IEEE Control Systems Society
Technical Committee on Discrete Event Systems

Newsletter **March 2020**

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Welcome to the 2020 March issue of the newsletter, also available online at
http://discrete-event-systems.ieeecss.org/tc-discrete/newsletters

Editorial

You are welcome to submit new items to the newsletter (topics including schools, workshops, sessions, conferences, journals, books, software, positions). Also please encourage relevant colleagues and students to subscribe to this newsletter.

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Contents

1 Selections of Journal Publications

Contributed by: Xiang Yin (yinxiang@sjtu.edu.cn)

1.1. Discrete Event Dynamic Systems Theory and Applications

Volume: 30, Issue: 1, March 2020

- **Leveraging Horn clause solving for compositional verification of PLC software**
  Authors: Dimitri Bohlender ; Stefan Kowalewski
  Abstract: Real-world PLC software is modular and composed of many different function blocks. Nevertheless, common approaches to PLC software verification do not leverage this but resort to inlining, or analyse instances of the same function block type independently. With the advent of constrained Horn clauses as the basis for automated program verification, many state-of-the-art verification procedures build upon them. We illustrate how this formalism allows for a uniform characterisation of PLC program semantics and safety goals, derived from reactive systems safety foundations. Furthermore, we give a natural extension of the resulting encoding which enables compositional reasoning about modular software. Due to the cyclic execution of PLCs, an engineer's mental model of a single function block often exhibits state machine semantics-partitioning a block's behaviour into different modes of operation. We illustrate how such a mode space, and similar high-level knowledge, can be integrated with our compositional characterisation. We investigate the impact of each technique on the model checking performance by characterising PLC software verification problems, both in a non-compositional and a compositional way that may incorporate mode transitions, and solving them with an SMT solver. Evaluation of our prototypical implementation on examples from the PLCopen Safety library shows the effectiveness of both the chosen formalism and using high-level summaries.
- **Analysis and control of max-plus linear discrete-event systems: An introduction**
  Authors: Bart De Schutter ; Ton van den Boom ; Jia Xu ; Samira S. Farahani
  Abstract: The objective of this paper is to provide a concise introduction to the max-plus algebra and to max-plus linear discrete-event systems. We present the basic concepts of the max-plus algebra and explain how it can be used to model a specific class of discrete-event systems with synchronization but no concurrency. Such systems are called max-plus linear discrete-event systems because they can be described by a model that is "linear" in the max-plus algebra. We discuss some key properties of the max-plus algebra and indicate how these properties can be used to analyze the behavior of max-plus linear discrete-event systems. Next, some control approaches for max-plus linear discrete-event systems, including residuation-based control and model predictive control, are presented briefly. Finally, we discuss some extensions of the max-plus algebra and of max-plus linear systems.
- **Path planning for robotic teams based on LTL specifications and Petri net models**
  Authors: Marius Kloetzer ; Cristian Mahulea
  Abstract: This research proposes an automatic strategy for planning a team of identical robots evolving in a known environment. The robots should satisfy a global task for the whole team, given in terms of a Linear Temporal Logic (LTL) formula over predefined regions of interest. A Robot Motion Petri Net (RMPN) system is used for modeling the evolution of the robotic team in the environment, bringing the advantage of a fixed topology versus the number of robots, with respect to methods based on synchronous automaton products. The algorithmic method iterates the selection of an accepted run that satisfies the specification and the search for RMPN sequences of reachable markings that can produce desired observations. A Büchi automaton witnesses the advancement towards formula fulfillment, and at the core of our methods are three Mixed Integer Linear Programming (MILP) formulations that yield firing sequences and markings of RMPN model. The cost functions of these formulations reduce the number of robot synchronizations and induce collision avoidance. Simulation examples support the computational feasibility of the proposed method.
- **On the relation between reactive synthesis and supervisory control of non-terminating processes**
  Authors: Anne-Kathrin Schmuck ; Thomas Moor ; Rupak Majumdar

Abstract: Reactive synthesis and supervisory control theory both provide a design methodology for the automatic and algorithmic design of digital systems from declarative specifications. The reactive synthesis approach originates in computer science, and seeks to synthesise a system that interacts with its environment over time and that, doing so, satisfies a prescribed specification. Here, the distinguishing feature when compared to other synthesis problems in computer science is that the interaction is temporal in that it explicitly refers to a sequence of computation cycles. Supervisory control originates in control theory and seeks to synthesise a controller that – in closed-loop configuration with a plant-enforces a prescribed specification over time. The distinguishing feature compared to other branches of control is that all dynamics are driven by discrete events as opposed to continuous signals. While both methods apparently are closely related, the technical details differ significantly. We provide a formal comparison which allows us to identify conditions under which one can solve one synthesis problem using methods from the other one; we also discuss how the resulting solutions compare. To facilitate this comparison, we give a unified introduction to reactive synthesis and supervisory control and derive formal problem statements and a characterisation of their solutions in terms of omega-languages. Recent contributions to the two fields address different aspects of the respective problem, and we expect the formal relationship identified in this paper to be useful in that it allows the application of algorithmic techniques from one field in the other.

- **Stochastic flow models with delays, blocking and applications to multi-intersection traffic light control**
  Authors: Rui Chen ; Christos G. Cassandras
  Abstract: We extend Stochastic Flow Models (SFMs), used for a large class of discrete event and hybrid systems, by including the delays which typically arise in flow movements, as well as blocking effects due to space constraints. We apply this framework to the multi-intersection traffic light control problem by including transit delays for vehicles moving from one intersection to the next and possible blocking between two intersections. Using Infinitesimal Perturbation Analysis (IPA) for this SFM with delays and possible blocking, we derive new on-line gradient estimates of several congestion cost metrics with respect to the controllable green and red cycle lengths. The IPA estimators are used to iteratively adjust light cycle lengths to improve performance and, in conjunction with a standard gradient-based algorithm, to obtain optimal values which adapt to changing traffic conditions. We introduce two new cost metrics to better capture congestions and show that the inclusion of delays and possible blocking in our analysis lead to improved performance relative to models that ignore delays and/or blocking effects.
- **A contribution to the determinization of max-plus automata**
  Authors: Sebastien Lahaye ; Aiwen Lai ; Jan Komenda ; Jean-Louis Boimond
  Abstract: It is a well known fact that not all max-plus automata can be determinized, i.e. transformed into deterministic max-plus automata with the same behavior. A classical sequentialization procedure, extended in the literature to max-plus automata, succeeds in computing an equivalent deterministic max-plus automaton for important subclasses of max-plus automata. This procedure is based on the normalization of state vectors in order to detect and merge states which have similar future behavior. In this paper, a novel and weaker condition is proposed that still guarantees this property. This allows for a considerable improvement of the existing determinization procedure, because it terminates for a larger class of max-plus automata.

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1.2. IEEE Transactions on Automatic Control

Volume: 65, Issue: 3, March 2020

- **Sensitivity to Cumulative Perturbations for a Class of Piecewise Constant Hybrid Systems**
  Authors: Arsalan Sharifnassab ; John N. Tsitsiklis ; S. Jamaloddin Golestani
  Abstract: We consider a class of continuous-time hybrid dynamical systems that correspond to subgradient flows of a piecewise linear and convex potential function with finitely many pieces, and which includes the fluid-level dynamics of the Max-Weight scheduling policy as a special case.

We study the effect of an external disturbance/perturbation on the state trajectory, and establish that the magnitude of this effect can be bounded by a constant multiple of the integral of the perturbation.

- **The Value of Timing Information in Event-Triggered Control**
  Authors: Mohammad Javad Khojasteh ; Pavankumar Tallapragada ; Jorge Cortes ; Massimo Franceschetti
  Abstract: We study event-triggered control for stabilization of unstable linear plants over rate-limited communication channels subject to unknown bounded delay. On one hand, the timing of event triggering carries implicit information about the state of the plant. On the other hand, the delay in the communication channel causes information loss, as it makes the state information available at the controller out of date. Combining these two effects, we show a phase transition behavior in the transmission rate required for stabilization using a given event-triggering strategy. For small values of the delay, the timing information carried by the triggering events is substantial, and the system can be stabilized with any positive rate. When the delay exceeds a critical threshold, the timing information alone is not enough to achieve stabilization, and the required rate grows. When the delay equals the inverse of the entropy rate of the plant, the implicit information carried by the triggering events perfectly compensates the loss of information due to the communication delay, and we recover the rate requirement prescribed by the data-rate theorem . We also provide an explicit construction yielding a sufficient rate for stabilization, as well as results for vector systems. Our results do not rely on any a priori probabilistic model for the delay or the initial conditions.

- **Opacity Enforcement for Confidential Robust Control in Linear Cyber-Physical Systems**
  Authors: Liwei An ; Guang-Hong Yang
  Abstract: Opacity, a confidentiality property, is an increasing concern in cyber-physical systems (CPSs) that are vulnerable to an intruder which intends to reveal a “secret" of a system. This note presents a new framework for opacity and considers the problem of enforcing opacity in CPSs modeled as linear time-invariant systems. The confidential information involves the CPS’ interference attenuation capacity (IAC), called the secret. A system is opaque if the intruder never infers the secret IAC from an observation mapping of system output. To guarantee the confidentiality requirement, an effective algorithm is proposed for synthesizing opacity-enforcing controllers by using a new approximation-based Q-learning. A main advantage of this method is that it does not require any knowledge of the system dynamics matrices. A simulation example is presented to sustain the theoretical results.

- **Inverse Risk-Sensitive Reinforcement Learning**
  Authors: Lillian J. Ratliff ; Eric Mazumdar
  Abstract: This work addresses the problem of inverse reinforcement learning in Markov decision processes where the decision-making agent is risk-sensitive . In particular, a risk-sensitive reinforcement learning algorithm with convergence guarantees that makes use of coherent risk metrics and models of human decision-making which have their origins in behavioral psychology and economics is presented. The risk-sensitive reinforcement learning algorithm provides the theoretical underpinning for a gradient-based inverse reinforcement learning algorithm that seeks to minimize a loss function defined on the observed behavior. It is shown that the gradient of the loss function with respect to the model parameters is well defined and computable via a contraction map argument. Evaluation of the proposed technique is performed on a Grid World example, a canonical benchmark problem.

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1.3. Automatica

Volume: 113 March 2020

- **On the state liveness of some classes of guidepath-based transport systems and its computational complexity**
  Authors: Spyros Reveliotis

Abstract: Guidepath-based transport systems is a pertinent abstraction for the traffic that is generated in many contemporary applications, ranging from industrial material handling and robotics, to computer game animations and the qubit transport systems employed in quantum computing. A particular problem that must be effectively addressed for the systematic operation of these systems, is the preservation of their “liveness", i.e., the preservation of the ability of the system agents to complete their current assignments and engage successfully in similar assignments in the future operation of the system. This paper provides a systematic and comprehensive characterization of the notion of “liveness" for the entire spectrum of the aforementioned transport systems, and it further investigates the implications of this characterization for the deployment of maximally permissive liveness-enforcing supervision for the underlying traffic. It is shown that the computational complexity of the sought supervisors is contingent upon certain structural and operational attributes of the considered transport systems, that define, thus, a useful taxonomy for these environments. The paper proposes effective and efficient liveness-enforcing supervisors for each member of this taxonomy. Furthermore, the concluding part of the paper indicates how the obtained results can be integrated in a broader control framework for the considered transport systems that will also address time-related performance considerations for these environments, like the maximization of their throughput.

- **Coordinated static control of asynchronous sequential machines**
  Authors: Jung-Min Yang
  Abstract: This paper considers static corrective control of asynchronous sequential machines (ASMs). While static corrective controllers are more efficient than dynamics ones as their implementation needs no memory elements, they have restrictive existence conditions in association with transient states. To alleviate this drawback, we propose a framework of coordinated static control for ASMs. A number of single static controllers are designed to achieve local objectives and the coordinator selects the active controller among them based on the external input and state feedback so that the overall behavior of the closed-loop system matches that of a reference model. Compared with previous static controllers, the existence condition is much improved with mild degradation of design complexity.

- **Event-triggered stabilization of nonlinear systems with time-varying sensing and actuation delay**
  Authors: Erfan Nozari ; Pavankumar Tallapragada ; Jorge Cortes
  Abstract: This paper studies the problem of stabilization of a nonlinear system with time-varying delays in both sensing and actuation using event-triggered control. Our proposed strategy seeks to opportunistically minimize the number of control updates while guaranteeing stabilization and builds on predictor feedback to compensate for arbitrarily large known time-varying delays. We establish, using a Lyapunov approach, the global asymptotic stability of the closed-loop system as long as the open-loop system is globally input-to-state stabilizable in the absence of time delays and sampling. We further prove that the proposed event-triggered law has inter-event times that are uniformly lower bounded and hence does not exhibit Zeno behavior. For the particular case of a stabilizable linear system, we show global exponential stability of the closed-loop system and analyze the trade-off between the rate of exponential convergence and a bound on the sampling frequency. We illustrate these results in simulation and also examine the properties of the proposed event-triggered strategy beyond the class of systems for which stabilization can be guaranteed.

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1.4. IEEE Transactions on Control Systems Technology

Volume: 28, Issue: 2, March 2020

- **Supervisory Control of Labeled Transition Systems Subject to Multiple Reachability Requirements via Symbolic Model Checking**
  Authors: Blake C. Rawlings ; Stephane Lafortune ; B. Erik Ydstie
  Abstract: We present an algorithm to compute the unique maximally permissive state-based supervisor for any deterministic finite labeled transition system subject to a specification with combined invariance and reachability requirements. The specifications that we consider are expressed

in computation tree logic and include specifications with multiple reachability requirements, each of which should always be satisfied. The form of the controller (a state-based supervisor) is purely memoryless, so the control decisions can be made by directly sampling the state of the system that is being controlled, without recording any past event or transition history. The algorithm has been implemented in SynthSMV, an extension of the well-known model-checking solver NuSMV, which uses NuSMV's efficient implementation of symbolic model checking (based on binary decision diagrams). A case study that involves coordinating the operation of a set of reactors in a chemical plant shows how the methods that we develop apply in practice.

- **Energy Management of Fuel Cell Hybrid Vehicle Based on Partially Observable Markov Decision Process**
  Authors: Di Shen ; Cheng-Chew Lim ; Peng Shi ; Piotr Bujlo
  Abstract: This paper presents a nonmyopic energy management strategy (EMS) for controlling multiple energy flow in fuel cell hybrid vehicles. The control problem is solved by convex programing under a partially observable Markov decision process-based framework. We propose an average-reward approximator to estimate a long-term average cost instead of using a model to predict future power demand. Thus, the dependence between the system closed-loop performance and the model accuracy for predicting the future power demand is decoupled in the energy management design for fuel cell hybrid vehicles. The energy management scheme consists of a real-time self-learning system, an average-reward filter based on the Markov chain Monte Carlo sampling, and an action selector system through the rollout algorithm with a convex programing-based policy. The performance evaluation of the EMS is conducted via simulation studies using the data obtained from real-world driving experiments and its performance is compared with three benchmark schemes.

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1.5. IEEE Transactions on Systems, Man, and Cybernetics: Systems

Volume: 50, Issue: 3, March 2020

- **Discrete-Event-Based Deterministic Execution Semantics With Timestamps for Industrial Cyber-Physical Systems**
  Authors: Wenbin Dai ; Cheng Pang ; Valeriy Vyatkin ; James H. Christensen ; Xinping Guan
  Abstract: Cyber-physical systems (CPSs) are becoming common in the industrial automation domain. In industrial CPS, distributed programmable logic controllers collaborate to control manufacturing plants. Design and analysis of such systems require a system model that covers control, computation, and communication with physical plant dynamics. This paper focuses on execution semantics for industrial CPS with the aim of providing a deterministic and platform-independent execution environment. A discrete-event-based execution semantics augmented with timestamp mechanism is proposed for IEC 61499 to provide deterministic behavior and guarantee compliance with real-time constraints for industrial CPS. The timestamped discrete-event-based execution semantics is implemented in an IEC 61499 runtime with service-enabled features. A case study of building automation system is used to prove the proposed semantics.
- **Modeling and Optimal Cyclic Scheduling of Time-Constrained Single-Robot-Arm Cluster Tools via Petri Nets and Linear Programming**
  Authors: FaJun Yang ; NaiQi Wu ; Yan Qiao ; MengChu Zhou ; Rong Su ; Ting Qu
  Abstract: Scheduling a cluster tool with wafer residency time constraints is challenging and important in wafer manufacturing. With a backward strategy, the scheduling problem of such single-robot-arm cluster tools is well-studied in the literature. It is much more challenging to schedule a more general case whose optimal scheduling strategy is not limited to the backward one. This work uses a timed Petri net (PN) to model the dynamic behavior of the system and presents a method to determine the optimal scheduling strategy for the system. Based on its PN model and the obtained strategy, it reveals that the key issue to schedule such a tool is to determine when and how long the robot should wait for. Based on this finding, this work establishes for the first time the necessary and sufficient conditions regarding the existence of an optimal and feasible one-wafer cyclic schedule for single-robot-arm cluster tools. It then formulates a computationally efficient linear program to find it if existing, and finally gives industrial examples to show the application

and power of the proposed method.

- **Modeling and Evaluation of Service Composition in Commercial Multiclouds Using Timed Colored Petri Nets**
  Authors: Reza Entezari-Maleki ; Sayed Ehsan Etesami ; Negar Ghorbani ; Arian Akhavan Niaki ; Leonel Sousa ; Ali Movaghar
  Abstract: The increasing demand for Web services encourages commercial cloud service providers to publish their own services with various functional and nonfunctional capabilities in different cloud platforms. The aggregation of atomic services from multiple service repositories is the main idea of the service composition concept in multiclouds. The cloud Web service composition is a suitable way for satisfying users' complex requests by integrating services from different clouds in order to create a new value-added composite service. The time required to serve a composite service by a multicloud environment is an important parameter, which depends on different factors, ranging from the service composition and selection algorithm to the number of atomic services published in the clouds. In this paper, a model based on timed colored Petri nets (TCPNs) is proposed to evaluate the service composition in multicloud environments while minimizing the number of clouds involved in serving a composite service request. The proposed TCPN graphically models the process of request submission, composite service analysis, service selection, and service provisioning in a multicloud environment. It also assesses both mean response time of the environment and probability of dropping composite requests. The verification of the accuracy of the proposed model is done by comparing the results obtained from the TCPN model, in two different scenarios, with the results from the CloudSim framework. These results confirm that our proposed TCPN model can appropriately model the system and evaluate its performance more efficiently than the CloudSim.

- **Adaptive Discrete Event Simulation Systems to Embrace Changes of Requirements Using Event Control Models**
  Authors: Se Jung Kwon ; Bonggu Kang ; Changbeom Choi ; Tag Gon Kim
  Abstract: During the development or deployment of discrete event simulation systems, many sudden changes in requirements emerge. To embrace the changes rapidly and reduce development costs, attaching reusable, and black-boxed components to existing systems has been regarded as one of the most effective approaches because modifications at the code level are generally costly and risky. However, since this approach requires components that are an exact fit, it may not be easy to avoid the modifications at the source code level actually. Moreover, the required components may not exist. Hence, this paper applies black-box extensibility to simulation systems in order to avoid the modifications. This paper proposes adaptive discrete event simulation systems using event control models for extending and modifying semantics through event-based simulation interface. With the proposed work, the simulation events are modulated, deleted, and generated by the event-oriented control functions in the event control model to embrace the changes of requirements. It can substitute for the modifications at the code level and extend the existing behavioral semantics. As a result, the proposed work provides a new alternative step in the development process with reusable components to avoid modifications at the source code level. The new step will lead to rapid adaptations of existing simulation systems. To support the effectiveness of this approach, this paper will describe applicable examples based on our empirical studies.

- **Fleet Sizing for Electric Car Sharing Systems in Discrete Event System Frameworks**
  Authors: Maria Pia Fanti ; Agostino Marcello Mangini ; Giovanni Pedroncelli ; Walter Ukovich
  Abstract: This paper proposes a two-level strategy to determine the optimal fleet size of electric car (EC) sharing systems (ECSSs) in a networks of a set of stations. At the first level, the system is modeled as a discrete event system in a closed queueing network framework that allows describing the asymptotic system behavior and determining the optimal fleet size that maximizes the network profit. At the second level the ECSS dynamics is modeled by timed Petri net, in order to take into account some particular aspects, such as the user flows in different time periods of the day or the exit of the customers from the stations when they do not find available ECs. A simulation campaign analysis enlightens the effectiveness of the presented complementary design strategy.

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2 Conferences

Contributed by: Xiang Yin (yinxiang@sjtu.edu.cn)

2.1 **2020 International Workshop on Discrete Event Systems**
Rio de Janeiro, Brazil, May 13-15, 2020
https://wodes2020.eventos.ufrj.br

2.2 **2020 International Conference on Control, Decision and Information Technologies**
Prague, Czech Republic, June 29 - July 02, 2020
https://codit2020.com

2.3 **2020 American Control Conference**
Denver, Colorado, USA, July 1-3, 2020
http://acc2020.a2c2.org

2.4 **2020 IEEE International Conference on Control & Automation**
Sapporo, Hokkaido, Japan, July 6-9, 2020
http://www.ieee-icca.org

2.5 **2020 IFAC World Congress**
Berlin, Germany, July 12-17, 2020
https://www.ifac2020.org

2.6 **2020 IEEE Conference on Automation Science and Engineering**
Hong Kong, China, August 20-24, 2020
https://www.imse.hku.hk/case2020

2.7 **2020 IEEE Conference on Control Technology and Applications**
Montréal, Canada, August 24-26, 2020
https://ccta2020.ieeecss.org

2.8 **2020 IEEE Conference on Decision and Control**
Jeju Island, Republic of Korea, December 8-11, 2020
https://cdc2020.ieeecss.org

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3 International Graduate School on Control

Introduction to Discrete Event Systems

Lecturers: Stéphane Lafortune, Christos Cassandras

Location: Marseille, France, June 8-12, 2020

Message from Lecturers:
Dear Colleagues,

We are pleased to inform you that we will be the main lecturers for a module of 21 hours on "Introduction to Discrete Event Systems", to be offered as part of the European Embedded Control Institute (EECI) International Graduate School on Control in 2020. This course will be held from June 8 to 12, 2020 in Marseilles, France. See: http://www.eeci-igsc.eu/venues/

While the area of discrete event systems started as a sub-discipline in control engineering almost 40 years ago, the study of discrete event systems (DES) remains highly relevant to control engineering problems nowadays, such as in cyber-physical systems, transportation, software engineering, and in the study of privacy and security in engineered systems. In fact, DES form the centerpiece of the event-driven (cyber) component in the hybrid systems that comprise much of today's technology, complementing the time-driven (physical) components.

This course will strike a balance between introducing the students to the key concepts, models, and results of discrete-event control theory for logical and stochastic models, while at the same time emphasizing current research trends in DES theory and applications.

More details about the program can be found at:
https://www.web-events.net//doc/users/395/bib/2019-2020/eeciigsc2020summariesvf31oct.pdf
Students can apply to get financial support. The registration is open at:
http://www.eeci-igsc.eu/registration/
The early registration deadline is March 8. Please register by that date to ensure participation.

Best regards,

Stéphane Lafortune and Christos Cassandras

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4 Books

4.1 **Estimation and Inference in Discrete Event Systems — A Model-Based Approach with Finite Automata**

Author: Christoforos N. Hadjicostis

Description: Estimation and Inference in Discrete Event Systems chooses a popular model for emerging automation systems—finite automata under partial observation—and focuses on a comprehensive study of the key problems of state estimation and event inference. The text includes treatment of current, delayed, and initial state estimation. Related applications for assessing and enforcing resiliency—fault detection and diagnosis—and security—privacy and opacity—properties are discussed, enabling the reader to apply these techniques in a variety of emerging applications, among them automated manufacturing processes, intelligent vehicle/highway systems, and autonomous vehicles.

The book provides a systematic development of recursive algorithms for state estimation and event inference. The author also deals with the verification of pertinent properties such as:
• the ability to determine the exact state of a system, "detectability";
• the ability to ensure that certain classes of faults can be detected/identified, "diagnosability"; and
• the ability to ensure that certain internal state variables of the system remain "hidden" from the outside world regardless of the type of activity that is taking place, "opacity".
This book allows students, researchers and practicing engineers alike to grasp basic aspects of state estimation in discrete event systems, aspects like distributivity and probabilistic inference, quickly and without having to master the entire breadth of models that are available in the literature.

More details: https://www.springer.com/gp/book/9783030308209

4.2 **Path Planning and Control of Cooperative Mobile Robots Using Discrete Event Models**

Authors: Cristian Mahulea, Marius Kloetzer, Ramon Gonzalez
ISBN: 978-1-119-48632-9, January 2020, Wiley-IEEE Press, 240 Pages
https://bit.ly/2MYphKe

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5 Call for Papers

5.1 IEEE Conference on Decision and Control
Invited Session: Security, Safety and Resilience of Discrete Event Systems

Organizers: Xiang Yin ; Rong Su ; Kai Cai

Submission information: code 3drg4; deadline: 2020.03.30

Description: An invited session is planned on *Security, Safety and Resilience of Discrete Event Systems* at IEEE Conference on Decision and Control, to be held in Jeju Island, Republic of Korea, December 8-11, 2020. The objective of this invited session is to present recently developed novel approaches devoted to the analysis and design of safety-critical networked control systems using DES models. The focus of this session is on the following topics:

- modeling and analysis of cyber-security of discrete event systems
- supervisory control and fault-tolerant control of networked discrete event systems
- opacity, diagnosability, observability analysis of discrete event systems
- analysis and design of discrete-event system under cyber-attacks
- performance analysis and enhancement techniques for discrete event systems

If you are interested or have questions, please contact Dr. Xiang Yin yinxiang@sjtu.edu.cn.

5.2 IEEE Conference on Automation Science and Engineering
Special Session: AI enabled Discrete Event Dynamic Systems

Organizers: Li Xia ; Qianchuan Zhao

Submission information: code 11i61; deadline: 2020.03.29

Goal: Discrete event dynamic systems (DEDS) aim at studying the man-made systems driven by events, such as the systems of manufacturing, transportation, computer, communication, energy, robots, etc. The foundation of DEDS is built on mathematical models, such as Markov systems, queueing systems, Petri net, automata, etc. The decision and control of DEDS is fundamental to improve the operation efficiency of those man-made systems, which involves the optimization theory such as Markov decision process (MDP), optimal control, etc. Recently, the remarkable successes of AI attract intensive attention on the study of data-driven learning and optimization. One of the main research streams of AI is to handle the dynamic decision-making problem with reinforcement learning, whose mathematical foundation is MDP. Therefore, with these facts, the research development of DEDS theory encounters a crossroad, combining the techniques of AI and enabling the study of DEDS in a manner of data-driven learning and optimization.
This special session aims to bring together the international scholars and industry practitioners to discuss the recent progress of DEDS in the background of big development of AI techniques, while focusing on the field of automation science and engineering. The potential topics include but are not limited to the development of DEDS theory such as Markov systems, queueing systems, Petri net, automata, the development of reinforcement learning & MDP theory, the AI enabled solution to dynamic games & multi-agent systems, and the application of above theories to solve engineering problems in the field of automation science and engineering.

5.3 J-DEDS Topical Collection on Smart Cities
Discrete Event Dynamic Systems: Theory and Applications

Topical Collection on Smart Cities

Guest Editors: (Samuel) Qing-Shan Jia ; Mariagrazia Dotoli ; Qianchuan Zhao

Call for Papers: Smart cities have attracted more and more attention in recent years due to the close relationship to sustainable development and to the daily lives of citizens in developed as well

as developing countries. The research focus in smart cities involves but is not limited to buildings, transportation, mobility, water system management, security, and pollution control. In order to make cities smarter, a technological infrastructure is required to connect networks of sensors and actuators embedded throughout the urban terrain, and to interact with wireless mobile devices. Smart city is also a great example for cyber-physical systems and the Internet of Things and is a rich domain for research and education.

In this special topical collection on smart cities, we focus on the application of theories and models of discrete event dynamic systems in the general field of smart cities. Papers in the following directions are especially encouraged for submission: Smart Buildings, Intelligent Transportation Systems, Smart Grids, Water System Management, Cyber-security.

The final deadline for paper submission is March 1, 2020. Papers will be reviewed promptly according to the normal J-DEDS review process, and will appear online as soon as they are accepted.

While the area of discrete event systems started as a sub-discipline in control engineering almost 40 years ago, the study of discrete event systems (DES) remains highly relevant to control engineering problems nowadays, such as in cyber-physical systems, transportation, software engineering, and in the study of privacy and security in engineered systems. In fact, DES form the centerpiece of the event-driven (cyber) component in the hybrid systems that comprise much of today's technology, complementing the time-driven (physical) components.

This course will strike a balance between introducing the students to the key concepts, models, and results of discrete-event control theory for logical and stochastic models, while at the same time emphasizing current research trends in DES theory and applications.

Submissions should be made through the journal website (https://www.editorialmanager.com/disc/default.aspx), under the TC: Smart Cities category. Contributors are strongly encouraged to read Instructions at https://www.springer.com/mathematics/applications/journal/10626?detailsPage=pltci_2530565 while preparing their manuscript. Both short papers (less than 12 pages) and regular papers are welcome.

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