# Control Engineering Series

# System Modeling and Control with Resource-Oriented Petri Nets



NaiQi Wu MengChu Zhou



Aman Behal, Warren Dixon, Darren M. Dawson, Bin Xian

System Modeling and Control with Resource-Oriented Petri Nets MengChu Zhou, Naiqi Wu, 2018-09-03 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 authors 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

Anti-Disturbance Control for Systems with Multiple Disturbances Lei Guo, Songyin Cao, 2018-10-08 The main focus of this monograph will be on the Enhanced Anti Disturbance Control and filtering theory and their applications In fact the classical anti disturbance control theory only considered one equivalent disturbance which is merged by different unknown sources However it is noted that along with the development of information obtaining and processing technologies one can get more information or knowledge about various types of disturbances Formal Methods in Manufacturing Systems: Recent Advances Li, Zhiwu, 2013-05-31 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 Linear Control System Analysis and Design with MATLAB Constantine H. Houpis, Stuart N. Sheldon, 2013-10-30 This book uses numerous in

depth explanations diagrams calculations and tables to provide an intensive overview of modern control theory and control system design Mathematics is kept to a minimum and engineering applications are stressed throughout Completely updated and packed with student friendly features the sixth edition presents a range of updated examples using MATLAB as well as an appendix listing MATLAB functions for optimizing control system analysis and design Over 75 percent of the problems presented in the previous edition have been revised or replaced Formal Methods in Manufacturing Javier Campos, Carla Seatzu, Xiaolan Xie, 2018-09-03 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 Synchronization and Control of Multiagent Systems Dong Sun, 2018-10-09 Multiple manufacturing systems intelligent agent systems are commonly used in research requiring complex behavior Synchronization control provides an advantage in solving the problem of multi agent coordination This book focuses on the use of synchronization control to coordinate the group behavior of multiple agents The author includes numerous real world applicatio Petri Nets Guanjun Liu, 2022-11-03 This book provides essential information on Petri net theory and Petri net based model checking methods As for the Petri net theory it involves the interleaving semantics and concurrency semantics of elementary net systems some important net structures e q invariant repetitive vector siphon and trap some classical net subclasses with special structures e g state machine marked graph free choice net asymmetric choice net normal net and weakly persistent net and some basic properties e g reachability liveness deadlock and soundness It also involves four high level Petri nets knowledge oriented Petri nets Petri nets with insecure places time Petri nets and plain time Petri nets with priorities focusing on different fields of application As for the model checking methods this book introduces readers to computation tree logic CTL computation tree logic of knowledge CTLK and timed computation tree logic TCTL as well as Petri net based methods for checking them The basic principle of the reduced ordered binary decision diagram ROBDD is employed to compress the state space used in these model checking procedures The book also covers time soundness for time Petri nets and secure bisimulation for Petri nets with insecure places both of which are based on the bisimulation theory As such it offers an introduction to basic information on bisimulation theory Lyapunov-Based Control of Robotic Systems Aman

Behal, Warren Dixon, Darren M. Dawson, Bin Xian, 2009-12-17 Lyapunov Based Control of Robotic Systems describes nonlinear control design solutions for problems that arise from robots required to interact with and manipulate their environments Since most practical scenarios require the design of nonlinear controllers to work around uncertainty and measurement related issues the authors use Lyapunov s direct method as an effective tool to design and analyze controllers for robotic systems After describing the evolution of real time control design systems and the associated operating environments and hardware platforms the book presents a host of standard control design tools for robotic systems using a common Lyapunov based framework It then discusses several problems in visual servoing control including the design of homography based visual servo control methods and the classic structure from motion problem The book also deals with the issues of path planning and control for manipulator arms and wheeled mobile robots With a focus on the emerging research area of human machine interaction the final chapter illustrates the design of control schemes based on passivity such that the machine is a net energy sink Including much of the authors own research work in controls and robotics this book facilitates an understanding of the application of Lyapunov based control design techniques to up and coming problems in robotics

Modeling, Simulation, And Control Of Flexible Manufacturing Systems: A Petri Net Approach Kurapati Venkatesh, Mengchu Zhou, 1999-01-29 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 FMSs 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 End-to-End Adaptive Congestion Control in TCP/IP Networks Christos N. Houmkozlis, George A. Rovithakis, 2017-12-19 Establishing adaptive control as an alternative framework to design and analyze Internet congestion controllers End to End Adaptive Congestion Control in TCP IP Networks employs a rigorously mathematical approach coupled with a lucid writing style to provide extensive background and introductory material on dynamic systems stability and neural network approximation alongside future internet requests for congestion control architectures Designed to operate under extreme heterogeneous dynamic and time varying network conditions the developed controllers must also handle network modeling structural uncertainties and uncontrolled traffic

flows acting as external perturbations The book also presents a parallel examination of specific adaptive congestion control NNRC using adaptive control and approximation theory as well as extensions toward cooperation of NNRC with application QoS control Features Uses adaptive control techniques for congestion control in packet switching networks Employs a rigorously mathematical approach with lucid writing style Presents simulation experiments illustrating significant operational aspects of the method including scalability dynamic behavior wireless networks and fairness Applies to networked applications in the music industry computers image trading and virtual groups by techniques such as peer to peer file sharing and internet telephony Contains working examples to highlight and clarify key attributes of the congestion control algorithms presented Drawing on the recent research efforts of the authors the book offers numerous tables and figures to increase clarity and summarize the algorithms that implement various NNRC building blocks Extensive simulations and comparison tests analyze its behavior and measure its performance through monitoring vital network quality metrics Divided into three parts the book offers a review of computer networks and congestion control presents an adaptive congestion control framework as an alternative to optimization methods and provides appendices related to dynamic systems through universal neural network approximators

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