INFORMATION TECHNOLOGY FOR BALANCED MANUFACTURING SYSTEMS

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

> *IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.*

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

INFORMATION TECHNOLOGY FOR BALANCED MANUFACTURING SYSTEMS

IFIP TC5, WG 5.5 Seventh International Conference on Information Technology for Balanced Automation Systems in Manufacturing and Services, Niagara Falls, Ontario, Canada, September 4-6, 2006

Edited by

Weiming Shen

Springer

Library of Congress Control Number: 2006929211

Information Technology for Balanced Manufacturing Systems

Edited by W. Shen

p. cm. (IFIP International Federation for Information Processing, a Springer Series in Computer Science)

ISSN: 1571-5736 / 1861-2288 (Internet)
ISBN: 10: 0-387-36590-7
ISBN: 13: 9780-3870-36590-7
eISBN: 10: 0-387-36594-X
Printed on acid-free paper

Copyright © 2006 by International Federation for Information Processing.
All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer Science+Business Media, LLC, 233 Spring Street, New York, NY 10013, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with any form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.
The use in this publication of trade names, trademarks, service marks and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

Printed in the United States of America.

9 8 7 6 5 4 3 2 1
springer.com

TABLE OF CONTENTS

SPONSORS ix
COMMITTEES xi
PREFACE xiii

KEYNOTE PAPERS 1

1 AGENT BASED MANUFACTURING
L. Monostori, J. Váncza, Soundar Kumara 3
2 TOOL CONDITION MONITORING IN MACHINING – NEURAL NETWORKS
Mo A. Elbestawi, Mihaela Dumitrescu 5
3 AGENT-BASED SUPPLY CHAIN PLANNING IN THE FOREST PRODUCTS INDUSTRY
Sophie D'Amours, Jean-Marc Frayret, Alain Rousseau, Steve Harvey, Pascale Plamondon, Pascal Forget 17

PART A: MULTI-AGENT AND HOLONIC SYSTEMS IN MANUFACTURING 27

4 AN AGENT-OS FOR AUTONOMOUS COOPERATIVE SYSTEMS
Francisco Maturana, Raymond Staron, Pavel Tichý, Pavel Vrba, Charles Rischar, Vladimír Mařík, Kenwood Hall 29
5 A HOLONIC APPROACH TO DYNAMIC MANUFACTURING SCHEDULING
Paulo Leitão, Francisco Restivo 37
6 TOWARD COLLABORATIVE SCHEDULING
Ana Almeida, Goreti Marreiros 47
7 A FRAMEWORK OF AGENT-BASED SUPPLY CHAIN PERFORMANCE ANALYSIS SYSTEM
Guannan Qu, Zhiyi Fang, Chao Zhang 57
8 AN AGENT-BASED SIMULATION OF A JIT MATERIAL HANDLING SYSTEM
Qi Hao, Weiming Shen 67
9 UNCERTAIN TEMPORAL SUPPORT IN MULTIAGENT MEDICAL SERVICE
Kamil Matoušek, Zdeněk Kouba 79
10 COLLABORATIVE EVENT MANAGEMENT IN SUPPLY CHAINS: AN AGENT-BASED APPROACH
Pascal Forget, Sophie D'Amours, Jean-Marc Frayret 89
11 DESIGN PATTERNS FOR DISTRIBUTED CONTROL SYSTEM BENCHMARKING
Karthik Soundararajan, Robert W. Brennan 99

12 INDUSTRIAL APPLICATION INTEGRATION USING AGENT-ENABLED SEMANTIC SOA: CAPNET CASE STUDY
Leonid Sheremetov, Miguel Contreras 109
13 A MULTIAGENT BASED CONTROL SYSTEM APPLIED TO AN EDUCATIONAL SHOP FLOOR
José Barata, Gonçalo Cândido, Filipe Feijão 119

PART B: NETWORKED ENTERPRISES 129

14 DISTRIBUTED WORK ENVIRONMENTS FOR COLLABORATIVE ENGINEERING
H.-H. Erbe, D. Müller 131
15 MARKET OF RESOURCES AS AN ENABLER OF (INTER-) ORGANIZATIONAL RECONFIGURATION DYNAMICS
Maria Manuela Cunha, Goran D. Putnik 141
16 BUSINESS NETWORKS IN SMALL TEXTILE ENTERPRISES: THE CASE OF NOVA FRIBURGO-BRASIL
Américo Azevedo, Luísa Faria, ... 149
17 BUSINESS PROCESS BASED INTEGRATION OF DYNAMIC COLLABORATIVE ORGANIZATIONS
Guillermo Jimenez, Manuel Ocampo, Nathalie Galeano, Arturo Molina 157
18 MANAGING COMPLEXITY IN INDUSTRIAL COLLABORATIONS WITHIN TOOL & DIE INDUSTRY
Günther Schuh, Alexander Sauer, Sebastian Döring 167
19 A MULTIAGENT-BASED COMPLEX SYSTEMS APPROACH FOR EFFICIENT PARTNERING IN VIRTUAL ENTERPRISE
Toshiya Kaihara 175
20 DESIGN FOR PRODUCT LIFECYCLE MANAGEMENT
Wenlei Zhang, Yushun Fan 183
21 TOWARDS A REFERENCE MODEL FOR COLLABORATIVE NETWORKED ORGANIZATIONS
Luis M. Camarinha-Matos, Hamideh Afsarmanesh 193
22 AGENT-BASED INTELLIGENT MEDIA DISTRIBUTION IN ADVERTISEMENT
Raafat Aburukba, Hamada Ghenniwa, Weiming Shen 203
23 A SERVICE COMPOSABILITY MODEL TO SUPPORT DYNAMIC COOPERATION OF CROSS-ENTERPRISE SERVICES
Jing-fan Tang 213
24 ON FORMAL THEORIES AND FORMALISMS FOR VIRTUAL ENTERPRISES
Goran Putnik, Rui Sousa 223
25 TOWARDS A DISTRIBUTED PROCESS EXECUTION PLATFORM FOR COLLABORATIVE NETWORKS
A. Luis Osório, Luis M. Camarinha-Matos 233

PART C: INTEGRATED DESIGN AND ASSEMBLY 241

26 AN INNOVATIVE MAINTENANCE SOLUTION FOR COMPLEX MACHINERY: THE KOBAS PROJECT CASE
Américo Azevedo, Paula Silva, César Toscano, Joao Cardoso 243
27 REAL-TIME COLLABORATIVE DESIGN SYSTEM FOR PRODUCT ASSEMBLY OVER THE INTERNET
Xiangxu Meng, Weiwei Liu, Yanning Xu 253
28 AN INTEGRATED APPROACH TO A MULTI-ATTRIBUTE DECISION PROBLEM THROUGH A CASE STUDY
Ashish Ganguli, Yong Zeng, Akif A. Bulgak 261
29 MAKING MANUFACTURING CHANGES LESS DISRUPTIVE: AGENT-DRIVEN INTEGRATION
Joseph Neelamkavil, Weiming Shen, Qi Hao, Helen Xie 271
30 A VISION-BASED APPROACH OF BARE-HAND INTERFACE DESIGN IN VIRTUAL ASSEMBLY
Xiaobu Yuan, Jiangnan Lu 281
31 ON THE ASSEMBLY LINE: A VIEW FROM INDUSTRIAL SOCIOLOGY
Paula Urze, Tiago Machado 291
32 AN OBJECT BASED VIRTUAL REALITY SIMULATION TOOL FOR DESIGN VALIDATION OF A NEW PARADIGM CLOTH MANUFACTURING FACILITY
Fabio Bonsignorio, Rezia Molfino 301
33 ON THE RE-CONFIGURABILITY DESIGN OF PARALLEL MACHINE TOOLS
Dan Zhang 309
34 EVOLVABLE ASSEMBLY SYSTEMS BASIC PRINCIPLES
Mauro Onori, José Barata, Regina Frei 317
35 A CELLULAR NEURAL NETWORK FOR DEFORMABLE OBJECT MODELLING
Y. Zhong, B. Shirinzadeh, X. Yuan, G. Alici, J. Smith 329

PART D: MONITORING AND CONTROL 337

36 A LOAD BALANCING METHOD FOR DEDICATED PHOTOLITHOGRAPHY MACHINE CONSTRAINT
Arthur Shr, Alan Liu, Peter P. Chen 339
37 ITERATIVE HEURISTICS FOR PERMUTATION FLOW SHOPS WITH TOTAL FLOWTIME MINIMIZATION
Xiaoping Li, Qian Wang 349
38 PARAMETER ESTIMATION FOR TIME-VARYING SYSTEM BASED ON COMBINATORIAL PSO
Weixing Lin, Peter X. Liu 357
39 REMOTE MONITORING AND CONTROL OF MANUFACTURING SYSTEM
E. Villani, R.A. Castro, F.M. Marques, P.E. Miyagi 369

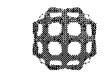
40 ARCHITECTURE OF A WEB-BASED POWER SCADA SYSTEM USING J2EE TECHNOLOGY
Qizhi Chen, Hamada Ghenniwa, Weiming Shen 377
41 A WEB-BASED CSCW SYSTEM FOR REMOTE SUBSTATION FAULT DIAGNOSIS
Hongsheng Su, Jianwu Dang, Feng Zhao 385
42 A SERVICE-ORIENTED FRAMEWORK FOR INTEGRATION OF SHOP FLOOR SCHEDULING AND CONTROL
Kewei Li, Chun Wang, Hamada Ghenniwa, Weiming Shen 395
43 COMPUTATIONAL REPRESENTATION, HETEROGENEITY AND INTEGRATION OF PRODUCTION SYSTEM MODELS
Wilson M. Arata and Paulo E. Miyagi 405
44 TIMED-EVENT-STATE-BASED DIAGNOSER FOR MANUFACTURING SYSTEMS
M. Sayed-Mouchaweh, A. Philippot, V. Carré-Ménétrier, B. Riera 415
45 NFC TECHNOLOGIES IN MOBILE PHONES AND EMERGING APPLICATIONS
Diogo Remédios, Luís Sousa, Manuel Barata and Luís Osório 425
46 INTEGRATED KNOWLEDGE- AND SIMULATION-BASED FACILITY SUPERVISION AND CONTROL
Gerhard Schreck, Alexei Lisounkin, Jörg Krüger 435
47 ON STABILITY ANALYSIS OF BEARING-ROTOR SYSTEM
Meng-su Li, Xu-chu Cai, Dan Zhang 443
48 BATCH ROUNDNESS CHARACTERIZATION AND EVALUATION
Qimi Jiang, Hsi-Yung Feng 453
49 A POINT CLOUD SIMPLIFICATION ALGORITHM FOR MECHANICAL PART INSPECTION
Hao Song, Hsi-Yung Feng 461
50 DEGENERATION METHODS IN INTELLIGENT BUILDING CONTROL SYSTEM DESIGN
Julio Arakaki, Paulo Eigi Miyagi 469
51 A NEW METHOD FOR THE HIERARCHICAL MODELING OF PRODUCTIVE SYSTEMS
Fabricio Junqueira, Paulo E. Miyagi 479
52 MODELING AND ON-LINE MONITORING OF MACHINED SURFACE IN TURNING OPERATIONS
Avisekh Banerjee, Evgueni V. Bordatchev, Sounak Kumar Choudhury 489

AUTHOR INDEX **499**

SPONSORS

IFIP – The International Federation for Information Processing

IFIP WG 5.5 COVE
Co-Operation infrastructure for Virtual Enterprise and electronic business



International Working Group on Computer Supported Cooperative Work in Design

Society of Collaborative Networks

University of Western Ontario

University of Windsor

COMMITTEES

Steering Committee

L. M. Camarinha-Matos (PT) **[Chair]**
H. Afsarmanesh (NL)
V. Marik (CZ)
H. Erbe (DE)

Program Committee Chairs

Weiming Shen, National Research Council / University of Western Ontario, Canada
Robert Brennan, University of Calgary, Canada
Luis M. Camarinha-Matos, New University of Lisboa, Portugal

Track Chairs

Track A: Vladimir Marik, Czech Technical University, Czech Republic
Track B: Hamideh Afsarmanesh, University of Amsterdam, The Netherlands
Track C: Mauro Onori, Royal Institute of Technology, Sweden
Track D: Paulo E. Miyagi ,University of Sao Paulo, Brazil

Organizing Committee Chairs

Xiaobu Yuan, University of Windsor, Canada
Qi Hao, National Research Council, Canada

Program Committee Members

Track A: Multi-Agent and Holonic Systems in Manufacturing

- J. Barata (PT)
- R. W. Brennan (CA)
- Y. Fan (CN)
- S. Feng (US)
- M. Fletcher (UK)
- H. Ghenniwa (CA)
- W. Gruver (CA)
- K. Hall (US)
- P. Kopacek (AT)
- V. Marik (CZ) **[Chair]**
- F. Maturana (US)
- E. Oliveira (P)
- M. Pechoucek (CZ)
- W. Shen (CA)
- L. Sheremetov (MEX)
- P. Sousa (PT)
- S. Tamura (J)
- P. Valckenaers (BE)
- L. Wang (CA)

Track B: Networked Enterprises

- H. Afsarmanesh (NL) **[Chair]**
- P. Bernus (AU)
- F.W. Bruns (DE)
- L.M. Camarinha-Matos (PT)
- W. Cellary (PL)
- B. Chaib-draa (CA)
- S. D'Amours (CA)
- S. Dudstar (AT)
- H. Erbe (DE)
- C. Garita (CR)
- T. Goranson (US)
- H.S. Jagdev (UK)
- T. Kaihara (JP)
- K. Kosanke (DE)
- G. Kovács (HU)
- A. Molina (MX)
- L. Nemes (AU)
- G. Olling (US)
- M. Ollus (FI)
- J. Pinho Sousa (PT)
- G. Putnik (PT)
- R. Rabelo (BR)

Track C: Integrated Design and Assembly

- T. Arai (JP)
- R. Bernhardt (DE)
- J. Camelio (US)
- Q. Hao (CA)
- J. Jacot (CH)
- S. Lang (CA)
- R. Molfino (IT)
- M. Onori (SW) **[Chair]**
- S. Ratchev (UK)
- M. Santocchi (IT)
- G. Schreck (DE)
- R. Tuokko (FI)
- S. Yang (CA)
- X. Yuan (CA)
- Y. Zeng (CA)
- D. Zhang (CA)

Track D: Monitoring and Control

- M. Barata (PT)
- E. Bordatchev (CA)
- S. Feng (CA)
- A. Giua (IT)
- L. Gomes (PT)
- G.K. Knopf (CA)
- P. Li u (CA)
- P.E. Miyagi **[Chair]**
- P. Orban (CA)
- L. Seabra Lopes (PT)
- J. Shi (US)
- X. Tu (CA)
- R. Valette (FR)
- E. Villani (BR)
- J. Zaytoon (FR)

PREFACE

The manufacturing sector has been facing major challenges as it undergoes revolutionary changes fuelled by new and sophisticated demands from customers, global competition, distribution of manufacturing and marketing activities, and technological advances. In order to address these challenges, manufacturing enterprises need to change the way they do business and adopt innovative technologies and solutions to increase their responsiveness and production efficiency. Information technology plays an essential role in this process.

Current manufacturing systems are collections of complex systems or subsystems operating in distributed collaborative environments involving software, hardware, humans, and organizations. It is crucial to keep a balance between the technical aspects of automation and the human and social facets when applying information technology in industrial applications, particularly with the rapid advancements in information and communication technologies and the wide deployment of automated manufacturing systems. However, in order to create appropriate frameworks for exploring the best synergies between humans and automated systems, there are still numerous issues in terms of processes characterization, modeling, and development of adequate support tools. BASYS conferences have been developed and organized to promote the development of balanced automation systems in an attempt to address these issues.

The first BASYS conference was successfully launched in Victoria, Brazil (1995), and then the following conferences were held in Lisbon, Portugal (1996), Prague, Czech Republic (1998), Berlin, Germany (2000), Cancun, Mexico (2002), and Vienna, Austria (2004).

BASYS'06 is the 7^{th} edition in its series. It keeps the same objective and style of previous BASYS conferences. While keeping the three tracks the same as BASYS'04, BASYS'06 changes the fourth track (Track D) from "Machine Learning and Data Mining in Industry" to "Monitoring and Control", which currently has 17 accepted papers among the total of 49 regular papers. From another point of view, BASYS'06 has a smooth shift of the focus on the integration and balanced automation from the high levels (enterprise and virtual enterprise levels) to the low levels (shop floor and machine levels).

This book contains three invited keynote papers and forty-nine regular papers accepted for presentation at the conference.

Three keynote papers are presented by internationally recognized experts in the related fields:

- Prof. Soundar Kumara provides an overview of Agent-Based Manufacturing. An extended abstract is included in this book with a reference to a full survey paper co-authored by Monostori, Váncza, Kumara for CIRP - College

International pour la Recherche en Productique (The International Academy for Production Engineering).

- Prof. Mo A. Elbestawi presents a comprehensive review of tool monitoring systems, techniques, their components, and particularly the Multiple Principle Component fuzzy neural network for tool condition monitoring.
- Prof. Sophie D'Amours proposes an architecture integrating agent technology and operational research with the objective to enable the development of advanced planning systems for the forest products industry.

Forty-nine regular papers are organized in four main tracks:

- *Track A: Multi-Agent and Holonic Systems in Manufacturing*
- *Track B: Networked Enterprises*
- *Track C: Integrated Design and Assembly*
- *Track D: Monitoring and Control*

All together, the papers will make significant contributions to the literature of Intelligent Technology for Balanced Manufacturing Systems. However, it seems that significant efforts are still required to develop practical IT solutions for balanced manufacturing systems where humans and intelligent machines are in perfect harmony.

Special thanks to all the authors for their contributions to the book and to the BASYS'06 Program Committee members (particularly Program Committee Co-Chairs and Track Chairs) for their efforts in promoting the conference and reviewing / selecting submitted papers.

The editor,
Weiming Shen
National Research Council Canada/
University of Western Ontario
weiming.shen@nrc.gc.ca
wshen@ieee.org