IEEE Control Systems Society
Technical Committee on Discrete Event Systems

Newsletter **June 2025**

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Welcome to the 2025 June 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: 70, Issue: 6, June 2025

- **Resilient Supervisor Synthesis for Labeled Petri Nets Against Sensor Attacks**
  Authors: Gang Xie ; Yin Tong ; Xiaomin Wang ; Carla Seatzu
  Abstract: This article studies the supervisory control problem (SCP) of discrete-event systems under sensor attacks. The plant is modeled with a labeled Petri net (LPN) and the attacker has the ability to replace and erase the sensor readings in the communication channel. Our goal is to synthesize a maximally permissive and resilient supervisor for the LPN such that the controlled system satisfies the safety specification under attack. Given a set of safe markings, the basis reachability graph (BRG) for control is defined. We prove that the resilient supervisor synthesis problem of LPNs against sensor attacks can be reduced to the SCP of its BRG. In this way, exhaustive enumeration of the reachability space of the LPN is avoided. Then, a method of supervisor synthesis for the BRG is proposed. The complexity of the proposed method remains the same as that of solving a standard SCP without attacks.

- **Secure-by-Construction Synthesis for Control Systems**
  Authors: Bingzhuo Zhong ; Siyuan Liu ; Marco Caccamo ; Majid Zamani
  Abstract: In this note, we present the synthesis of secure-by-construction controllers that address safety and security properties simultaneously in cyber-physical systems. Our focus is on studying a specific security property called opacity, which characterizes the system's ability to maintain plausible deniability of its secret behavior in the presence of an intruder. These controllers are synthesized based on a concept of so-called (augmented) control barrier functions (CBFs). We propose conditions that facilitate the construction of the desired (augmented) CBFs and their corresponding secure-by-construction controllers. To compute these functions, we propose an iterative scheme that leverages iterative sum-of-square programming techniques. This approach enables efficient computation of these functions, particularly for polynomial systems. Finally, we validate the effectiveness of our results through a case study of a vehicle.

- **On Approximate Opacity of Stochastic Control Systems**
  Authors: Siyuan Liu ; Xiang Yin ; Dimos V. Dimarogonas ; Majid Zamani
  Abstract: This article investigates an important class of information-flow security property called opacity for stochastic control systems. Opacity captures whether a system's secret behavior (a subset of the system's behavior that is considered to be critical) can be kept from outside observers. Existing works on opacity for control systems only provide a binary characterization of the system's security level by determining whether the system is opaque or not. In this work, we introduce a quantifiable measure of opacity that considers the likelihood of satisfying opacity for stochastic control systems modeled as general Markov decision processes (gMDPs). We also propose verification methods tailored to the new notions of opacity for finite gMDPs by using value iteration techniques. Then, a new notion called approximate opacity-preserving stochastic simulation relation is proposed, which captures the distance between two systems' behaviors in terms of preserving opacity. Based on this new system relation, we show that one can verify opacity for stochastic control systems using their abstractions (modeled as finite gMDPs). We also discuss how to construct such abstractions for a class of gMDPs under certain stability conditions.

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1.2. Automatica

Volume: 176, June 2025

- **Verification of current-state opacity and opaque time for labeled time Petri net systems**
  Authors: Yuting Wang ; Liang Li ; Zhiwu Li
  Abstract: This paper investigates the verification of current-state opacity and opaque time in timed discrete event systems modeled with labeled time Petri nets (LTPNs). First, we formally

conceptualize current-state opacity and opaque time for LTPN systems. Based on the solution of a set of linear programming problems (LPPs) associated with the transitions-related timing constraints in the modified state class graph (MSCG) of an LTPN system, an approach is proposed to find all the state classes and logic transition sequences that the system may generate at a given time instant. By utilizing such state classes and logic transition sequences, a method for verifying the current-state opacity of an LTPN system is presented, avoiding an exhaustive enumeration of the state classes that are consistent with all the observable label sequences at the time instant. To further acquire the current-state opaque time of the LTPN system, we propose a method for calculating the length of opaque time based on the solution of LPPs that are associated with the paths in the MSCG. Particularly, an algorithm is reported to compute the opaque time of an LTPN system with respect to a given secret. Finally, a case study is provided to illustrate the proposed algorithms to determine the current-state opacity and opaque time for an LTPN system.

- **Joint opacity and opacity against state-estimate-intersection-based intrusion of discrete-event systems**
  Authors: K. Ritsuka ; Stéphane Lafortune ; Feng Lin
  Abstract: This paper presents a general framework for joint opacity of discrete-event systems under partial observation. It discusses a class of state-estimate-intersection-based (SEI-based) intrusions that existing opacity conditions cannot prevent. The paper provides a procedure to verify the opacity of a system against such SEI-based intrusions. The results are formally verified by Isabelle/HOL.

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1.3. IEEE Control Systems Letter

Volume: 9, May 2025

- **Online Fault Prognosis of Labeled Petri Nets**
  Authors: Braian I. de Freitas ; Armand Toguyeni ; João C. Basilio
  Abstract: This letter addresses the problem of online fault prognosis of discrete event systems modeled by bounded and unbounded-labeled Petri nets (LPNs). Fault prognosis, also known as fault prediction, has as its main goal to detect that an unobservable fault event will inevitably occur in the future given the current event observation. Using the concepts of basis markings and coverability trees, we show that the prognosis can be performed online with a copy of the system LPN, referred to as the fault-driven Petri net. The contributions of this letter are the following: we present a general formulation and a solution to the problem of fault prognosis for both bounded and unbounded LPNs whose unique assumption is that the LPN has no cycles of unobservable transitions. The proposed method can perform an online fault prognosis even after fault occurrences, making it suitable for the prognosis of repetitive fault occurrences.
- **Verification of Stochastic Systems Under Signal Temporal Logic Specifications**
  Authors: Liqian Ma ; Zishun Liu ; Hongzhe Yu ; Yongxin Chen
  Abstract: We study the verification problem of stochastic systems under signal temporal logic (STL) specifications. We propose a novel approach that enables the verification of the probabilistic satisfaction of STL specifications for nonlinear systems subject to both bounded deterministic disturbances and stochastic disturbances. Our method, referred to as the STL erosion strategy, reduces the probabilistic verification problem into a deterministic verification problem with a tighter STL specification. The degree of tightening is determined by leveraging recent results on bounding the deviation between the stochastic trajectory and the deterministic trajectory. Our approach can be seamlessly integrated with any existing deterministic STL verification algorithm. Numerical experiments are conducted to showcase the efficacy of our method.

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2 Conferences

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

2.1 **2025 American Control Conference (ACC)**
Denver, Colorado, USA, July 8-10, 2025.
https://acc2025.a2c2.org/

2.2 **2025 International Conference on Automation Science and Engineering (CASE)**
Los Angeles, California, USA, August 17-21, 2025.
https://2025.ieeecase.org/

2.3 **2025 IEEE Conference on Control Technology and Applications (CCTA)**
San Diego, California, USA, August 25-27, 2025.
https://ccta2025.ieeecss.org/

2.4 **2025 IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)**
Porto, Portugal, September 9-12, 2025.
https://etfa2025.ieee-ies.org/

2.5 **2025 International Conference on Systems, Man, and Cybernetics (SMC)**
Vienna, Austria, October 5-8, 2025.
https://www.ieeesmc2025.org/

2.6 **2025 IEEE Conference on Decision and Control (CDC)**
Rio de Janeiro, Brazil December 9-12, 2025.
https://cdc2025.ieeecss.org/

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3 Books

3.1 Invitation to Supervisory Control of Discrete-Event Systems with Hands-On Python Software Tool

Author: Kai Cai, Osaka Metropolitan University.

Publish Information: Kindle Direct Publishing, 2024, ISBN: 9798373331449

Book website:
https://www.caikai.org/invitation-scdes

About the book:
This book is for anyone who is interested in getting a quick start with the supervisory control theory of discrete-event systems. A companion software package PyTCT (python-based TCT) is available for the reader to get hands-on experience with the theory.
Your feedback comments on how the book materials may be improved are highly appreciated and please send them to: cai@omu.ac.jp

3.2 Cybersecurity of Discrete Event Systems—From Smart Attacks to Resilient Defence

Author: Rong Su, Nanyang Technological University.

Description: This book describes analysis and control against smart cyberattacks in discrete event systems (DES), modelled by regular languages or finite-state automata. "Smart attacks" cannot be detected by the supervisor until an irreversible process towards ensured damage occurs. An attack may be conducted either in the observation channel (i.e., the input of the supervisor) or in the command channel (i.e., the output of the supervisor), or both simultaneously. Therefore, defense strategies against these attacks are urgently needed. This book provides an overview of the latest theories and includes empirical examples to illustrate concepts and methods. By centering on what information is available and how such information is used, the readers are provided with methods to evaluate the cyber vulnerability of a given system and to design a resilient supervisor against relevant smart attacks. By focusing on a conceptual introduction and systematic analysis, this book provides a solid theoretical foundation for future exploration by researchers and graduate students who are interested in cybersecurity research, not necessarily limited to those in the DES community. Readers are recommended to have a background in formal language theory.

Additional information on the book can be found at
https://www.routledge.com/Cybersecurity-of-Discrete-Event-Systems-From-Smart-Attacks-to-Resilient
Su/p/book/9781032368108?srsltid=AfmBOor9fqjhOR7YfMgGE8coz0rHXF6YyKhoucc7UzqYlY9GhcWpQBg3,
where an inspection copy is possible for educational institutions.

3.3 Graph-Theoretical Methods in Systems Theory and Control

Author: Jan Lunze, Ruhr-University, Germany

Description: The book describes for numerous scenarios how to use the structural properties of a system represented by a graph to simplify modelling, analysis, and design tasks. For example, block diagrams and coupling graphs can be used to decompose systems, automata graphs to analyse discrete-event systems and Markov chains, structure graphs to find generic properties of linear systems or communication graphs to design networked control systems. The book includes many examples derived from diverse fields of application, exercises with solutions and MATLAB scripts to implement graph-theoretical methods for systems analysis.

Additional information on the book can be found at
www.editionmora.de/gmsc

The book is produced as "print-on-demand" and can be ordered directly at the printer:
https://publish.bookmundo.de/books/349971

3.4 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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4 Call for Papers

4.1 NAHS special issue on Applications of Hybrid Systems

Scope and Objectives
Hybrid systems—integrating discrete and continuous dynamics—have become essential for addressing complex challenges in automation, control, and decision-making. With rapid advancements in industry and technology, hybrid systems play a pivotal role in ensuring safety, efficiency, and adaptability in real-world applications.

This special issue aims to showcase the impact of hybrid systems and their critical importance in tackling societally relevant challenges. By gathering a collection of high-quality research contributions, we seek to foster stronger interaction between academia and industry, highlighting how hybrid systems have an impact in industry and society.

We encourage contributions that not only advance the theory of hybrid systems but also demonstrate their impact on practical applications across various domains, including robotics, automotive systems, energy systems, vehicles in challenging environment (marine, extraterrestrial), smart manufacturing, and beyond.

Topics of Interest
We invite original research papers that address, but are not limited to, the following topics:

- Hybrid systems in robotics and autonomous systems
- Cyber-physical systems and intelligent automation
- Hybrid control in automotive, mechatronic and aerospace engineering
- Power systems, energy grids
- Hybrid approaches in smart cities and IoT applications
- Safety, reliability, and certification of industrial and manufacturing systems
- Applications in transportation, such as control of High-speed trains, highways and marine vehicles
- e-Health, medical equipments such as pacemakers and artificial pancreas.

Manuscripts may present new theoretical advancements, but the primary focus should be on demonstrating the practical use of hybrid systems and control in real-world scenarios, supported by laboratory experiments, industrial applications, or high-fidelity simulations.

Submission Guidelines

- Authors should prepare their manuscripts according to the NAHS journal format available at Elsevier's NAHS website.
- Submissions must be original, unpublished work that is not under consideration elsewhere.
- Papers should be submitted via the Elsevier Editorial Manager (https://www.editorialmanager.com/nahs/default.aspx), selecting the special issue title upon submission.

Important Dates

- Manuscript Submission Deadline: November 30, 2025
- First Round of Reviews: February 2026
- Final Acceptance Notification: October 2026
- Expected Publication Date: December 2026

Special Sessions & Further Engagement
To strengthen the visibility and impact of this special issue, we may organize special sessions at conferences or dedicated workshops, depending on the response. Authors of selected papers may be invited to present their work at these events, fostering further collaboration between researchers and industry experts.

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5 Software Tools

5.1 Eclipse ESCET™ version 7.0 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.dev/escet/.

In March 2025, ESCET version 7.0 has been released and can be downloaded from https://www.eclipse.dev/escet/download.html. The main changes in this version are

- The data-based synthesis tool may internally produce simpler predicates, such as 'true or X' now becoming 'true', in the conversion of the specification to BDDs. This may lead to differences in conversion performance, variable ordering, and debug output. The benchmarks shown only minimal changes (less than 0.1% change in memory/time). However, for the wafer_scanner_n1 benchmark, synthesis requires about 12% less BDD operations.
- The CIF language now features input parameters, a new kind of parameters for component definitions (automaton and group definitions). For such parameters, only input variables and input parameters can be used as arguments in component instantiations. A primary use case for using input parameters instead of algebraic parameters, is that input parameters can be assigned by SVG input mappings within component definitions.
- A new Eliminate state invariants CIF to CIF transformation has been added. It comes in three variants: one that eliminates all state invariants, one that only eliminates plant state invariants, and one that only eliminates supervisor state invariants.
- Several improvements to the HTML code generator, including a new HTML frequencies.
- The Developers section of the documentation now contains a page about how to reliably extract information from a CIF specification, by converting the CIF specification to XML and using XML queries.

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.dev/escet/release-notes.html.

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