

Contents

Invited Papers

Challenges in Design of Heterarchical Controls for Dynamic Logistic Systems

<i>Neil A. Duffie</i>	3
1 Introduction	3
2 Options for Structuring Controls for Logistic Systems	6
2.1 Hierarchy	7
2.2 Heterarchy	7
2.3 Responsible Autonomy	7
2.4 Anarchy	7
3 Design of Heterarchical Control	8
3.1 Principles for Partitioning	9
3.2 Principles for Fault Tolerance	9
3.3 Example: Heterarchical Control of Part Production	9
3.4 Example: Heterarchical Control of a Multitude of Propulsion Units	11
4 Developing and Evolving Organizations	13
5 Design of Web Services	17
6 Conclusions	21
References	23

Making the Business Case for RFID

<i>Bill Hardgrave, Cynthia K. Riemenschneider, Deborah J. Armstrong</i>	25
1 Introduction	25
2 Model of RFID Assimilation	26
2.1 Phase 1: Technology Deployment	27
2.2 Phase 2: Data Analytics	27
2.3 Phase 3: Business Value – Proven	29
2.4 Phase 3: Business Value – Potential	32
3 Conclusion	34
References	34

General Aspects of Dynamics in Logistics

Review of Trends in Production and Logistic Networks and Supply Chain Evaluation

<i>Paul Maropoulos, Maxime Chauve, Catherine Da Cunha</i>	39
1 Introduction	39
2 From Supply Chain to Production Networks	40
2.1 Supply Chain and Supply Chain Management	40
2.2 Integration, Virtual Integration	41
2.3 Joint Venture	42
2.4 Cluster	43
2.5 Production Networks	43
2.6 Reverse Logistics	43
2.7 Competence Profiling for Company Identification and Appraisal	44
3 Performance Assessment of Supply Chains and Networks	45
3.1 The Concept of Performance	46
3.2 An Overall view of Performance Criteria	47
3.3 Evaluation	48
3.4 The Major role of Communication in an Assessment Process	48
3.5 Real Time Networks Evaluation Technology: The Radio Frequency Identification (RFID)	49
4 Established Benchmarks for Production Networks	50
4.1 The Lean Principles in Supply	50
4.2 The need for Agility	51
4.3 Leagility	51
5 Conclusions	52
References	52

Dynamic Data Mining for Improved Forecasting in Logistics and Supply Chain Management

<i>Richard Weber, Jose Guajardo</i>	57
1 Introduction	57
2 Support Vector Regression	57
3 The Proposed Forecasting Methodology	58
3.1 General Framework of the Proposed Methodology	58
3.2 Model Updating within the Proposed Methodology	59
4 Experiments and Results	62
5 Conclusions and Future Works	62
References	63

Introducing Bounded Rationality into Self-Organization-Based Semiconductor Manufacturing

<i>Tomomi Kito, Kanji Ueda</i>	65
1 Introduction	65
2 Introducing Bounded-Rational Agents	66
3 Self-Organization-Based Semiconductor Manufacturing Model . . .	67
3.1 Complexity of Semiconductor Manufacturing	67
3.2 Self-Organization-Based Model	68
3.3 Local Competitions in Self-Organization-Based System . . .	69
3.4 Introducing Spatial Restriction	69
4 Simulation Results and Discussion	70
4.1 Comparison Between Information Localization and Information-Use Limitation	70
4.2 Introduction of Bounded Rationality	72
5 Conclusion	73
References	73

Routing in Dynamic Logistics Networks

Travel Time Estimation and Deadlock-free Routing of an AGV System

<i>Hyo Young Bae, Ri Choe, Taejin Park, Kwang Ryel Ryu</i>	77
1 Introduction	77
2 AGV Traffic Control	78
2.1 Route Creation	78
2.2 AGV Travel Scheduling	79
3 Travel Time Estimation Algorithm	80
3.1 Travel Time Estimation in Accelerated Motion	80
3.2 Travel Time Estimation Considering Interference	81
4 Experimental Results	82
4.1 Experimental Setting	82
4.2 Results	82
5 Conclusions	84
References	84

Integration of Routing and Resource Allocation in Dynamic Logistic Networks

<i>Thomas Huth, Dirk C. Mattfeld</i>	85
1 Introduction	85
2 Problem Description	86
3 Mathematical Model	87
4 Strategy for a Dynamic Environment	90
5 Conclusion	92
References	92

Dynamic Vehicle Routing with Drivers' Working Hours

<i>Asvin Goel</i>	95
1 Introduction	95
2 Related Literature	96
3 The General Vehicle Routing Problem	96
4 Drivers' Working Hours	97
5 Solution Approaches	98
5.1 Reduced Variable Neighbourhood Search	98
5.2 Large Neighbourhood Search	99
6 Evaluation	99
7 Conclusions	101
References	102

RFID in Logistics and Manufacturing Networks

A Survey of RFID Awareness and Use in the UK Logistics Industry

<i>Johann Riedel, Kulwant S. Pawar, Stefano Torroni, Emilio Ferrari</i>	105
1 Introduction	105
1.1 Objectives	106
1.2 Sample Selection	106
2 Degree of Awareness of RFID	108
3 RFID Adoption and Diffusion	110
4 Modelling RFID Diffusion	111
5 Barriers to RFID Adoption	111
6 Conclusion	114
References	115

RFID-Based Intelligent Logistics for Distributed Production Networks

<i>Alexander Smirnov, Tatiana Levashova, Nikolay Shilov</i>	117
1 Introduction	117
2 Context-Driven Methodology	118
3 Case Study	120
4 Conclusion	123
References	124

Methodology for Development and Objective Comparison of Architectures for Networked RFID

<i>Béla Pátkai, Damith Ranasinghe, Mark Harrison, Duncan McFarlane</i>	125
1 Introduction	125
2 Problem Definition	126
3 The Design Methodology	127
4 Demonstrative Example	128
4.1 General Ontology Definition	128
4.2 Specific Ontology Definition	129

4.3	Definition of Layers	130
4.4	Usage of the Ontology Model	130
5	Conclusions	132
	References	132

Supply Chain Control Policies

Determining Optimal Control Policies for Supply Networks Under Uncertainty

<i>Marco Laumanns</i>		135
1	Introduction	135
2	Optimal Control by Stochastic Dynamic Programming	136
3	Numerical Example	139
4	Conclusions	140
	References	141

Adaptive Production and Inventory Control in Supply Chains against Changing Demand Uncertainty

<i>Markus Zschintzsch, Amir Sheikh Jabbari, Walter Lang, Bernd Scholz-Reiter</i>		
		143
1	Introduction	143
2	The production and inventory control policy	144
3	Variance ratios and objective function	145
4	Methodology	146
5	Adaptive policy	147
6	Summary	150
	References	150

A Framework of Adaptive Control for Complex Production and Logistics Networks

<i>Dmitry Ivanov, Marina Ivanova</i>		151
1	Introduction	152
2	State-of-the-art	152
3	Research methodology: MARINA	153
4	Illustration	155
5	Conclusions	158
	References	159

Mechanisms of Instability in Small-Scale Manufacturing Networks

<i>Reik Donner, Uwe Hinrichs, Bernd Scholz-Reiter</i>		
		161
1	Introduction	161
2	Model Description	162
3	Classification and Quantification of Instabilities	164
4	Conclusions	167
	References	168

Decentralized Decision-making in Supply Chains

Aspects of Agent Based Planning in the Demand Driven Railcab Scenario

Wilhelm Dangelmaier, Benjamin Klöpper, Nando Rüngerer,

<i>Mark Aufenanger</i>	171
1 Introduction	171
2 Problem Description	172
3 Asynchronous Coordination and Synchronous Optimization	173
4 Decentralized Optimization	174
4.1 Decentralized Swapping of Jobs	174
4.2 Decentralized Convoy Formation	175
5 Consideration of Uncertain Travel Times	176
6 Conclusion	177
References	177

Merging Time of Random Mobile Agents

Shehla Abbas, Mohamed Mosbah, Akka Zemmari

1 Introduction	179
1.1 An Introductory Example	181
2 A Genral Markov Chain Formulation	182
2.1 Configurations Graph	182
2.2 Components Graph	183
2.3 From 2 to k Agents	184
3 Hypercubes	186
4 Conclusion and Perspectives	189
References	189

Dynamic Decision Making on Embedded Platforms in Transport Logistics – A Case Study

Reiner Jedermann, Luis Javier Antúnez Congil, Martin Lorenz,

<i>Jan D. Gehrke, Walter Lang, Otthein Herzog</i>	191
1 Introduction	191
2 Autonomous Decision Making in Transport Logistics	192
3 Implementation in Embedded Systems	193
3.1 Representation of Logistical Objects by Software Agents	194
3.2 Interpretation of Sensor Data and Quality Assessment	194
4 Distributed Solution of Route Planning Problems	194
4.1 Distributed Planning by Truck Agents	195
4.2 Experimental Evaluation	196
5 Conclusion	197
References	197

The Global RF Lab Alliance: Research and Applications

The Value of RF Based Information

<i>Dieter Uckelmann</i>	201
1 Introduction	201
2 Value of RF based information	205
3 Solution Model – The “Billing Integrated Internet-of-Things”	205
4 Business Scenarios	207
5 Conclusion and future work	209
References	209

Reengineering and Simulation of an RFID Manufacturing System

<i>Antonio Rizzi, Roberto Montanari, Andrea Volpi, Massimo Tizzi</i>	211
1 Introduction	211
2 RFID Lab at the University of Parma	212
3 Reengineering and simulation of logistics processes	213
4 Development of BIMs and results	217
5 Future research directions and conclusions	219
References	219

LIT Middleware: Design and Implementation of RFID Middleware Based on the EPC Network Architecture

<i>Ashad Kabir, Bonghee Hong, Wooseok Ryu, Sungwoo Ahn</i>	221
1 Introduction	221
2 Overview of EPC Network Architecture	222
3 Features of LIT Middleware	223
3.1 Features of ALE	223
3.2 Features of EPCIS	225
4 Design and Implementation of LIT Middleware	226
5 Conclusions	228
References	229

Shelf Life Prediction by Intelligent RFID – Technical Limits of Model Accuracy

<i>Reiner Jedermann, Jean-Pierre Emond, Walter Lang</i>	231
1 Introduction	231
2 Intelligent RFID as enabling technology	232
3 Modelling approaches	233
4 Software simulation for the table-shift approach	234
5 Implementation	235
5.1 Required resources	236
6 Summary and outlook	237
References	238

Sustainable Collaboration

Effects of Autonomous Cooperation on the Robustness of International Supply Networks – Contributions and Limitations for the Management of External Dynamics in Complex Systems

Michael Hülsmann, Bernd Scholz-Reiter, Christoph de Beer,

<i>Linda Austerschulte</i>	241
1 Risks of External Dynamics for the Robustness of Complex International Supply Networks	241
2 Autonomous Cooperation as an Approach to Increase the Robustness of ISN	243
3 Empirical Analysis	244
4 Conclusions	248
References	248

Sustainability and Effectiveness in Global Supply Chains: Toward an Approach Based on a Long-term Learning Process

<i>Bernd Scholz-Reiter, Enzo Morosini Frazzon</i>	251
1 Introduction	251
2 Logistic Systems	252
3 Logistic Systems' Potential Absorptive Capacity	254
4 Preliminary Conclusions and Prospective Research	256
References	257

Risk Management in Dynamic Logistic Systems by Agent Based Autonomous Objects

<i>Boris Bemeleit, Martin Lorenz, Jens Schumacher, Otthein Herzog</i>	259
1 Introduction	259
2 Complexity and Dynamic in Logistic Systems	260
3 Control of a Dynamic System by Online Risk Management	262
4 Risk Management of Autonomous Objects	263
5 Technical Risk Aware Decision-Making	264
6 Conclusion	265
References	266

Knowledge Management and Service Models in Logistics

Knowledge Management in Intermodal Logistics Networks

<i>Hans-Dietrich Haasis</i>	269
1 Intermodal logistics networks	269
2 Challenges in Knowledge Management	270
3 Selected aspects of applied knowledge management in intermodal logistics	272
4 Conclusions	274
References	274

Knowledge Management in Food Supply Chains

<i>Bernd Scholz-Reiter, Salima Delhoum, César Stoll</i>	277
1 Introduction	277
2 Knowledge Management Processes	278
3 Organizational Approach to Knowledge Management	279
3.1 Learning Lab	280
4 Conclusion	282
References	283

Service Models for a Small-sized Logistics Service Provider – A Case Study from Finland

<i>Jukka Hemilä</i>	285
1 Introduction	285
2 Service development steps	288
3 Services for small sized LSP	289
4 Conclusions	290
References	291

Container Logistics

A Framework for Integrating Planning Activities in Container Terminals

<i>Seung Hwan Won, Kap Hwan Kim</i>	295
1 Introduction	295
2 The framework for a planning procedure	296
3 Resource profiles for various activities	298
4 Conclusion	302
References	303

Electronic Seals for Efficient Container Logistics

<i>Kateryna Daschkovska, Bernd Scholz-Reiter</i>	305
1 Introduction	305
2 Container Electronic Seals	306
3 Cost-Effective Investments and Returns on ESeals	307
4 Conclusions	311
References	312

Towards Autonomous Logistics: Conceptual, Spatial and Temporal Criteria for Container Cooperation

<i>Arne Schuldt, Sven Werner</i>	313
1 Introduction	313
2 Criteria for Cooperation	314
2.1 Conceptual and Spatial Constraints	315
2.2 Agent Clusters	316
2.3 Temporal Constraints	316

3	Case Study	318
4	Discussion	319
	References	320
Distributed Process Control by Smart Containers		
	<i>Türk Kiziltoprak, René Schumann, Axel Hahn, Jan Behrens</i>	321
1	Introduction	321
2	Problem	322
3	Solution ideas	323
4	Technical aspects	323
5	Communicational aspects	324
6	Modern Information processing	326
7	Related work	327
8	Future work	328
	References	328
Autonomous Control in Logistics		
Autonomous Units for Communication-based Dynamic Scheduling		
	<i>Karsten Hölscher, Peter Knirsch, Melanie Luderer</i>	331
1	Introduction	331
2	Autonomous Units	332
3	Communication-based Dynamic Scheduling	333
	3.1 Transport Networks	333
	3.2 Sample Negotiation	334
4	Conclusion	337
	References	338
Autonomously Controlled Adaptation of Formal Decision Models – Comparison of Generic Approaches		
	<i>Jörn Schönberger, Herbert Kopfer</i>	341
1	Introduction	341
2	Vehicle Scheduling Problem	341
3	Online Decision Strategies	343
4	Numerical Experiments	344
5	Conclusions	348
	References	348
Clustering in Autonomous Cooperating Logistic Processes		
	<i>Gulshanara Singh, Bernd-Ludwig Wenning, Amanpreet Singh, Carmelita Görg</i>	349
1	Introduction	349
2	Routing and Clustering Approach	350
3	Scenario Description	351
	3.1 Messages Sent during Clustering	352

- 4 Communication Traffic for Clustering 352
 - 4.1 Representation and Assumption 353
 - 4.2 Messages Sent during Routing 353
- 5 Results 355
- 6 Summary and Outlook 356
- References 357

**Application of Small Gain Type Theorems
in Logistics of Autonomous Processes**

Sergey Dashkovskiy, Björn Rüffer, Fabian Wirth 359

- 1 Introduction 359
- 2 Motivating example 360
- 3 Feedback loop as a two nodes network 361
 - 3.1 Interpretations 361
 - 3.2 State equation and stability of the queues 362
- 4 Conclusions 364
- References 365
- Appendix: Definitions and known results 365

Next Generation Supply Chain Concepts

**Web-service Based Integration
of Multi-organizational Logistic Process**

Hyerim Bae 369

- 1 Introduction 369
- 2 Backgrounds 370
 - 2.1 Workflow interoperability 370
 - 2.2 XML and interoperability 371
- 3 Web service and BPEL4WS 372
 - 3.1 Web service 372
 - 3.2 Process-oriented web service integration and BPEL4WS ... 372
- 4 Workflow integration using BPEL4WS 373
 - 4.1 Using BPEL4WS as a process definition language 373
 - 4.2 Using BPEL4WS as a process exchange format 375
 - 4.3 Workflow as Web service 376
 - 4.4 Workflow as Web services' coordinator 376
- 5 System implementation: uEngine 377
- 6 Conclusions 378
- References 379

**An Approach for the Integration of Data
Within Complex Logistics Systems**

Carl Hans, Karl A. Hribernik, Klaus-Dieter Thoben 381

- 1 Motivation 381
- 2 Challenge 383
- 3 State of the Art 384

4	Approach to Data Integration	385
5	Approach and Methodology	387
6	Conclusion	389
	References	389
Developing a Measurement Instrument for Supply Chain Event Management-Adoption		
	<i>Rebekka Sputtek, Joerg S. Hofstetter, Wolfgang Stölzle, Phillip Kirst</i>	391
1	Introduction	391
2	Methodology	392
	2.1 Development of a measurement instrument for SCEM-adoption	393
3	Implications	400
4	Outlook	402
	References	403
Developing a Security Event Management System for Intermodal Transport		
	<i>Rainer Müller</i>	405
1	Introduction	405
2	The SCEM approach	406
3	Logistics Event Manager	407
4	Security Event Manager	408
	4.1 Security related data and events	408
	4.2 Automatic messaging of events	409
	4.3 Generating events manually	411
	4.4 Security factor	411
5	Conclusions	412
	References	412
Logistic Processes Modelling		
Autonomous Control of a Shop Floor Based on Bee's Foraging Behaviour		
	<i>Bernd Scholz-Reiter, Thomas Jagalski, Julia C. Bendul</i>	415
1	Introduction	415
2	Autonomy in production logistics	416
3	Shop floor scenario	416
4	Autonomous control based on bee's foraging behaviour	417
	4.1 Choosing the best feeding place in a honey bee colony	417
	4.2 Transfer of best feeding place choice to the best machining program problem	418

5 Simulation Results 419
 5.1 Scenario without setup times 419
 5.2 Scenario with setup times 421
 6 Conclusion 422
 References 422

Proof Principles of CSP – CSP-Prover in Practice

Yoshinao Isobe, Markus Roggenbach 425
 1 Introduction 425
 2 The process algebra CSP in CSP-Prover 427
 3 Algebraic Laws 429
 3.1 Correctness proofs of algebraic laws 430
 3.2 Proofs based on algebraic laws 432
 4 Fixed point analysis 433
 4.1 Basic fixed point analysis techniques in CSP-Prover 435
 5 Deadlock analysis 437
 5.1 Proofs by abstraction 438
 6 Summary and Future work 441
 References 442

Application of Markov Drift Processes to Logistical Systems Modeling

Mikhail Postan 443
 1 Definition of Markov Drift Process and its Properties 443
 2 Production Line with Unreliable Units 446
 3 Interaction of Two Transport Units Via Warehouse 448
 4 Optimal Cargo-Flows Distribution among
 a Set of Transshipment Points 451
 5 Conclusion 455
 References 455

Analysis of Decentral Order-picking Control Concepts

Thorsten Schmidt, Guido Follert 457
 1 Introduction 457
 2 Application 458
 3 Control strategies 459
 4 Experiments 460
 4.1 Evaluation 460
 4.2 Improvement by strategies 463
 5 Conclusion 464
 References 464