Sustainable Production and Logistics in Global Networks

43rd CIRP International Conference on Manufacturing Systems
26 – 28 May 2010, Vienna

Proceedings
PROCEEDINGS

International Conference on Manufacturing Systems

26 – 28 May 2010

Organised by

Vienna University of Technology
Institute of Management Science
Division Production Engineering and System Planning

Fraunhofer Austria Research GmbH
Division Production and Logistics Management
www.fraunhofer.at / office@fraunhofer.at

Editors:

Wilfried Sihn  Peter Kuhlang

TECHNIK
Vienna · Graz 2010
Table of Contents

Foreword ................................................................. III
Committees .............................................................. IV
Acknowledgements ...................................................... V
A short view on CIRP .................................................. VI

Key-notes ........................................................................ 1

Should CIRP develop a Production Theory? Motivation • Development Path • Framework ........................................ 3
  H.-P. Wiendahl, P. Nyhuis, W. Hartmann

Manufacturing Systems Sustainability Through Perfect Co-evolution ........................................ 19
  H.A. ElMaraghy

Production & logistic networks ......................................... 29

A Production Planning and Scheduling Architecture for Networked-manufacturing System based on Available-to-Promise ................................................................. 31
  Wenhao Wang, Jie Zhang

Adaptive evaluation method for relocation activities in global production networks ........................................ 38
  S. Lohmann, P. Ponton, M. Jaehne, R. Riedel, E. Mueller

An Approach for Systematic Production Network Configuration ................................................................. 45
  A. Kampker, G. Schuh, B. Schittny, D. Kupke

Analysis of Lead-Time Regulation in an Autonomous Work System ................................................................. 53
  N. Duffe, H. Rekersbrink, L. Shi, D. Halder, J. Blazei

Collaboration in Value Creation Networks to improve Material Cycles ................................................................. 61
  S. Heyer, M. Grismayer, G. Selliger

Development of organizational models for cross-company transport bundling ................................................................. 69
  Margarethe Prochazka, René Leitner, Felix Meizer, Wilfried Sihn

Impact of influence factors on logistics planning in the Automotive Industry ................................................................. 77
  D. Palm, W. Sihn
Table of Contents

Improving the distribution of value-added activities in complex business networks considering qualitative factors ........................................... 85
   A. Prinz, S. Ost, J. Mandel

An Integrated Approach to Sustainable Multimodal Transportation in Logistics Networks .................................................................................. 93
   G. Confessore, G. Galiano, G. Liotta, G. Stecca

Concept of transport-oriented scheduling for reduction of inbound logistics traffic ......................................................................................... 101
   M. Florian, J. Kemper, W. Sihn, B. Helingrath

Internet Based Collaboration in the Manufacturing Supply Chain ........... 110
   D. Mourtzis

Nearshoring, Sustainability and Free Trade Facilitation for Global Logistics Networks ......................................................................................... 121
   Eleftherios Iakovou, Dimitrios Vitachos, Maria Chatzipanagioti and Ioannis Mallidis

Networked Manufacturing Control: an Industrial Case ................................ 129
   P. Valckenaers, H. Van Brussel, B. Saint Germain, J. Van Belle

Use of the real options analysis to valuate new supplier development – a South Korean case study ................................................................. 137
   G. Lanza, S. Weiler, J. Möhlmann

Self-Configuring Service Network for Decision Support in Sustainable Smart Logistics ......................................................................................... 145
   A. Smirnov, N. Shilov

Sustainability ........................................................................................................ 153

A modular LCA framework for the eco-effective design of production systems ................................................................................................. 155
   C. Brondi, E. Carpanzano

Environmental Assessment of Automotive Joining Processes .................. 163
   J. Pandremenos, J. Paralikas, A. Fysikopoulos, K. Salonitis and G. Chryssolouris

Fostering sustainability using Sustainable Supply Chain Networks (SSCN) ............................................................................................................. 171
   H. Winkler

Green supply chain management in Korean major industries .................. 179
   S. Sim, J. Oh, B. Kim, J. Choi, B. Jeong

VIII
Impact of Manufacturing Supply Chains on the Embodied Energy of Products ................................................................. 187
  S. Kara, S. Marmek

Integrating sustainability into supply chain management – a stakeholder perspective ........................................... 195
  N. Vojdani, M. Knop

Life Cycle Approaches on Product Realization: meeting the challenges of future production research ..................... 204
  M. Wiktorsson, G. Sivard, T. Kjellberg

Main drivers of ecological innovation performance ....................................................................................... 212
  M. Zwainz

A Framework for Modelling Energy Consumption within Manufacturing Systems ............................................... 220
  Y. Soow, S. Rahimifard

A new Approach for Controlling Disassembly Systems ..................................................................................... 228
  G. Zülch, J. Hrdina

Polymer Water as Optimal Cutting Fluid - Technological Analysis ................................................................. 236
  C. Herrmann, A. Zein

Industrial Smart Metering – Application of Information Technology Systems to Improve Energy Efficiency in Manufacturing ................................................................. 244
  C. Herrmann, G. Bogdanski, A. Zein

Tactical planning of sustainable transportation by logistics service providers for the automotive industry ............... 252
  M. Preuss, B. Hellingrath

Product and service development/management - special session: IPS² ................................................................. 263

Analysis of Optimization Algorithms’ Usability for the Operational Resource Planning of Industrial Product-Service Systems (IPS²) .............................................................. 265
  H. Meier, B. Funke

Approach for intelligent design and manufacturing of footwear for diabetic persons ....................................................... 273
  M. Germani, M. Mengoni, E. Montiel, R. Raffaeli

Design Method for Life Cycle Oriented Product-Service Systems Development .................................................. 281
  K. Kimita, F. Akasaka, S. Hosono, Y. Shimomura
Table of Contents

Industrial experience with Life Cycle Costing and the potential of Product-Service Systems ............................................. 289
   J. Van Ostaeyen, J. Duffou

Intelligent Process Data Management for product-service-systems in the European Tooling Industry ............................................. 299
   Günther Schuh, Wolfgang Boos, Moritz Rittstieg

Managing Uncertainties in Life Cycle Evaluation of various Manufacturing Alternatives for a Product ............................................. 307
   D. Janz, E. Westkämper, S. Rahimifard

Product Development Strategy in Markets with Network Externalities ............................................................................. 316
   N. Nishino, T. Takenaka, K. Ueda

Reference Model for IPS² Service Supply Chains ............................................................................. 324
   H. Meier, O. Volker

Production systems – special session: SPECIES .................. 333

A Method for the Joint Design of Quality and Production Control in Manufacturing Systems ............................................. 335
   M. Colledani, T. Tolio

A novel method for the development of modular product architectures ............................................................................. 343
   J. Pandremenos, A. Natsis, G. Chryssoulouris

A Web-services oriented workflow management system for integrated production engineering ............................................. 351
   K. Alexopoulos, S. Makris, V. Xanthakis and G. Chryssoulouris

Cognitive Controlling Systems for Tolerance Optimization ............................................................................. 359
   R. Schmitt, C. Wagels, N. Matuschek, M. Isermann

Developing Sustainable Competitive Edge for Small to Medium Size Businesses through Realizing Agility ............................................................................. 367
   M. Gadalla, A. Delf

Development of a Manufacturing Equipment Configurator and an NC Simulator ............................................................................. 375
   I. Németh, J. Puspdőki

Evaluation of RFID implementation in manufacturing systems. A case study in automotive industry ............................................................................. 383
   I. Baffo, M. Carlinho, G. Confessore, G. Stecca
Maintenance of Intralogistics-Systems – Introduction of the Pilot Installation “Log CoMo-Tec Lab” ......................................................... 391
S. Wenzel, A. Wötzel, G. Bandow

Production System for the Automated Finishing in Die and Mold Making .............................................................................. 399
C. Brecher, R. Tuecks, C. Wenzel

Ramp-up of hybrid manufacturing technologies .............................. 407
F. Klocke, H. Wegner, A. Roderburg, B. Nau

Rule-based Engineering Change Mechanisms in Production Systems .......................................................................................... 416
R.C. Malak, J.C. Aurich

Simulation-based Assessment of the Productivity of Adaptive and Selective Production Systems ...................................................... 425
C. Hermann, P. Halubek, J. Stehr, J. Kayasa

Step-NC Compliant Approach for Workpiece Setup Planning Problem on Transfer Line ................................................................. 433
S. Borgia, S. Pellegrinelli, T. Tolio

Lean Engineering & Assembly .............................................................. 441

A new methodical approach to increase productivity in productionlogistical processes ..................................................................... 443
P. Kuhlang, T. Edtmayr, W. Sihn

Analyzing Production Systems: Combining Perspectives of ‘Process’ and ‘Work Activity’ ................................................................. 452
Klaus-Peter Schulz

Development of a “convergent” order control for small and mediumsized production companies in the context of a turbulent market environment ................................................................. 461
E. Okhan, T. Derneer, M. Schubert, W. Sihn

Lean process analysis in administration and production .................. 470
A. Schloske, P. Thieme

Measuring the Complexity of Manual Products Assembly ............. 478
S.N. Samy, H.A. ElMaraghy

Optimization of the material flow using the principles of the Toyota Production System ......................................................... 488
K. Tracht, J. Wrehde, T. Seuguep Kouamo
Table of Contents

Problems of Lean Production Implementation in the Croatian Enterprises
I. Veza, N. Gjeldum, L. Celent, N. Stefanić ......................................................... 496

Highly Extensible Life-Cycle Oriented Placement of the Order Penetration Point in International Supply Chains
Y. Uygur, B. Sieben, A. Kuhn .................................................................................. 504

Using BPMN for Modeling Manufacturing Processes
S. Zor, K. Görlach, F. Leymann ............................................................................. 515

Value Stream Mapping for the Optimization of Maintenance Processes
K. Matyas, F. Hagmair, W. Sihn ............................................................................. 523

Technology in production & logistics ................................................................. 533

Automation of Driving Process in Copying manual Manipulations .......... 535
Z. Yang, F. Echtler, D. Scherer, M. Golle, H. Hoffmann, G. Klinker

Cognitive Agent based Control of a Machining Shop ...................................... 543
H.S. Park, N.H. Tran, J.Y. Song, D.H. Kim

Development of Chatter Vibration Detection System utilizing Sensor-less Process Monitoring ............................................................... 551
Y. Sudo, Y. Kakinuma, T. Aoyama (2), K. Ohnishi

Hardware-Accelerated Measurement of Particle Velocities in Thermal Spray Processes ........................................................................ 559
L. Rockstroh, J. Hillebrand, W. Li, M. Wroblewski, S. Simon, R. Gadow

Identification of RFID Application Potentials in Manufacturing Processes ......................................................................................... 567
M. Fallin, F.A. Gómez Kempf, J.C. Aurich

A comparison of the logistics performance of autonomous control methods in production logistics ............................................................ 576
K. Windl, T. Becker, I. Kolev

Monitoring of the Welding Station Cluster ......................................................... 584
A. Lehar, L. Selak, D. Braćun, A. Sluga, D. Husenagić, P. Butala

XII
Knowledge management in production & logistics ..........591

A Knowledge Management Concept for Product Ramp-up in Automotive Industry ............................................593
  C. Hermann, H. Bruns, P. Halubek, A. Wenda, S. Altuner

Education in Industrial Automation in an Innovative Learning Factory .......................................................601
  E. Carpanzano, A. Cataldo

Holistic Approach against product piracy ........................................609
  H. Meiör, C. Slobel

Knowledge Flows in Early Stages of Product Development ..........617
  D. Spath, L. Wagner, F. Goll, P. Ohlhausen

Mastering Production Processes on the Basis of Management of Measurement Processes ..................................625
  R. Schmitt, J. Lose, M. Harding

Semantic integration by means of a graphical OPC Unified Architecture (OPC-UA) information model designer for Manufacturing Execution Systems ...........................................633
  M. Schlepent, O. Sauer, J. Wang

Process modelling and process planning ................641

A Distributed Routing Concept for Dynamic Flexible Flowshop Problems with Unrelated Parallel Machines .........................643
  B. Scholz-Reiter, H. Rekersbrink, B.-L. Wenning

A methodology to support the design of multi-stage material separation systems for recycling ......................................651
  M. Colledani, S.B. Gershwin, T. Gutowski, M.I. Wolf

Analysis of NC data based on feature information model of shape and process for retaining machining information ..............................659
  F. Tanaka, S. Igarı, T. Kawaguchi, M. Onosato

Assessment of an Organization for Digital Production Planning Validation with Axiomatic Design ..................................667
  M. Manns, K.-J. Wack

Automotive Supply Chain Flexibility Evaluation ......................675
  D. Mourtzis, L. Rentzos and S. Makris

Cognitive Process Planning ..............................................683
  B. Denkena, L.-E. Lorenzen, S. Kröning

XIII
Table of Contents

Empirical and Neural Network Modelling of Tool Wear
Development in Ni-Base Alloy Machining ............................................. 691
   C. Leone, D. D’Addona, R. Tetti

Modelling and analysis of an autonomous control method based on
bacterial chemotaxis .................................................................................. 699
   B. Scholz-Ritter, M. Görges, T. Jagalski, L. Naujok

Modelling of Tool Wear in Gear Hobbing with Coated Tools for
Facilitating Process Planning ..................................................................... 707
   K.-D. Bouzakis, S. Kombogiannis, E. Bouzakis

Production of a variable cross sectional profile from AHSS – A
sequential roll forming approach ............................................................... 717
   J. Parilikas, K. Salonitis, G. Chryssoulouris

Routing model refinement in large-scale manufacturing
environment by using data mining ............................................................ 725
   D. Kamok, L. Monostori

The mathematical structure of CAPP within the software application
developed at FMT in Presov ....................................................................... 735
   K. Monkova, P. Monka

Understanding and Improvement of the Piston Insertion Operation ...... 743
   Arnaud Robert, Serge Tichkiewitch

Utilization of a Bioinformatics Algorithm for the Comparison of
Process Chains .......................................................................................... 751
   F. Reichert, A. Kunz, C. Bender, R. Moryson, K. Wegener

Factory planning ...................................................................................... 759

AMOR – An Agent for Assisting Monitoring, Optimization and
(Re-)Design in Factory Design ................................................................. 761
   D. P. Politze, N. Jufer, J. Balthet, A. Kunz, K. Wegener

Approach for planning of unit cost-optimal manufacturing and
transport systems ...................................................................................... 769
   R. Schulze, A. Opitz, A. Krauß, E. Müller

Cross-Functional Digital Production Validation Framework for
Automotive Industry .................................................................................. 779
   J. Kiefer, M. Manns, K.-J. Wack

Energy Efficiency at Manufacturing Plants – A Planning Approach ...... 787
   E. Müller, T. Löfler

XIV
Participatory Design of Communication and Information Flows in Plant Layouts

D. Jentsch, D. Menzel, R. Riedel, K.-P. Schulz

Production planning

A Key Performance Indicator System of Process Control as a Basis for Relocation Planning

F. Reichert, A. Kunz, R. Moryson, K. Wegener

A proposal of socio-inspired manufacturing scheduling concept and its application into flexible flowshop

T. Kaihara, N. Fujii, S. Toide, H. Ishibashi, T. Nakano

An approach to avoid collisions in sheet metal forming during early stages of production planning

D. Metz, M. Grauer, O. Reichert, W. Schäfer


J. Malta, P. F. Cunha

Assessment of Products Eco-Efficiency for the purpose of Eco-Design

Snezhana Kostova, Peter Mitrouchev and Nonka Georgieva

Collaborative Planning with Dynamic Supply Loops

P. Egri, A. Döring, T. Timm, J. Vánca

Considering Worst-case Scenarios within Final Assembly Planning

L. Woyand, H. Bley

Efficient Phase-Out Planning by Alignment of Lot Sizes in Supply Chains

F. Hertrampf, R. Nickel, P. Nyhuis

Exploiting Repetitive Patterns in Practical Scheduling Problems

A. Kovács, J. Vánca

Flexible and Autonomous Production Planning Directed by Product Agents

M. Matsuda, N. Sakao, Y. Sudo, K. Kashiwase

Hybrid evolutionary optimization in efficient assembly task planning

T. Jankowski, J. Jędrzejewski

Improved logistics performance through the use of locked flexibility potentials

K. Windt, O. Jeken, F. Arbabzadah
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration of Personnel and Production Programme Planning in the</td>
<td>900</td>
</tr>
<tr>
<td>Automotive Industry</td>
<td></td>
</tr>
<tr>
<td>S. Auer, T. Winterer, W. Mayrhofer, L. März, W. Sihr</td>
<td></td>
</tr>
<tr>
<td>Long-term Capacity Planning in the Shipbuilding Industry</td>
<td>909</td>
</tr>
<tr>
<td>M.-C. Wanner, J. Sender, U. Kothe, R. Böhnenberg</td>
<td></td>
</tr>
<tr>
<td>Inventory Allocation with Consideration of Component Commonality</td>
<td>917</td>
</tr>
<tr>
<td>and Risk Management</td>
<td></td>
</tr>
<tr>
<td>A.M. Radke, M.M. Tseng</td>
<td></td>
</tr>
<tr>
<td>Methodology for Structure-Analysis of Automotive Manufacturing</td>
<td>925</td>
</tr>
<tr>
<td>C. Löffler, A. Lakeit, E. Westkämper</td>
<td></td>
</tr>
<tr>
<td>Process Harmonisation in Digital Manufacturing</td>
<td>933</td>
</tr>
<tr>
<td>J. Schallow, D. Petzelt, J. Deuse</td>
<td></td>
</tr>
<tr>
<td>Product Variety in the Brazilian Cosmetic Industry</td>
<td>941</td>
</tr>
<tr>
<td>L.F. Scavarda, A.C. Reis, S. Braffmann, H. Winkler</td>
<td></td>
</tr>
<tr>
<td>Leveling of Low Volume and High Mix Production based on a Group</td>
<td>949</td>
</tr>
<tr>
<td>Technology Approach</td>
<td></td>
</tr>
<tr>
<td>F. Bohnen, J. Deuse</td>
<td></td>
</tr>
<tr>
<td>Rolling Horizon and online optimization in discrete lotsizing</td>
<td>957</td>
</tr>
<tr>
<td>production</td>
<td></td>
</tr>
<tr>
<td>W. Dangelmaier</td>
<td></td>
</tr>
<tr>
<td>Simulation-based, energy-aware production planning</td>
<td>964</td>
</tr>
<tr>
<td>S. Chiotelis, N. Weinert, G. Seliger</td>
<td></td>
</tr>
<tr>
<td>Total Quality Assurance, Productive Maintenance</td>
<td>973</td>
</tr>
<tr>
<td>An Approach to Workflow Based Quality Management</td>
<td>975</td>
</tr>
<tr>
<td>D.C. ten Dam, D. Lutters</td>
<td></td>
</tr>
<tr>
<td>An efficient use of quality engineering techniques for analysis and</td>
<td>983</td>
</tr>
<tr>
<td>improvement of industrial processes</td>
<td></td>
</tr>
<tr>
<td>V. Majstorovic, T. Stbalija</td>
<td></td>
</tr>
<tr>
<td>Determination Of The Overall Equipment Effectiveness For Assembly</td>
<td>991</td>
</tr>
<tr>
<td>Systems On The Base Of Product Data</td>
<td></td>
</tr>
<tr>
<td>R. Neugebauer, D. Kreppenhofer, T. Langer</td>
<td></td>
</tr>
<tr>
<td>Transparency in Production by Sensor Equipped Molds and Dies</td>
<td>999</td>
</tr>
<tr>
<td>R. Schmitt, M. Harding, J. Lose</td>
<td></td>
</tr>
</tbody>
</table>

XVI
ICT in production & logistics ................................................................. 1007

Design and Analysis of A Simulation, Monitoring and Control
System of 4-DOF Modular Reconfigurable Robot ............................... 1009
D. Zhang, J. Lei

A Robust Multiple Logistic Objectives-oriented Manufacturing
Control (RMLOO) ........................................................................... 1017
K. Windt, B. Scholz-Reiter, Huaxin Liu

Achieving Distributed Control Applications Using IEC 61499 and
Communication Standards ............................................................... 1028
G. Morán, F. Pérez, E. Estevez, D. Orive, M. Marcos

Agent-based Simulation Modeling of an Interaction Mechanism for
Detailed Design of Autonomic Manufacturing Execution Systems ...... 1036
Milagros Roldón, Ernesto Martínez

CAM System Development for Multi-tasking Machine Tools .......... 1044
T. Kotani, K. Nakamoto, T. Ishida, Y. Takeuchi

Sensible Ergonomics Network in Smart Environment (SENSE) — A
Step to Human Safety and Productivity Sensitive in Smart Factory .... 1052
C.F. Kuo, M.J. Wang, C.H. Su

Implementation of practice-oriented IT Frameworks for knowledge
based configuration and design of customised products ................... 1060
C. Lutz, D. Gerhard

iPod touch — an ICT tool for operators in factories of the future? ...... 1070
T. Fässberg, G. Nordin, A. Fasth, J. Stahre

Lightweight IT support for ad-hoc-processes in production and
logistics ....................................................................................... 1078
Martin Böhringer, David Jentsch

Modular INFEELT STEP: An Integrated and Interoperable Platform
for collaborative product development based on STEP Standard ....... 1085
O. Fatani Vallilai, M. Houshmand

Seasonal Demand on the Array of Spare Parts in the Aviation
Industry ....................................................................................... 1093
K. Tracht, P. Schuh, F. Weikert

Production Simulation in Virtual Worlds ......................................... 1101
S. Seitz, M. Herrmann, D. Wimpff

Rule based Expert System with Quality Control Charts to support a
Logistic Strategy on Operational Level .......................................... 1109
M. Elswieer, P. Nyhuis, R. Nickel
Table of Contents

Introducing SOA into Production Environments – The Manufacturing Service Bus.................................................................1117

J. Minguez, D. Lucke, M. Jakob, C. Constantinescu, B. Mitschang, (†) E. Westkämper

Wireless Field Bus Communication with UWB for Manufacturing Environments ......................................................................1125

M. Masini, M. Jakob, M. Berroth