

Performance Modeling Of Automated Manufacturing Systems Prentice Hall Information And System Sciences Series

From traditional topics that form the core of industrial electronics, to new and emerging concepts and technologies, The Industrial Electronics Handbook, in a single volume, has the field covered. Nowhere else will you find so much information on so many major topics in the field. For facts you need every day, and for discussions on topics you have only dreamed of, The Industrial Electronics Handbook is an ideal reference.

Proceedings of the European Control Conference 1993, Groningen, Netherlands, June 28 – July 1, 1993

Deadlock problems in flexible manufacturing systems (FMS) have received more and more attention in the last two decades. Petri nets are one of the more promising mathematical tools for tackling deadlocks in various resource allocation systems. In a system modeled with Petri nets, siphons are tied to the occurrence of deadlock states as a structural object. The book systematically introduces the novel theory of siphons, traps, and elementary siphons of Petri nets as well as the deadlock control strategies for FMS developed from it. Deadlock prevention methods are examined comparatively. The many FMS examples presented to demonstrate the concepts and results of this book range from the simple to the complex. Importantly, to inspire and motivate the reader's interest in further research, a number of interesting and open problems in this area are proposed at the end of each chapter.

The phenomenal success of integrated product and process development (IPPD) at such companies as Boeing, Motorola, and Hewlett-Packard has led many manufacturers to place renewed emphasis on this critical aspect of concurrent engineering. If you are among those charged with the daunting task of implementing, upgrading, or maintaining IPPD, you need a single reference/handbook that covers all of the tools, technologies, and applications that support IPPD. You need Integrated Product and Process Development. Emphasizing applications, this extremely user-friendly guide covers everything from basic principles to cutting-edge research. It addresses ideas and methods in product design as well as issues related to process design and manufacturing. Case studies illustrate the application of various tools and techniques of IPPD in manufacturing for the defense industry, making the most of product planning, applications of quality function deployment (QFD), the effective use of design optimization, and integrating design and process planning. Other topics covered include: Identifying customer needs using QFD. Issues and constraints in time-driven product development.

Enhancing automated design systems with functional design. Rapid prototyping. Case-based process planning systems

PERFORMANCE MODELING OF AUTOMATED SYSTEMS

1st International Conference on Manufacturing and Management

A Novel Petri-Net Approach

Autonomous Guided Vehicles

Stochastic Modeling and Analysis of Manufacturing Systems

Fieldbus Technology

The two-volume set originates from the Advanced Course on Petri Nets held in Dagstuhl, Germany in September 1996; beyond the lectures given there, additional chapters have been commissioned to give a well-balanced presentation of the state of the art in the area. Together with its companion volume "Lectures on Petri Nets I: Basic Models" this book is the actual reference for the area and addresses professionals, students, lecturers, and researchers who are - interested in systems design and would like to learn to use Petri nets familiar with subareas of the theory or its applications and wish to view the whole area - interested in learning about recent results presented within a unified framework - planning to apply Petri nets in practical situations - interested in the relationship of Petri nets to other models of concurrent systems.

Illustrated with real-life manufacturing examples, Formal Methods in Manufacturing provides state-of-the-art solutions to common problems in manufacturing systems. Assuming some knowledge of discrete event systems theory, the book first delivers a detailed introduction to the most important formalisms used for the modeling, analysis, and control of manufacturing systems (including Petri nets, automata, and max-plus algebra), explaining the advantages of each formal method. It then employs the different formalisms to solve specific problems taken from today's industrial world, such as modeling and simulation, supervisory control (including deadlock prevention) in a distributed and/or decentralized environment, performance evaluation (including scheduling and optimization), fault diagnosis and diagnosability analysis, and reconfiguration. Containing chapters written by leading experts in their respective fields, Formal Methods in Manufacturing helps researchers and application engineers handle fundamental principles and deal with typical quality goals in the design and operation of manufacturing systems.

Manufacturing systems have become increasingly complex over recent years. This volume presents a collection of chapters which reflect the recent developments of probabilistic models and methodologies that have either been motivated by manufacturing systems research or been demonstrated to have significant potential in such research. The editor has invited a number of leading experts to present detailed expositions of specific topics. These include: Jackson networks, fluid models, diffusion and strong approximations, the GSPM framework, stochastic convexity and majorization, perturbation analysis, scheduling via Brownian models, and re-entrant lines and dynamic scheduling. Each chapter has been written with graduate students in mind, and several have been used in graduate courses that teach the modeling and analysis of manufacturing systems.

Petri nets are widely used in modeling, analysis, and control of discrete event systems arising from manufacturing, transportation, computer and communication networks, and web service systems. However, Petri net models for practical systems can be very large, making it difficult to apply such models to real-life problems. System Modeling and Control with Resource-Oriented Petri Nets introduces a new resource-oriented Petri net (ROPN) model that was developed by the author. Not only does it successfully reduce model size, but it also offers improvements that facilitate effective modeling, analysis, and control of automated and reconfigurable manufacturing systems. Presenting the latest research in this novel approach, this cutting-edge volume provides proven theories and methodologies for implementing cost and time-saving improvements to contemporary manufacturing systems. It provides effective tools for deadlock avoidance—deadlock-free routing and deadlock-free scheduling. The authors supply simple and complex industrial manufacturing system examples to illustrate time-tested concepts, theories, and approaches for solving real-life application problems. Written in a clear and concise manner, the text covers applications to automated and reconfigurable manufacturing systems, automated guided vehicle (AGV) systems, semiconductor manufacturing systems, and flexible assembly systems. Explaining complex concepts in a manner that is easy to understand, the authors provide the understanding and tools needed for more effective modeling, analysis, performance evaluation, control, and scheduling of engineering processes that will lead to more flexible and efficient manufacturing systems.

Modeling and Control of Automated Manufacturing Systems

Control and Dynamic Systems V47: Manufacturing and Automation Systems: Techniques and Technologies

Reliability Testing and Improvement : Proceedings of the 2nd Asian International Workshop (AIWARM 2006), Busan, Korea, 24-26 August 2006

European Control Conference 1993

Methods, Tools, and Technologies

Integrated Models in Production Planning, Inventory, Quality, and Maintenance

Fieldbus Technology (FT) is an enabling platform that is becoming the preferred choice for the next generation real-time automation and control solutions. This book incorporates a selection of research and development papers. Topics covered include: history and background, contemporary standards, underlying architecture, comparison between different Fieldbus systems, applications, latest innovations, new trends as well as issues such as compatibility, interoperability, and interchangeability. Sustainable production automation, as an effective way to enable and expedite transitions to sustainability and enhance resource utilization, attracts substantial efforts from researchers in both academy and industry. This book presents the recent development of innovative algorithms, models, heuristics, hardware and software in broad areas of sustainable production systems. It focuses on design, analysis and management of the processes involved in the product life cycle (from design to delivery to return) to have the minimal negative impacts on society (including environmental, economic and social). The contributors are experts from both universities and industrial research centers.

One critical barrier leading to successful implementation of flexible manufacturing and related automated systems is the ever-increasing complexity of their modeling, analysis, simulation, and control. Research and development over the last three decades has provided new theory and graphical tools based on Petri nets and related concepts for the design of such systems. The purpose of this book is to introduce a set of Petri-net-based tools and methods to address a variety of problems associated with the design and implementation of flexible manufacturing systems (FMS), with several implementation examples. There are three ways this book will directly benefit readers. First, the book will allow engineers and managers who are responsible for the design and implementation of modern manufacturing systems to evaluate Petri nets for applications in their work. Second, it will provide sufficient breadth and depth to allow development of Petri-net-based industrial applications. Third, it will allow the basic Petri net material to be taught to industrial practitioners, students, and academic researchers much more efficiently. This will foster further research and applications of Petri nets in aiding the successful implementation of advanced manufacturing systems.

Increasingly, over the last few years, intelligent controllers have been incorporated into control systems. Presently, the numbers and types of intelligent controllers that contain variations of fuzzy logic, neural network, genetic algorithms or some other forms of knowledge based reasoning technology are dramatically rising. However, considering the stability of the system, when such controllers are included it is difficult to analyse and predict system behaviour under unexpected conditions. Leading researchers and industrial practitioners were able to discuss and evaluate current development and future research directions at the first IPAC International Workshop on safety, reliability and applications on emerging intelligent control technology. This publication contains the papers, covering a wide range of topics, presented at the workshop.

Advanced Reliability Modeling II

Petri Net Modeling and Performance Analysis of Can Fieldbus

Design, Production, Automation, and Integration

System Modeling and Control with Resource-Oriented Petri Nets

Performance Modeling of Automated Manufacturing Systems with Unreliable Machines and Random Processing Times

Analysis, Control and Optimization of Complex Dynamic Systems

Control and Dynamic Systems: Advances in Theory and Applications, Volume 47: Manufacturing and Automation Systems: Techniques and Technologies, Part 3 of 5 deals with techniques and technologies in manufacturing and automation systems. This book discusses techniques in modeling and control policies for production networks; effective planning and control of day-to-day operations; evaluation of automated manufacturing systems; the use of Petri Nets in modeling, control and performance analysis of automated manufacturing systems; and concurrent engineering and evaluation of concurrency in engineering design. The final chapter discusses the algorithm for solving allocation problems. This book will provide a uniquely significant reference source for practitioners in the field who want a comprehensive source of techniques with significant applied implications.

The progress of science and technology has placed Queuing Theory among the most popular disciplines in applied mathematics, operations research, and engineering. Although queuing has been on the scientific market since the beginning of this century, it is still rapidly expanding by capturing new areas in technology. Advances in Queuing provides a comprehensive overview of problems in this enormous area of science and focuses on the most significant methods recently developed. Written by a team of 24 eminent scientists, the book examines stochastic, analytic, and generic methods such as approximations, estimates and bounds, and simulation. The first chapter presents an overview of classical queuing methods from the birth of queues to the seventies. It also contains the most comprehensive bibliography of books on queuing and telecommunications to date. Each of the following chapters surveys recent methods applied to classes of queuing systems and networks followed by a discussion of open problems and future research directions. Advances in Queuing is a practical reference that allows the reader quick access to the latest methods.

Production Systems Engineering (PSE) is an emerging branch of Engineering intended to uncover fundamental principles of production systems and utilize them for analysis, continuous improvement, and design. This volume is the first ever textbook devoted exclusively to PSE. It is intended for senior undergraduate and first year graduate students interested in manufacturing. The development is first principle-based rather than recipe-based. The only prerequisite is elementary Probability Theory; however, all necessary probability facts are reviewed in an introductory chapter. Using a system-theoretic approach, this textbook provides analytical solutions for the following problems: mathematical modeling of production systems, performance analysis, constrained improvability, bottleneck identification and elimination, lean buffer design, product quality, customer demand satisfaction, transient behavior, and system-theoretic properties. Numerous case studies are presented. In addition, the so-called PSE Toolbox, which implements the algorithms developed, is described. The volume includes numerous case studies and problems for homework assignment.

The 2006 Asian International Workshop on Advanced Reliability Modeling (AIWARM) is the second symposium in a series of biennial workshops for the dissemination of state-of-art research and the presentation of practice in reliability and maintenance engineering in Asia. It brings together researchers and engineers from not only Asian countries but also all over world to discuss the state of research and practice in dealing with both reliability issues at the system design phase and maintenance issues at the system operation phase. The theme of AIWARM 2006 is OC reliability testing and improvementOCO. The contributions in this volume cover all the main topics in reliability and maintenance engineering, providing an in-depth presentation of theory and practice. Sample Chapter(s): Chapter 1: Optimal Burn-In for Minimizing Total Warranty Cost (311 KB). Contents: System and Network Reliability; Optimization in Reliability Engineering; Maintenance; Advanced Warranty Modeling; Software Reliability; Acceleration Testing and Failure Analysis; Statistical Analysis and Reliability Modeling; Stochastic Models; Statistical Quality Control. Readership: Graduate students and researchers and as well as reliability, maintenance and industrial engineers."

Modeling, Simulation, and Control of Flexible Manufacturing Systems

Industrial Network Standards for Real-Time Distributed Control

Performance Modeling of Automated Manufacturing Systems

Group Technology and Cellular Manufacturing

Advances in Theory and Applications

Instructor's Manual Performance Modeling of Automated Manufacturing Systems

Group Technology and Cellular Manufacturing (GT/CM) have been widely-researched areas in the past 15 years and much progress has been made in all branches of GT/CM. Resulting from this research activity has been a proliferation of techniques for part-machine grouping, engineering data bases, expert system-based design methods for identifying part families, new analytical and simulation tools for evaluating performance of cells, new types of cell incorporating robotics and flexible automation, team-based approaches for organizing the work force and much more; however, the field lacks a careful compilation of this research and its outcomes. The editors of this book have commissioned leading researchers and implementers to prepare specific treatments of topics for their special areas of expertise in this broad-based philosophy of manufacturing. The editors have sought to be global both in coverage of topic matters and contributors. Group Technology and Cellular Manufacturing addresses the needs and interests of three groups of individuals in the manufacturing field: academic researchers, industry practitioners, and students. (1) The book provides an up-to-date perspective, incorporating the advances made in GT/CM during the past 15 years. As a natural extension to this research, it synthesizes the latest industry practices and outcomes to guide research to greater real-world relevance. (2) The book makes clear the foundations of GT/CM from the core elements of new developments which are aimed at reducing developmental and manufacturing lead times, costs, and at improving business quality and performance. (3) Finally, the book can be used as a textbook for graduate students in engineering and management for studying the field of Group Technology and Cellular Manufacturing.

Analysis, Control and Optimization of Complex Dynamic Systems gathers in a single volume a spectrum of complex dynamic systems related papers written by experts in their fields, and strongly representative of current research trends. Complex systems present important challenges, in great part due to their sheer size which makes it difficult to grasp their dynamic behavior, optimize their operations, or study their reliability. Yet, we live in a world where, due to increasing inter-dependencies and networking of systems, complexity has become the norm. With this in mind, the volume comprises two parts. The first part is dedicated to a spectrum of complex problems of decision and control encountered in the area of production and inventory systems. The second part is dedicated to large scale or multi-agent system problems occurring in other areas of engineering such as telecommunication and electric power networks, as well as more generic context.

The CAN FB (Controller Area Network FieldBus) has been in existence for ten years. It supports automated manufacturing and process control environments to interconnect intelligent devices such as valves, sensors, and actuators. CAN FieldBus has a high bit rate and the ability to detect errors. It is immune to noise and resistant to shock, vibration, and heat. Two recently introduced mechanisms, Distributed Priority Queue (DPQ) and Priority Promotion (PP) enable CAN FieldBus networks to share out the system bandwidth and grant all upper bound on the transmission times so as to meet the requirements in real-time communications. Modeling and analysis of such networks are an important research area for their wide applications in manufacturing automation. This thesis presents a Petri net methodology which models and analyzes CAN FieldBus access protocol. A Reachability Graph of the Petri net model is utilized to study the behavioral properties of the protocol. A timed Petri net simulator is used to evaluate the performance of the protocol. Performance measures include the completion time for successful events and operations. Operational parameters investigated

using the Petri Net model are: Fieldbus speed, the length of each frame, and the number of frames in a message. This book provides readers with extensive information on path planning optimization for both single and multiple Autonomous Guided Vehicles (AGVs), and discusses practical issues involved in advanced industrial applications of AGVs. After discussing previously published research in the field and highlighting the current gaps, it introduces new models developed by the authors with the goal of reducing costs and increasing productivity and effectiveness in the manufacturing industry. The new models address the increasing complexity of manufacturing networks, due for example to the adoption of flexible manufacturing systems that involve automated material handling systems, robots, numerically controlled machine tools, and automated inspection stations, while also considering the uncertainty and stochastic nature of automated equipment such as AGVs. The book discusses and provides solutions to important issues concerning the use of AGVs in the manufacturing industry, including material flow optimization with AGVs, programming manufacturing systems equipped with AGVs, reliability models, the reliability of AGVs, routing under uncertainty, and risks involved in AGV-based transportation. The clear style and straightforward descriptions of problems and their solutions make the book an excellent resource for graduate students. Moreover, thanks to its practice-oriented approach, the novelty of the findings and the contemporary topic it reports on, the book offers new stimulus for researchers and practitioners in the broad field of production engineering.

From Aggregate Planning to Real-Time Control

Advances in Petri Nets

Advances in Queuing Theory, Methods, and Open Problems

Lectures on Petri Nets II: Applications

Methods and Models for Optimal Path Planning

Deadlock Resolution in Automated Manufacturing Systems

This volume contains the proceedings of the 14th International Conference on Application and Theory of Petri Nets. The aim of the Petri net conferences is to create a forum for discussing progress in the application and theory of Petri nets. Typically, the conferences have 150-200 participants, one third of whom come from industry, while the rest are from universities. Three invited papers, "Modeling and enactment of workflow systems" (C.A. Ellis, G.J. Nutt), "Interleaving functional and performance structural analysis of net modes" (M. Silva), and "FSPNs: fluid stochastic Petri nets" (K.S. Trivedi, V.G. Kulkarni), together with 26 full papers (selected from 102 submissions) and 6 project papers.

Handbook

PERFORMANCE MODELING OF AUTOMATED SYSTEMSPHI Learning Pvt. Ltd. Modeling and control issues in automated manufacturing systems. Introduction to Markov processes and queuing theory. Petri net theory in manufacturing. Formal definitions, classification, and properties of ordinary petri nets. Analysis of petri nets. Timed, stochastic, and generalized stochastic petri nets. Performance analysis of automated manufacturing systems and time controllers.

Application and Theory of Petri Nets 1998

Sustainable Production Automation

Techniques and Technologies

Safety, Reliability and Applications of Emerging Intelligent Control Technologies

A State-of-the-Art Synthesis of Research and Practice

Logistics of Production and Inventory

From concept development to final production, this comprehensive text thoroughly examines the design, prototyping, and fabrication of engineering products and emphasizes modern developments in system modeling, analysis, and automatic control. This reference details various management strategies, design methodologies, traditional production techniques, and assembly applications for clear illustration of manufacturing engineering technology in the modern age. Considers a variety of methods for product design including axiomatic design, design for X, group technology, and the Taguchi method, as well as modern production techniques including laser-beam machining, micro lithography.

Control and Dynamic Systems V47: Manufacturing and Automation Systems: Techniques and Technologies.

Presents research and case studies from over 200 Manufacturing Professionals across the globe in the area of: Manufacturing Process; Materials; Metrology; Finite Element Methods; Industrial Engineering; Optimization; Quality; and Supply Chain Management.

Discusses developments in the integration of production, quality, and maintenance models, critical components of the manufacturing system. The effective integration of these four components gives a manufacturing operation the competitive edge in today's global market place.

Formal Methods in Manufacturing

Performance Analysis of Flexible Manufacturing Systems with a Single Discrete Material Handling Device

Concurrent Engineering Techniques and Applications

14th International Conference, Chicago, Illinois, USA, June 21-25, 1993. Proceedings

Manufacturing and Automation Systems

Intelligent Task Planning Using Fuzzy Petri Nets

Concurrent Engineering Techniques and Applications reviews advances in concurrent engineering techniques and applications. An in-depth treatment of the quantitative and economic aspects of concurrent engineering is presented, with emphasis on techniques for measuring the performances of concurrent engineering and for comparing its economic effectiveness with that of traditional engineering. Open systems software standards in concurrent engineering are also discussed. Comprised of 12 chapters, this volume begins with an introduction to techniques for measuring the performances of concurrent engineering and for comparing its economic effectiveness with that of traditional engineering. The next chapter deals with open systems software standards and how to use open systems products effectively in concurrent engineering. The discussion then turns to concurrent product design and manufacturing; the essential issues involved in design-decision support in concurrent/simultaneous engineering; design for manufacturing and assembly and concurrent engineering in electro-optical systems; and the use of visualization in concurrent engineering. The use of multimedia presentation techniques and technology in the concurrent engineering process is also considered, along with techniques in technical documentation. This monograph will be useful to students, academicians, practicing professionals, and research workers.

Advanced modeling techniques are a necessary tool in order to design and manage manufacturing systems effectively. This book contains a set of tutorial chapters on topics ranging from aggregate production planning to real time control, including predictive and reactive scheduling, flow management in assembly systems, simulation of robotic cells, design of manufacturing systems under uncertainty and a historical perspective on production management philosophies. The book will be of interest both to researchers and practitioners, including graduate students in Manufacturing Engineering and Operations Research.

This volume contains the proceedings of the 19th annual International Conference on Application and Theory of Petri Nets. The aim of the Petri net conference is to create a forum for the dissemination of the latest results in the application and theory of Petri nets. It always takes place in the last week of June. Typically there are 150 - 200 participants. About one third of these come from industry while the rest are from universities and research institutions. The conferences and a number of other activities are coordinated by a steering committee with the following members: G. Balbo (Italy), J. Billington (Australia), G. DeMichelis(Italy),C. Girault(France),K. Jensen (Denmark), S. Kumagai (Japan), T. Murata (USA), C. A. Petri (Germany; honorary member), W. Reisig (Germany), G. Roucairol (France), G. Rozenberg (The Netherlands; chairman), M. Silva (Spain). The 19th conference has been organized for the rst time in Portugal, by the Department of Electrical Engineering of the Faculty of Sciences and Technology of the New University of Lisbon, together with the Center for Intelligent Robotics of UNINOVA. It takes place in Lisbon at the same time as EXPO'98, the last world exhibition of the 20th century.

The text is designed for engineering students at the senior undergraduate level and first-year students at graduate level, and professionals (R&D engineers in the industry and factory managers). The authors offer a unique effort in presenting a unified and systematic treatment of various modeling methodologies and analysis techniques for performance evaluation of automated manufacturing systems. The text begins with an overview of automated manufacturing systems, and then provides a clear and comprehensive discussion of three principal analytical modeling paradigms: Markov Chains, Queues and Queuing Networks, and Petri Nets. Salient Features - Present the first ever treatment of the mathematical modeling of manufacturing systems. - Offers a unified study of principal analytical modeling paradigms for automated manufacturing systems. • Discusses many recent research contributions in the area of modeling of automated manufacturing systems. • Discusses many recent research contributions in the area of modeling of automated manufacturing systems, including deadlock modeling, transient analysis, queuing network approximations, Petri Net modeling, and integrated analytical modeling. • Provides a large number of exercises and problems.

Production Systems Engineering

Modeling, Control, and Performance Analysis

GCMM 2004

Volume 2

A Petri-Net Approach

Application and Theory of Petri Nets 1993

This book describes an approach to intelligent task planning in a robotic system. Petri net and fuzzy logic are integrated and used to represent task sequence planning and error recovery. During the generation and execution of task plans, different kinds of uncertainties need to be handled to ensure the efficiency and reliability of the system. Following a systematic modeling procedure, a fuzzy Petri net is constructed based on geometric relations, fuzzy variables, and reasoning structures. The resulting net can be used to analyze and control the system. Many examples are discussed to illustrate the theory and the applications of fuzzy Petri nets.

Applications of Petri Nets in Manufacturing Systems

The Industrial Electronics Handbook

Integrated Product and Process Development

Modeling Manufacturing Systems

Manufacturing