IEEE Control Systems Society
Technical Committee on Discrete Event Systems

Newsletter **February 2024**

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Welcome to the 2024 February issue of the newsletter, also available online at
https://ieeecss.org/tc/discrete-event-systems/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. IEEE Transactions on Automatic Control

Volume: 69, Issue: 2, February 2024

- **Equivalence of Optimality Criteria for Markov Decision Process and Model Predictive Control**
  Authors: Arash Bahari Kordabad ; Mario Zanon ; Sebastien Gros
  Abstract: This article shows that the optimal policy and value functions of a Markov decision process (MDP), either discounted or not, can be captured by a finite-horizon undiscounted optimal control problem (OCP), even if based on an inexact model. This can be achieved by selecting a proper stage cost and terminal cost for the OCP. A very useful particular case of OCP is a model predictive control (MPC) scheme where a deterministic (possibly nonlinear) model is used to reduce the computational complexity. This observation leads us to parameterize an MPC scheme fully, including the cost function. In practice, reinforcement learning algorithms can then be used to tune the parameterized MPC scheme. We verify the developed theorems analytically in an LQR case and we investigate some other nonlinear examples in simulations.
- **Event-Variant and Time-Variant (max,+) Systems**
  Authors: Johannes Trunk ; Bertrand Cottenceau ; Laurent Hardouin ; Jörg Raisch
  Abstract: This article deals with the input–output representation of a class of timed discrete event systems. The systems considered are those that can be described using timed event graphs extended with weights on the arcs and clock rate modifiers or time-varying delays. The model relies on periodic expressions using six elementary operators: Shift, multiplication, and division of events and time. In this context, we show how to develop the transfer matrix computation based on a matrix decomposition called core decomposition.
- **Supervisory Control Synthesis of Timed Automata Using Forcible Events**
  Authors: Aida Rashidinejad ; Michel Reniers ; Martin Fabian
  Abstract: This article presents an algorithm for synthesizing a supervisor for timed automata (TA) using the conventional supervisory control theory. The algorithm is directly applicable to TA without explicit transformation into finite automata, and iteratively strengthens the guards of edges labeled by controllable events and invariants of locations where the progression of time can be preempted by forcible events. The synthesized supervisor, also a TA, is controllable, maximally permissive, and guarantees a nonblocking and safe supervised plant. The use of real-valued clocks in TA makes it a practical modeling framework; however, the infinite state space brings challenges. The proposed algorithm addresses these by providing a synthesis method that avoids the state-space explosion of finite automata and the loss of information that can result from abstraction of real-time values.
- **Observability Decomposition of Boolean Control Networks Under Several Kinds of Observability**
  Authors: Yiliang Li ; Jun-E Feng ; Daizhan Cheng ; Yingzhe Jia
  Abstract: In this article, a uniform method is provided to investigate the observability decomposition of Boolean control networks (BCNs) under different definitions of observability. Since the observability of BCNs is defined via the distinguishability of states, an algorithm is devised to identify and sort distinguishable states. To find the possible control sequences, a truth matrix reflecting the relationship between state pairs and control inputs is constructed. Using the truth matrix, necessary and sufficient conditions for several types of observability are given. Based on criteria for observability and some matrix discriminants, the realizability of observability decomposition is discussed. Notably, the proposed method is applicable to the observability decomposition under different definitions of observability, while the existing result is valid for only one type of observability. Furthermore, an example is introduced to illustrate the feasibility of the presented results.
- **On Exact Embedding Framework for Optimal Control of Markov Decision Processes**

Authors: Sonam Kharade ; Sarang Sutavani ; Amol Yerudkar ; Sushama Wagh ; Yang Liu ; Carmen Del Vecchio ; N. M. Singh
Abstract: This article deals with the embedding framework of Markov decision processes (MDPs) with discrete state and action space to find optimal actions. The optimal control problem of MDPs can be efficiently tackled by restructuring the same into an equivalent linearly-solvable Markov decision processes (LMDPs) through the method called embedding. However, state costs under the embedding may not exactly match the original costs and even assume unrealistic values. In this work, we derive a constructive sufficient condition to devise an exact embedding solution rendering the embedded state cost to match the original system. Furthermore, since, in this case, the embedding implies a transition from the discrete to continuous action space, the correlation between the obtained continuous action and an equivalent desired discrete action is investigated using a maximum a posteriori probability-based method. Finally, some examples, including mammalian cell-cycle network, are presented to demonstrate the effectiveness of the proposed method.

- **Transition Analysis of Stochastic Logical Control Networks**
Authors: Changxi Li ; Xiao Zhang ; Jun-e Feng ; Daizhan Cheng
Abstract: Transition analysis is essential for analyzing and regulating logical control networks (LCNs). The algebraic state-space representation method, which relies on the semitensor product of matrices, has been shown to allow deterministic LCNs to be represented as linear-like systems. However, due to the inherent uncertainty, it is hard to obtain the algebraic expression of an stochastic LCN. A unified paradigm for the transition analysis of LCNs with stochastic and deterministic dynamics is provided in this research. First, the algebraic expression of LCN with deterministic dynamics is reviewed. Second, the algebraic expression of LCN with stochastic dynamics is considered, where the nonequivalence between the dispersed form and the integrated form is proposed. Then, the reason for the nonequivalence is provided. After that, a consistency condition is presented to bridge the gap between the independent model and the conditionally independent model. Finally, we specifically point out that probabilistic LCN satisfies the consistency criteria, allowing one to calculate the probabilistic LCN transition matrix by using a power-reducing operator.

- **On Supervised Online Rolling-Horizon Control for Infinite-Horizon Discounted Markov Decision Processes**
Authors: Hyeong Soo Chang
Abstract: This note revisits the rolling-horizon control approach to the problem of Markov decision process (MDP) with infinite-horizon discounted expected reward criterion. Distinguished from the classical value-iteration approaches, we develop an asynchronous online algorithm based on policy iteration integrated with a multipolicy improvement method of policy switching. A sequence of monotonically improving solutions to the forecast-horizon sub-MDP is generated by updating the current solution only at the currently visited state, building in effect a rolling-horizon control policy for the MDP over infinite horizon. Feedbacks from "supervisors," if available, can be also incorporated while updating. We focus on the convergence issue with a relation to the transition structure of the MDP. Either a global convergence to an optimal forecast-horizon policy or a local convergence to a "locally-optimal" fixed-policy in a finite time is achieved by the algorithm depending on the structure.

- **Cooperative Multiagent Reinforcement Learning With Partial Observations**
Authors: Yan Zhang ; Michael M. Zavlanos
Abstract: In this article, we propose a distributed zeroth-order policy optimization method for multiagent reinforcement learning (MARL). Existing MARL algorithms often assume that every agent can observe the states and actions of all the other agents in the network. This can be impractical in large-scale problems, where sharing the state and action information with multihop neighbors may incur significant communication overhead. The advantage of the proposed zeroth-order policy optimization method is that it allows the agents to compute the local policy gradients needed to update their local policy functions using local estimates of the global accumulated rewards that depend on partial state and action information only and can be obtained using consensus. Specifically, to calculate the local policy gradients, we develop a new distributed zeroth-order policy gradient estimator that relies on one-point residual-feedback which, compared to existing zeroth-

order estimators that also rely on one-point feedback, significantly reduces the variance of the policy gradient estimates improving, in this way, the learning performance. We show that the proposed distributed zeroth-order policy optimization method with constant stepsize converges to the neighborhood of a policy that is a stationary point of the global objective function. The size of this neighborhood depends on the agents' learning rates, the exploration parameters, and the number of consensus steps used to calculate the local estimates of the global accumulated rewards. Moreover, we provide numerical experiments that demonstrate that our new zeroth-order policy gradient estimator is more sample-efficient compared to other existing one-point estimators.

- **Optimal Control of Probability on a Target Set for Continuous-Time Markov Chains**
  Authors: Chenglin Ma ; Huaizhong Zhao
  Abstract: In this article, a stochastic optimal control problem is considered for a continuous-time Markov chain taking values in a denumerable state space over a fixed finite horizon. The optimality criterion is the probability that the process remains in a target set before and at a certain time. The optimal value is a superadditive capacity of target sets. Under some minor assumptions for the controlled Markov process, we establish the dynamic programming principle, based on which we prove that the value function is a classical solution of the Hamilton–Jacobi–Bellman (HJB) equation on a discrete lattice space. We then prove that there exists an optimal deterministic Markov control under the compactness assumption of control domain. We further prove that the value function is the unique solution of the HJB equation. We also consider the case starting from the outside of the target set and give the corresponding results. Finally, we apply our results to two examples.

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1.2. Automatica

Volume: 160, February 2024

- **Model predictive monitoring of dynamical systems for signal temporal logic specifications**
  Authors: Xinyi Yu ; Weijie Dong ; Shaoyuan Li ; Xiang Yin
  Abstract: Online monitoring aims to evaluate or to predict, at runtime, whether or not the behaviors of a system satisfy some desired specification. It plays a key role in safety-critical cyber–physical systems. In this work, we propose a new monitoring approach, called model predictive monitoring, for specifications described by Signal Temporal Logic (STL) formulae. Specifically, we assume that the observed state traces are generated by an underlying dynamical system whose model is known but the control law is unknown. The main idea is to use the dynamic of the system to predict future states when evaluating the satisfaction of the STL formulae. To this end, effective approaches for the computation of feasible sets of STL formulae are provided. We show that, by explicitly utilizing the model information of the dynamical system, the proposed online monitoring algorithm can falsify or certify of the specification in advance compared with existing algorithms, where no model information is used. We also demonstrate the proposed monitoring algorithm by several real world case studies.

- **Symbolic state estimation in bounded timed labeled Petri nets**
  Authors: Yifan Dong ; Naiqi Wu ; Zhiwu Li
  Abstract: This paper addresses the state estimation of timed discrete event systems, where the occurrence of an event is associated with a time delay and the initial state of the system belongs to a set of possible initial states. A discrete event system is modeled with a bounded timed labeled Petri net whose unobservable subnet is acyclic, and the behavior of the system under a global time clock can be observed. The procedure for state estimations of partially observed Petri nets is refined by the introduction of time in discrete event systems. We apply the symbolic techniques to the representation of states and transition relations of bounded timed labeled Petri nets. Then we propose an online algorithm for the computation of state estimations generated by timed observations.

- **Robust stutter bisimulation for abstraction and controller synthesis with disturbance**
  Authors: Jonas Krook ; Robi Malik ; Sahar Mohajerani ; Martin Fabian
  Abstract: This paper proposes a method to synthesise controllers for cyber-physical systems

subjected to disturbances, such that the controlled system satisfies specifications given as linear temporal logic formulas. To solve this problem, a finite-state abstraction of the original system is first constructed, and then a controller is synthesised for the abstraction. Due to the disturbances and uncertainty in the environment, future states cannot be predicted exactly, and the abstraction must take this into account. For this purpose, the robust stutter bisimulation relation is introduced, which preserves the existence of controllers for any given linear temporal logic formula that excludes the next operator. States are related by the robust stutter bisimulation relation if the same target sets can be guaranteed to be reached or avoided under control of some controller, thus ensuring that disturbances have similar effect on paths that start in related states. It is shown that there exists a controller enforcing a linear temporal logic formula for the original system if and only if a controller exists for the abstracted system. The approach is illustrated by a robot navigation example.

- **Cost-aware defense for parallel server systems against reliability and security failures**
  Authors: Qian Xie ; Jiayi Wang ; Li Jin
  Abstract: Parallel server systems in transportation, manufacturing, and computing heavily rely on dynamic routing using connected cyber components for computation and communication. Yet, these components remain vulnerable to random malfunctions and malicious attacks, motivating the need for resilient dynamic routing that is both traffic-stabilizing and cost-efficient. In this paper, we consider a parallel server system with dynamic routing subject to reliability and stability failures. For the reliability setting, we consider an infinite-horizon Markov decision process where the system operator strategically activates a protection mechanism upon each job arrival based on traffic state observations. We prove that an optimal deterministic threshold protecting policy exists based on the dynamic programming recursion of the Hamilton–Jacobi–Bellman equation. For the security setting, we extend the model to an infinite-horizon stochastic game where the attacker strategically manipulates routing assignments. We show that both players follow a threshold strategy at every Markov perfect equilibrium. For both failure settings, we also analyze the stability of the traffic queues. Finally, we develop approximate dynamic programming algorithms to compute the optimal/equilibrium policies and present numerical examples/experiments for validation and illustration.

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1.3. Nonlinear Analysis: Hybrid Systems

Volume: 51, February, 2024

- **Compositional synthesis of control barrier certificates for networks of stochastic systems against ω-regular specifications**
  Authors: Mahathi Anand ; Abolfazl Lavaei ; Majid Zamani
  Abstract: This paper is concerned with a compositional scheme for the construction of control barrier certificates for interconnected discrete-time stochastic systems. The main objective is to synthesize switching controllers against ω-regular properties that can be described by accepting languages of deterministic Streett automata (DSA) along with providing probabilistic guarantees for the satisfaction of such specifications. The proposed framework leverages the interconnection topology and a notion of so-called control sub-barrier certificates of subsystems, which are used to compositionally construct control barrier certificates of interconnected systems by imposing some dissipativity-type compositionality conditions. We propose a systematic approach to decompose high-level ω-regular specifications into simpler tasks by utilizing the automata corresponding to the specifications. In addition, we formulate an alternating direction method of multipliers (ADMM) optimization problem in order to obtain suitable control sub-barrier certificates of subsystems while satisfying compositionality conditions. For systems with polynomial dynamics, we provide a sum-of-squares (SOS) optimization problem for the computation of control sub-barrier certificates and local controllers of subsystems. Finally, we demonstrate the effectiveness of our proposed approaches by applying them to a physical case study.
- **Symbolic control for stochastic systems via finite parity games**
  Authors: Rupak Majumdar ; Kaushik Mallik ; Anne-Kathrin Schmuck ; Sadegh Soudjani

Abstract: We consider the problem of computing the maximal probability of satisfying an ω-regular specification for stochastic, continuous-state, nonlinear systems evolving in discrete time. The problem reduces, after automata-theoretic constructions, to finding the maximal probability of satisfying a parity condition on a (possibly hybrid) state space. While characterizing the exact satisfaction probability is open, we show that a lower bound on this probability can be obtained by (I) computing an under-approximation of the qualitative winning region, i.e., states from which the parity condition can be enforced almost surely, and (II) computing the maximal probability of reaching this qualitative winning region.
The heart of our approach is a technique to symbolically compute the under-approximation of the qualitative winning region in step (I) via a finite-state abstraction of the original system as a $2\frac{1}{2}$-player parity game. Our abstraction procedure uses only the support of the probabilistic evolution; it does not use precise numerical transition probabilities. We prove that the winning set in the abstract $2\frac{1}{2}$-player game induces an under-approximation of the qualitative winning region in the original synthesis problem, along with a policy to solve it. By combining these contributions with (a) a symbolic fixpoint algorithm to solve $2\frac{1}{2}$-player games and (b) existing techniques for reachability policy synthesis in stochastic nonlinear systems, we get an abstraction-based algorithm for finding a lower bound on the maximal satisfaction probability.
We have implemented the abstraction-based algorithm in Mascot-SDS, where we combined the outlined abstraction step with our tool Genie (Majumdar et al., 2023) that solves $2\frac{1}{2}$-player parity games (through a reduction to Rabin games) more efficiently than existing algorithms. We evaluated our implementation on the nonlinear model of a perturbed bistable switch from the literature. We show empirically that the lower bound on the winning region computed by our approach is precise, by comparing against an over-approximation of the qualitative winning region. Moreover, our implementation outperforms a recently proposed tool for solving this problem by a large margin.

- **Controllability and observability of Boolean control networks subject to stuck-at fault**
Authors: Zhaoqi Liu ; Haitao Li
Abstract: Fault-tolerant control is a fundamental and challenging branch in the control community, and has wide applications in aerospace, automotive technology and nuclear engineering. Particularly, the study of faulty Boolean control networks (BCNs) is meaningful to the gene engineering. This paper focuses on the stuck-at fault occurring in BCNs, and investigates the controllability and observability of faulty BCNs. The basic mathematical tool is semi-tensor product (STP) of matrices, which is used to determine the algebraic formulation of BCNs subject to the meaningful stuck-at fault. Through the construction of faulty matrix, the relation between stuck-at fault and controllability of BCNs is presented. In addition, the observability of BCNs subject to stuck-at fault is discussed. Several new criteria are derived for the controllability and observability of BCNs subject to stuck-at fault, which have lower complexity than that of original BCNs. Finally, the obtained results are applied to analyze the controllability and observability of an faulty apoptosis network.

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

Volume: 54, Issue: 2, February 2024

- **Correctness Analysis of Cross-Organization Emergency Response Processes Based on Petri Nets**
Authors: Qi Mo ; Jianeng Wang ; Chengting Jiang ; Zhongwen Xie ; Cong Liu ; Fei Dai
Abstract: When an emergency occurs, disposal needs to be built to reduce the risk imposed on life, property, and environment. Generally, the disposal is organized as a cross-organization emergency response process (CERP). To achieve better-emergency response services, its correctness analysis is an important task that needs to be dealt with at design time. In this article, we propose a novel correctness analysis approach for CERPs. Given a CERP, this approach first decomposes it into a set of instance nets. Then, it excludes the invalid instance nets (each corresponds to an incomplete process instance) and adopts the stubborn set to check the structural correctness of each valid instance net without considering resource factors, as well as introduces a structure-based

resource analysis (SRA) method to determine whether the resources in it are sufficient. Finally, it determines the correctness of the CERP by comparing the numbers of the correct instance nets and all valid instance nets. If the CERP is incorrect, it returns the correct instance nets, which capture the parts of the CERP that can be executed correctly. This approach is evaluated on an actual data set, and the comparison results show that it outperforms the state-of-the-art technique in terms of effectiveness and efficiency.

- **Distributed Motion Control for Multiple Mobile Robots Using Discrete-Event Systems and Model Predictive Control**
  Authors: Yuan Zhou ; Hesuan Hu ; Gelei Deng ; Kun Cheng ; Shang-Wei Lin ; Yang Liu ; Zuohua Ding
  Abstract: Distributed motion control is critical in multiple mobile robot systems (MMRSs). Current research usually focuses on either discrete approaches, which aim to deal with high-level collisions and deadlocks without considering the low-level motion commands, or continuous approaches, which can optimize low-level continuous commands to mobile robots but cannot deal with deadlocks efficiently. In this article, by combining discrete and continuous methods, we design a hybrid motion control method for MMRSs where each robot should move along a predefined path. First, each robot's motion is modeled as a discrete transition system, based on which a real-time supervisory control policy is illustrated to avoid collisions and deadlocks. Second, according to the discrete decisions, the continuous speed at each discrete state is computed using model predictive control and sequential convex programming. The proposed hybrid approach brings two advantages. First, the discrete control component guarantees collision and deadlock avoidance and reduces the scale of the optimization problems. Second, continuous control optimizes the continuous speed in real time and fulfills other performance requirements like time and energy costs. To move in a fully distributed way, each robot needs to predict the motion of its neighbors by retrieving their immediately available information through communications. The simulation and real-world experimental results show the effectiveness of our approach.

- **The Probabilistic Liveness Decision Method of Unbounded Petri Nets Based on Machine Learning**
  Authors: Hongda Qi ; Junli Wang ; Chungang Yan ; Changjun Jiang
  Abstract: The liveness of Petri nets (PNs) means that every event can occur in any state, establishing a close relationship with the deadlock-free property of existing systems. Due to the problem of state space explosion and the infinite state space of unbounded PNs (UPNs), the time complexity and space complexity of the liveness decision are difficult to give accurate measures; at least, they are both NP-hard. Except for some particular subclasses of UPNs, there has not been an accurate method to decide the liveness of generalized UPNs. Thus, a liveness decision method from a machine learning perspective is proposed to predict probability values about UPNs' liveness within a finite time. The method aims to learn the feature information on UPNs by deep neural networks and establish the mapping relationship between the UPNs and the liveness. First, the concept of approximating infinite space with finite states is applied to generate reachability graphs at different moments, following the firing rules of a UPN. Then, the graph convolutional network (GCN)-based reachability graph feature representation module and the gated recurrent unit (GRU)-based UPN feature representation module are designed to map the reachability graphs at different moments into the low-dimensional feature space. And the feature vector that can characterize the UPN's liveness is obtained to decide the liveness probabilistically. Finally, three datasets, including 50000 samples, are constructed. Based on these datasets and some case studies, the experimental results validate the method's ability to make liveness decisions for UPNs, demonstrating its strong performance in terms of effectiveness and generalization.

2 Call for Participants

2.1 EECI-IGSC Course: Introduction to Discrete Event Systems

Dear Colleagues,

We would like to remind you of the course titled "**Introduction to Discrete Event Systems**", to be taught by **Christos Cassandras** (Boston University, USA) and **Stéphane Lafortune** (University of Michigan, USA), which will be held from **June 3 to June 7, 2024, at the Campus Saint Charles, in Marseille, France**. Isabel Demongodin is the local organizer.

The registration is open as "M13-MARSEILLE-03/06/2024-07/06/2024" at: http://www.eeci-igsc.eu/earlyregistrationm03tom18/. The early registration deadline is **March 15**, 2024. Please register as "Administration fee" (20€) as soon as possible, but no later than March 15, to ensure that the course is offered (a minimum number of registrations is required by March 15). *Please note the change of the registration deadline from April 1 to March 15.*

This course of 21 hours, offered as part of the European Embedded Control Institute-International Graduate School on Control (M13 of EECI-IGSC-2024), is especially designed for doctoral students, post-docs and junior researchers, who will have the opportunity to learn the main concepts and recent results in the theory and application of discrete event systems.

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.

Please see the EECI's webpage, http://www.eeci-igsc.eu/, for further details.

Students can apply to get financial support. Pour les doctorants inscrits dans une Université française hors Ile-de-France, voir : http://www.eeci-igsc.eu/igsc-grant-registration-france/. For Female PhD Students & PhD Students from countries with Low Education Priorities, see http://www.eeci-igsc.eu/igsc-grant-registration-overseas/.

Looking forward to seeing many of you in Marseille in June!

Best regards,

Isabel Demongodin, Christos Cassandras and Stéphane Lafortune

2.2 Invited Session at CASE'24–AI Enabled Discrete Event Dynamic Systems

Conference: 2024 IEEE 20th International Conference on Automation Science and Engineering
August 28 - September 1, 2024 | Bari, Italy

Organizer

- Qianchuan Zhao, Tsinghua University
- Kai Cai, Osaka Metropolitan University
- Xiang Yin, Shanghai Jiao Tong University
- Li Xia, Sun Yat-sen University

Summary Statement
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 models, Petri net, automata, queueing models, 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, supervisory 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, Petri net, automata, the development of reinforcement learning & MDP decision 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.

- Fundamental theory development of DEDS
- Controlled Markov systems
- Control in reinforcement learning
- Petri Nets for Automation Control
- Formal Methods in Robotics and Automation
- New advancement in automata
- Security control and Supervisory control
- Control and management in queueing models

Session Code: **41pkv**

2.3 Invited Session at CASE'24–Applications and Tools of DES

Conference: 2024 IEEE 20th International Conference on Automation Science and Engineering
August 28 - September 1, 2024 | Bari, Italy

Organizer

- Kai Cai, Osaka Metropolitan University
- Michel Reniers, Eindhoven University of Technology
- Martin Fabian, Chalmers University of Technology

Dear Colleagues,

We are organizing a special session on "Applications and Tools of DES" at the IEEE International Conference on Automation Science and Engineering (CASE 2024), Bari, Italy. (https://2024.ieeecase.org/)

We warmly welcome your contributions. The submission code for this special session is: **1911f**

2.4 Invited Session at CoDIT'24–Applications of DES Methods in Healthcare Logistics

Conference: IEEE/IFAC International Conf. on Control, Decision and Information Technologies (CoDIT 2024), Valetta, Malta,
August 28 - September 1, 2024 | Bari, Italy

Organizer

- Cristian Mahulea, University of Zaragoza
- Naly Rakoto, IMT Atlantique

Dear Colleagues,

We are organizing a special session on "Applications of DES Methods in Healthcare Logistics" at the IEEE/IFAC International Conf. on Control, Decision and Information Technologies (CoDIT 2024), Valetta, Malta, July 1-4, 2024. https://codit2024.com/

We warmly welcome your contributions. The deadline for paper submission is 4 March 2024, and the submission site is https://controls.papercept.net The submission code for this special session is: **ca9vs**

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3 Conferences

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

3.1 **2024 IFAC Workshop on Discrete Event Systems (WODES)**
Rio de Janeiro, Brazil, April 29-May 1, 2024.
https://wodes2024.eventos.ufrj.br

3.2 **2024 IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)**
Boulder, Colorado, July 1-3, 2024.
https://www.colorado.edu/conference/adhs2024/

3.3 **2024 American Control Conference (ACC)**
Toronto, Canada, July 8-12, 2024.
https://acc2024.a2c2.org/

3.4 **The IEEE Conference on Control Technology and Applications (CCTA)**
Newcastle upon Tyne, UK, August 21-24, 2024.
https://ccta2024.ieeecss.org/

3.5 **2024 International Conference on Automation Science and Engineering (CASE)**
Bari, Italy, August 28-September 1, 2024.
https://www.ieeesmc2024.org/

3.6 **2024 International Conference on Systems, Man, and Cybernetics (SMC)**
Sarawak, Malaysia, October 7-10, 2024.
https://www.ieeesmc2024.org/

3.7 **2023 IEEE Conference on Decision and Control (CDC)**
Milan, Italy, December 16-19, 2024.
https://cdc2024.ieeecss.org/

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4 Books

4.1 Safe Autonomy with Control Barrier Functions: Theory and Applications

Authors: Wei Xiao, Christos G. Cassandras, and Calin Belta

Description: The book presents the concept of Control Barrier Function (CBF), which captures the evolution of safety requirements during the execution of a system and can be used to enforce safety. Safety is central to autonomous systems since they are intended to operate with minimal or no human supervision. The book includes both theoretical and application perspectives on how safety can be guaranteed. It explains how the CBF approach is computationally efficient and can easily deal with nonlinear models and complex constraints used in a wide spectrum of applications, including autonomous driving, robotics, and traffic control. Safety guarantees can be integrated into the operation of such autonomous systems, including typical safety requirements that involve collision avoidance, technological system limitations, and bounds on real-time executions. Adaptive and event-driven approaches for safety are also discussed for time-varying execution bounds and noisy dynamics, as well as for systems with unknown dynamics.

Additional information on the book can be found at
https://link.springer.com/book/10.1007/978-3-031-27576-0
where an eBook version can also be downloaded (free for some educational institutions).

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5 Software Tools

5.1 Eclipse ESCET™ version 2.0 release

The Eclipse Supervisory Control Engineering Toolkit (Eclipse ESCET) project provides a model-based approach and toolkit for the development of supervisory controllers. It includes the languages CIF, Chi and ToolDef. ESCET, initially developed by Eindhoven University of Technology, is since January 2020 an Eclipse Foundation open-source project. More information can be found on the toolkit's website at https://www.eclipse.org/escet/.

In December 2023, ESCET version 2.0 has been released and can be downloaded from https://www.eclipse.org/escet/download.html. The main changes in this version are

- A new CIF PLC code generator has been added to the CIF toolset. The new PLC code generator is currently being developed, and should be considered experimental. In due time, it will replace the current stable CIF PLC code generator.
- The CIF code generator can now generate HTML files and JavaScript code. The HTML files allow executing the model in a browser. Both are currently an experimental feature.
- The CIF explorer and the tools from the event-based toolset that output CIF models, now generate CIF models with state annotations. These state annotations indicate the current location of each automaton and the current value of each variable of the input CIF models. The generation of state annotations can be disabled using the tool's new Add state annotations option
- The CIF type checker now warns about certain duplicate state invariants. Furthermore, the CIF type checker now produces improved error messages in case of a mismatch between an argument of a component instantiation and the corresponding parameter of the instantiated component definition.
- The Eclipse ESCET project now deploys 'nightlies', in-development versions of the ESCET website and toolkit. See the nightly website at https://eclipse.dev/escet/nightly/. From the nightly website the nightly releases can be downloaded.

The full ESCET release notes, including links to the language specific release notes and release notes from previous versions, are available from https://www.eclipse.org/escet/release-notes.html.

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