Evolving technologies in mass production have led to the development of advanced techniques in the field of manufacturing. These technologies can quickly and effectively respond to various market changes, necessitating processes that focus on small batches of multiple products rather than large, single-product lines.

*Formal Methods in Manufacturing Systems: Recent Advances* explores this shifting paradigm through an investigation of contemporary manufacturing techniques and formal methodologies that strive to solve a variety of issues arising from a market environment that increasingly favors flexible systems over traditional ones. This book will be of particular use to industrial engineers and students of the field who require a detailed understanding of current trends and developments in manufacturing tools. This book is part of the Advances in Civil and Industrial Engineering series collection.

**Topics Covered:**

- Automated Manufacturing Systems
- Deadlock Control
- Dynamic Models
- Flexible Manufacturing Systems (FMS)
- Formal Modeling Tools
- Hybrid Optimization Techniques
- Intelligent Computation
- Manufacturing Technologies
- Petri Nets
- Planning and Scheduling

**Market:** This premier publication is essential for all academic and research library reference collections. It is a crucial tool for academicians, researchers, and practitioners. Ideal for classroom use.
Section 1: Supervisory Control in FMS

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Nonblocking Supervisory Control of Flexible Manufacturing Systems Based on State Tree Structures
Chao Wujie (Xi'an Jiaotong University, China)
Gan Yongmei (Xi'an Jiaotong University, China)
Wontham W. M. (University of Toronto, Canada)
Wang Zhaoan (Xi'an Jiaotong University, China)

Chapter 2
Petri Net Supervisory Method for Linear Constraints and its Applications to Flexible Manufacturing Systems
Luo Jiliang (Huaqiao University, China)

Chapter 3
Distributed Maximally Permissive Nonblocking Control of Flexible Manufacturing Systems
Zhang Renyuan (Xi'an Jiaotong University, China)
Gan Yongmei (Xi'an Jiaotong University, China)
Wontham W. M. (University of Toronto, Canada)
Wang Zhaoan (Xi'an Jiaotong University, China)

Chapter 4
A Computationally Improved Control Policy for FMS Using Crucial Marking/Transition-Separation Instances
Huang Yi-Sheng (National Ilan University, Taiwan, R.O.C.)
Pan Yen-Liang (Air Force Academy, Taiwan, R.O.C.)

Section 2: Production Planning and Scheduling

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Hybrid Optimization Techniques for Industrial Production Planning
Vasant Pandian (University Technology Petronas, Malaysia)

Chapter 6
MDA-Based Methodology for Verifying Distributed Execution of Embedded Systems Models
Costa Anikó (Universidade Nova de Lisboa, Portugal)
Barbosa Paulo E. S. (Universidade Estadual da Paraíba, Brazil)
Mounthio Filipe (Universidade Nova de Lisboa, Portugal)
Pereira Fernando (Instituto Politécnico de Lisboa, Portugal)
Ramalho Franklin (Universidade Federal de Campina Grande, Brazil)
Figueiredo Jorge C. A. (Universidade Federal de Campina Grande, Brazil)
Gomes Luís (Universidade Nova de Lisboa, Portugal)

Chapter 7
A Resource-Oriented Petri Net Approach to Scheduling and Control of Time-Constrained Cluster Tools in Semiconductor Fabrication
Wu NaiQi (Guangdong University of Technology, China)
Zhou MengChu (New Jersey Institute of Technology, USA & Tongji University, China)

Chapter 8
Real-Time Scheduling and Control of Single-Arm Cluster Tools with Residency Time Constraint and Activity Time Variation by Using Resource-Oriented Petri Nets
Qiao Yan (Guangdong University of Technology, China)
Wu NaiQi (Guangdong University of Technology, China)
Zhou MengChu (New Jersey Institute of Technology, USA & Tongji University, China)

Section 3: Deadlock Prevention and Net Analysis Techniques

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Intelligent Computation for Manufacturing
Afify Ashraf (King Saud University, Saudi Arabia & Zagazig University, Egypt)

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Flexible Dynamic Reconstructions of Petri Nets
Zhang Jia Feng (Xidian University, China)
Moshahi Ofa (University of Carthage, Tunisia)
Khulga Mohamed (University of Carthage, Tunisia & National Council of Research, Italy)
Gharbi Atef (University of Carthage, Tunisia)

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A Critical-Siphon Approach to Fastest Deadlock Controller for S3PR
Chao Daniel Yuh (National Cheng Chi University, China)

Chapter 12
Iterative Deadlock Control for Petri Net Models of Automated Manufacturing Systems
Wang Anrong (Xidian University, China)
Zhou MengChu (New Jersey Institute of Technology, USA & Tongji University, China)

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Design of Optimized Petri Net Supervisors for Flexible Manufacturing Systems Based on Elementary Siphons
Yan Mingming (University of Electronic Science and Technology of China, China)

Chapter 14
Deadlock Control in Generalized Petri Nets
Zhou Mi (Shihezi University, China)
Hou Yifan (Xidian University, China)

Chapter 15
Deadlock Prevention for Automated Manufacturing Systems with Uncontrollable and Unobservable Transitions
Qin Meng (Xidian University, China)

Chapter 16
Solving Siphons with the Minimal Cardinality for Deadlock Control
Li Shuopeng (Lanzhou University of Technology, China)

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