial systems
- The impact of system design on human errors
- Error-free systems
- Reduction of injury risks in manual operations
- The impact of demographic changes on industrial systems

- Timeline: WG was created in 2017

- Deliverables in 2018:

Organisational Committee for INCOM 2018 (Fabio Sgarbossa)

INCOM 2018:

Invited session: Warehousing and material handling in manufacturing and distribution settings: trends and technologies

Invited session: Human factors and ergonomics in industrial and logistic system design and management

Date and Place of Last TC Meeting IFAC INCOM 2018, Bergamo, June 12, 2018

Is your TC contributing to a Milestone Report?

Congress Year Report only

- Number of Congress Papers Reviewed by TC

Events sponsored or co-sponsored by your TC:

INCOM 2018, Bergamo, Italy, June 11-13, 2018

TECIS 2018, September 13-15, 2018, Baku, Azerbaijan

At INCOM 2018, more than 10 invited sessions and tracks have been proposed by TC 5.2. In addition to the tracks and sessions associated with the WGs as indicated above, the TC 5.2 members organized the following sessions:

Invited session: Digital Twins as the heart of Cyber-Physical manufacturing systems

Special session: Multimodal Networks Modeling and Design

Open Track: Industrial Performance Measurement and Management

Open Track: Industrial robotics and applications

Deliverables of TC 5.2 at INCOM 2018 in summary:

Special/Invited Sessions and tracks from TC 5.2: 13

Papers in the INCOM program from TC 5.2: 47

Plans for TC?

With seven established working groups and 86 members from 24 countries, the TC 5.2 is a good health and develops successfully. The next plan of TC 5.2 is the MIM 2019 Conference in Berlin on August 28-30, 2019. Other plans:

To prepare a special issue of an IFAC journal on the topics of IFAC TC 5.2 and by the members of IFAC TC 5.2

To prepare Special Issues in IJPR, IJOPM, IJPE and CAIE.

To edit a new book with a large participation of the members of IFAC TC 5.2

To organise a series of tracks and sessions at IFAC WC 2020 in Berlin

Problems – especially any that require TB attention?

No problems

What is the long-term outlook for the scientific topics of your TC?

Please describe likely future major developments within the scope of this TC

Industry 4.0, Resilient Supply Chains, Digital Manufacturing, Analytics applications to manufacturing, human factors

Recommendation

Please provide recommendations relevant to TC operation such as potential new Working Groups, recommendations to merge this TC with another TC, new trends within the technical field covered by the TC that suggest future changes in IFAC scope or activities, etc.)

no further recommendations