IEEE Control Systems Society
Technical Committee on Discrete Event Systems

Newsletter **July 2025**

Editor: Xiang Yin
Chair, IEEE CSS Technical Committee on DES
Professor
School of Automation & Intelligent Sensing, Shanghai Jiao Tong University
SEIEE Building 2-443, Dongchuan Rd 800, Shanghai, 200240, China

Phone: (+86) 021-34204022
Email: yinxiang@sjtu.edu.cn
Website: http://xiangyin.sjtu.edu.cn

Welcome to the 2025 July 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.

- To **submit a new item**, please email to yinxiang@sjtu.edu.cn.
- To **subscribe**, please email to yinxiang@sjtu.edu.cn.
- To **unsubscribe**, please reply to this email with the subject line UNSUBSCRIBE.

Contents

1. Selections of Journal Publications
   1.1. Discrete Event Dynamic Systems: Theory and Applications
   1.2. IEEE Transactions on Automatic Control
   1.3. Automatica
   1.4. IEEE Control Systems Letter
   1.5. IEEE Transactions on Automation Science and Engineering
   1.6. IEEE Transactions on Systems, Man, and Cybernetics: Systems
2. Conferences
   2.1. 2025 International Conference on Automation Science and Engineering (CASE)
   2.2. 2025 IEEE Conference on Control Technology and Applications (CCTA)
   2.3. 2025 IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)
   2.4. 2025 International Conference on Systems, Man, and Cybernetics (SMC)
   2.5. 2025 IEEE Conference on Decision and Control (CDC)
   2.6. 2026 International Workshop on Discrete Event Systems (WODES)
   2.7. 2026 IFAC World Congress (IFAC WC)
3. Books

3.1. Invitation to Supervisory Control of Discrete-Event Systems with Hands-On Python Software Tool
3.2. Cybersecurity of Discrete Event Systems—From Smart Attacks to Resilient Defence
3.3. Graph-Theoretical Methods in Systems Theory and Control
3.4. Safe Autonomy with Control Barrier Functions: Theory and Applications
4. Call for Paper
4.1. NAHS special issue on Applications of Hybrid Systems
4.2. Journal Option IFAC World Congress – Nonlinear Analysis: Hybrid Systems
5. Software Tools
5.1. Eclipse ESCET™ version 8.0 release
6. Open Positions
6.1. PhD position on Formal analysis and control of multi-agent cyber-physical systems

1 Selections of Journal Publications

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

1.1. Discrete Event Dynamic Systems Theory and Applications

Volume: 35, Issue: 2, June 2025

- **SMT-based and fixed-point approaches for state estimation in max-plus linear systems**
  Authors: Guilherme Espindola-Winck; Laurent Hardouin; Mehdi Lhommeau
  Abstract: This work builds on the seminal paper (Winck et al. IFAC-PapersOnLine 58(1):36–41 2024) and evaluates an existing method against a new approach for state estimation in Max-Plus Linear systems with bounded uncertainties. Traditional stochastic filtering is inapplicable to this system class, even though the posterior probability density function (PDF) can be computed. Previous research has shown a limited scalability of the disjunctive approach using difference-bound matrices. To address this, we investigate an alternative method recently explored in Mufid et al. (IFAC-PapersOnLine 53(4):459–465 2020, IEEE Trans Autom Control 67(6):2700–2714 2022), employing Satisfiability Modulo Theory (SMT) techniques, despite their NP-hard nature. The main novelty of this work is the proposal of a concise method based on fixed-point iteration in max-plus algebra, which is known to be a pseudo-polynomial time algorithm. To compare both approaches, a representative autonomous system is used in the paper to illustrate the basic computations. The efficiency of both approaches is compared through numerical experiments.
- **Optimization-based computation of bounded sequences to reach target states in DESs**
  Authors: Roberto Cordone; Francesco Basile; Luigi Piroddi
  Abstract: The enumeration of legal transition paths leading to a target state (or set of states) is of paramount importance in the control of discrete event systems, but is hindered by the state explosion problem. A method is proposed in this paper, in the context of Petri nets, to calculate and enumerate firing count vectors for which there exists at least an admissible transition sequence leading to a given target marking. The method is shown to improve the approach based on singular complementary transition invariants proposed by Kostin and combines an integer linear programming formulation that finds the shortest minimal solution and a branching procedure that realizes a partition of the solution set. The enumeration can be restricted to minimal solutions or extended to non-minimal ones. Moreover, the approach is extended by adding a further constraint that the target transition sequences should pass by intermediate markings (in a specific order or not). Finally, source, target and via markings can be replaced by sets of markings. Some analytical examples are discussed in detail to show the effectiveness of the proposed approach.
- **State estimation of timed probabilistic discrete event systems via artificial neural networks**
  Authors: Rafael Omar Amri; Carla Seatzu; Alessandro Giua; Dimitri Lefebvre
  Abstract: This paper is about state estimation of timed probabilistic discrete event systems. The main contribution is to propose general procedures for developing state estimation approaches based on artificial neural networks. It is assumed that no formal model of the system exists but a data set is available, which contains the history of the timed behaviour of the system. This dataset is exploited to develop a neural network model that uses both logical and temporal information gathered during the functioning of the system as inputs and provides the state probability vector as output. Two main approaches are proposed: (i) state estimation of timed probabilistic discrete event systems over observations: in this case the state estimate is reconstructed at the occurrence of each new observation; (ii) state estimation of timed probabilistic discrete event systems over time: in this case the state estimate is reconstructed at each clock time increment. For each approach, the paper outlines the process of data preprocessing, model building and implementation. The presented approaches pave the way for further applications of machine learning in discrete event systems.
- **Ergodic properties of concurrent systems**
  Authors: Samy Abbes; Vincent Jugé
  Abstract: A concurrent system is defined as a monoid action of a trace monoid on a finite set of

states. Concurrent systems represent state models where the state is distributed and where state changes are local. Starting from a spectral property on the combinatorics of concurrent systems, we prove the existence and uniqueness of a Markov measure on the space of infinite trajectories relatively to any weight distributions. In turn, we obtain a combinatorial result by proving that the kernel of the associated Möbius matrix has dimension 1; the Möbius matrix extends in this context the Möbius polynomial of a trace monoid. We study ergodic properties of irreducible concurrent systems and we prove a Strong law of large numbers. It allows us to introduce the speedup as a measurement of the average amount of concurrency within infinite trajectories. Examples are studied.

Back to the contents

1.2. IEEE Transactions on Automatic Control

Volume: 70, Issue: 7, July 2025

- **Model Approximation in MDPs With Unbounded Per-Step Cost**
  Authors: Berk Bozkurt ; Aditya Mahajan ; Ashutosh Nayyar ; Yi Ouyang
  Abstract: In this article, we consider the problem of designing a control policy for an infinite-horizon discounted cost Markov decision process $\mathcal{M}$ when we only have access to an approximate model $\hat{\mathcal{M}}$. How well does an optimal policy $\hat{\pi}^*$ of the approximate model perform when used in the original model $\mathcal{M}$? We answer this question by bounding a weighted norm of the difference between the value function of $\hat{\pi}^*$ when used in $\mathcal{M}$ and the optimal value function of $\mathcal{M}$. We then extend our results and obtain potentially tighter upper bounds by considering affine transformations of the per-step cost. We further provide upper bounds that explicitly depend on the weighted distance between cost functions and weighted distance between transition kernels of the original and approximate models. We present examples to illustrate our results.
- **On Lie-Bracket Averaging for Hybrid Dynamical Systems With Applications to Model-Free Control and Optimization**
  Authors: Mahmoud Abdelgalil; Jorge I. Poveda
  Abstract: The stability of dynamical systems with oscillatory behaviors and well-defined average vector fields has traditionally been studied using averaging theory. These tools have also been applied to hybrid dynamical systems, which combine continuous and discrete dynamics. However, most averaging results for hybrid systems are limited to first-order methods, hindering their use in systems and algorithms that require high-order averaging techniques, such as hybrid Lie-bracket-based extremum-seeking algorithms and hybrid vibrational controllers. To address this limitation, we introduce a novel high-order averaging theorem for analyzing the stability of hybrid dynamical systems with high-frequency periodic flow maps. These systems incorporate set-valued flow maps and jump maps, effectively modeling well-posed differential and difference inclusions. By imposing appropriate regularity conditions, we establish results on (T, ϵ)-closeness of solutions and semiglobal practical asymptotic stability for sets. These theoretical results are then applied to the study of three distinct applications in the context of hybrid model-free control and optimization via Lie-bracket averaging.
- **Multistep Sensor Attackability in Cyber-Physical Systems**
  Authors: Wenli Duo ; Shouguang Wang ; MengChu Zhou
  Abstract: This work investigates cyber-attacks targeting cyber-physical systems in the framework of discrete event systems. From intruders' perspective, we propose a concept called k-step attackability to explore attack scenarios where intruders are constrained by a limited number of attack operations. In particular, we focus on a class of sensor attacks where sensor readings can be replaced, deleted, and inserted during transmission. We examine k-step attackability under such attacks and address its verification problem by proposing a structure termed an attack recognizer. It evaluates whether an arbitrary strategy generated by an attack structure can compromise a system within a certain number of attacks. Furthermore, we extend this work to general attack scenarios and provide a method to identify desired attack strategies.
- **Complex Event Recognition Within a Discrete Event System Framework**

Authors: Yu Liu; Lin Cao; Shaolong Shu; Feng Lin
Abstract: Recognizing complex events revealed by raw data is an increasingly crucial task that serves as one of the foundations for system monitoring and decision making. Our goal is to accurately recognize the occurred complex events, that is, uniquely determine the occurred complex event sequence from the raw data. We abstract the outputs of data sources as a set of atomic events, and then, use an automaton to describe all atomic event sequences that can be generated by the given system. We represent a complex event as a set of atomic event sequences. For a given atomic event sequence and a complex event to be recognized, we introduce the notion of "partition" to stand for a possible single complex event sequence. By constructing an augmented automaton that includes all possible partitions, we derive a necessary and sufficient condition for the complex event recognition problem to be solvable. We then find an algorithm to check the condition. When the complex event recognition problem is solvable, any occurred complex event can be determined accurately and promptly online with existing methods like the Aho–Corasick algorithm.

- **Supervisory Control of Networked Timed Discrete Event Systems With Bandwidth Constraints**
Authors: Zhaoyu Xiang; Yufeng Chen; Naiqi Wu; Zhiwu Li
Abstract: In this article, we investigate the supervisory control of a networked timed discrete event system modeled with a timed automaton. In this system, a plant communicates with its supervisor through multiple observation channels and a single control channel. Any observation channel is imposed a bandwidth constraint such that the number of events transmitted through the channel per time unit should not exceed a given nonnegative integer. The control channel is subject to bounded control delays and losses. Our goal is to synthesize a supervisor against control delays and losses such that the bandwidth constraint of any observation channel is satisfied. To this end, the system is first transformed to a region automaton that is a finite representation of the system's semantics. Then, by considering the impact of control delays and losses on system state estimation, the conventional bipartite transition systems are extended to networked timed ones, from which a necessary and sufficient condition for the existence of a desired supervisor is derived. An algorithm is proposed for building such a supervisor if existing.

Back to the contents

1.3. Automatica
Volume: 177, June 2025

- **Algorithms enhancement for optimal triggering control in logical dynamic systems: Leveraging data structure storage**
Authors: Lin Lin; Min Meng; Zhan Shu; Zhiyi Zhong; James Lam
Abstract: This paper studies stabilization of logical control systems (LCSs) using an event-triggered control strategy. First, an LCS is converted into its algebraic state-space representation. In this framework, a stabilizability criterion for LCSs is established, and the optimal triggering control problem is formulated. The goal of the optimal triggering control is to drive the LCS to a desired state while minimizing the number of states that trigger the control action. Then, the equivalence between designing the optimal triggering controller for an LCS and finding the minimum-weight arborescence in the corresponding transition graph is proved. Subsequently, based on the depth-first search and utilizing a Fibonacci-heap-typed data structure, algorithms are established to determine the stabilizability of LCSs and to design the optimal triggering controller. Finally, an example involving the lac operon in the bacterium Escherichia coli is presented to illustrate the obtained results.

- **Stability and stabilization of piecewise homogeneous partially known hidden Markov jump linear systems**
Authors: Yue-Yue Tao; Zheng-Guang Wu; Gang Feng
Abstract: This brief deals with the asynchronous stabilization problem for discrete-time piecewise homogeneous Markov jump linear systems (MJLSs) with stochastic switching transition probabilities (TPs) that are governed by a higher-level Markov chain. Two practical scenarios are considered: (i) the modes of the system and its TP matrix cannot always be accurately detected, leading to the

mismatched modes phenomenon; and (ii) the information of probability matrices cannot be fully obtained. First, we adopt a dual hidden Markov model (HMM) to characterize the mismatched modes phenomenon. It is expected that the feasibility of the established stability conditions for the resulting closed-loop system is enhanced because both observed modes are used in the design. Second, we allow all transition and observation probability (T/OP) matrices to be partially known, considering that some T/OPs cannot be obtained. We propose a novel nonconservative probability decoupling principle to deal with the simultaneous existence of unknown T/OPs, and we then obtain several novel stability conditions based on the probability decoupling principle. We also show that the obtained stability conditions recover some existing results in the literature as special cases without sacrifice of any conservatism. In the end, we use an example of an economic model to demonstrate the effectiveness of the proposed controller design method.

- **Security verification against covert learning attackers**
  Authors: Ruochen Tai; Liyong Lin; Rong Su
  Abstract: This work investigates the security verification problem against covert learning attackers. These are attackers that do not know the supervisor model and thus may require passive learning by collecting observations of the system's runs. From the attacker's point of view, any supervisor consistent with the set of observations may have been deployed; thus, a successful attacker needs to remain covert and inflict damage against every supervisor consistent with the set of observations. In such a setting, a supervisor is said to be secure if no covert learning attacker can be successful. We then consider two different setups for the security verification. In the first setup, the attacker can only observe plant events. It is shown that the security verification in this setup can be reduced to verifying the existence of an attacker that is covert and damage-reachable against every supervisor that is consistent with the monitor language (without an explicit tracking of control commands). This is then solved by extending the existing observation-assisted covert attacker synthesis algorithm to the case where the set of observations is a regular set captured by a finite-state automaton. In the second setup, the attacker can observe both plant events and control commands. For this setup, we construct a new structure called unique monitor-embedded bipartite supervisor and prove that the security verification problem can be reduced to checking the existence of an attacker that is covert and damage-reachable against the unique monitor-embedded bipartite supervisor, which can be solved by invoking the existing covert attacker synthesis algorithm against a given supervisor whose model is known to the attacker.

Back to the contents

1.4. IEEE Control Systems Letter

Volume: 9, June 2025

- **Recovery of Discrete Event Systems After Active Cyberattacks**
  Authors: Dayse M. Cavalcanti; Publio M. M. Lima; Max H. de Queiroz; Felipe G. Cabral
  Abstract: In active cyberattacks, an intruder can alter the nominal system behavior to cause damage to devices and/or users. Although many works in the literature propose techniques to mitigate active attacks from the perspective of the discrete event supervisory control system, there is limited discussion on the recovery of the system's nominal behavior after an attack is detected and isolated by a cyberdefense mechanism. In this letter, we formulate a recovery structure and define a recoverability property, based on which we propose a method for the synthesis of a nonblocking supervisory control that drives the discrete event system from a state estimate after an extinguished attack back to its nominal closed-loop behavior in a finite number of observations while avoiding unsafe states.

- **Attack-Resilient Supervisory Control of Discrete Event Systems Under Dynamic-Event-Protection Mechanisms**
  Authors: Bohan Cui; Alessandro Giua; Xiang Yin
  Abstract: We investigate the problem of synthesizing safe supervisors for discrete-event systems under actuator attacks, where an adversary can partially override control commands at vulnerable states. We introduce a novel dynamic-event-protection mechanism, where the system can defend itself from attacks by taking defense actions when it meets certain required safety levels. The

system employs two policies: a safety-enhancement policy that dynamically manipulates protecting events to increase the safety level, and a state-defense policy that determines whether to defend against attacks when sufficient safety levels are accumulated. Our goal is to synthesize a attack-resilient supervisor, along with compatible safety-enhancement and state-defense policies, to ensure the closed-loop system remains safe under any possible attacks on vulnerable states. We provide a sound and complete approach for synthesizing the supervisor and policies by formulating the problem as a safety game played on a multilayered duplication structure of the original system. We illustrate the proposed approach by running examples.

Back to the contents

1.5. IEEE Transactions on Automation Science and Engineering

Volume: 22, June 2025

- **An Interpretable Data-Driven Fuzzy Petri Net Method for Industrial Domain Knowledge Modeling of Energy Efficiency Management**
  Authors: Kaiyuan Bai; Wenyu Zhang; Shiping Wen; Dan Jia; Weiye Meng
  Abstract: Industrial domain knowledge modeling aims to integrate multi-source industrial information to build a knowledge model that facilitates industrial system construction. Some studies have sought solutions by fuzzy Petri nets (FPNs), which graphically represent domain knowledge to realize interpretable knowledge modeling. However, these methods cannot meet the intelligent development demands of current industrial systems due to laborious manual modeling, inflexible knowledge representation, and non-adaptive parameter determination. In this paper, we propose an interpretable data-driven FPN (IDFPN) method to realize industrial domain knowledge modeling. Unlike traditional FPN modeling paradigm, IDFPN develops a data mining-based explicit knowledge acquisition (DEKA) to automatically explore the FPN structure. Then, a novel q-rung orthopair fuzzy Petri net (q-ROFPN) model and an adaptive model learning algorithm are proposed to dynamically adjust the knowledge representation ranges and adaptively determine q-ROFPN parameters. We apply IDFPN to address a real-world knowledge modeling problem in energy efficiency management of the data center cooling system. Experimental results demonstrate that the proposed IDFPN can fulfill the industrial domain knowledge modeling task automatically and generate an interpretable q-ROFPN model with good parameter learning capabilities and reasonable inferences regarding system behavior statuses. Note to Practitioners—This paper was motivated by the problem of modeling industrial domain knowledge, which is critical for understanding the operational mechanisms of industrial systems and enabling their intelligent maintenance. Although fuzzy Petri nets (FPNs) can successfully model industrial system domain knowledge in a graphical and interpretable manner, they are usually constructed by manually collecting expert knowledge, which limits their practicality in complex systems. This paper suggests a new method to realize interpretable and fully automated industrial domain knowledge modeling. The proposed method can automatically extract interpretable domain knowledge from industrial data and build the FPN-based industrial knowledge model. The model can visually represent operational rules, optimization strategies, and can complex internal relationships while accurately inferring the industrial system's operating status. A real-world application of energy efficiency management in data centers suggests that the proposed method is feasible and can be expanded to other fields, such as fault diagnosis, process control, and system management.
- **Fault Diagnosis of Discrete Event Systems Modeled by Time-Interval Automaton**
  Authors: João C. Basilio; Christiano H. Rezende; Gustavo S. Viana
  Abstract: We address in this paper the problem of diagnosability of time-interval discrete event systems (TIDES), a class of discrete event systems that has a single clock structure and whose event occurrences take place within a time interval after the previous event occurrence. The idea behind the diagnosability of TIDES is to leverage time information to distinguish fault traces from non-faulty ones, increasing the accuracy of the fault diagnosis system. For this purpose, we use a recently proposed timed model called time-interval automaton (TIA), and, based on this model, we present necessary and sufficient conditions for the diagnosability of discrete event systems modeled by TIA and an algorithm for its verification. Examples illustrate all of the results presented in

the paper. Note to Practitioners—Unlike the usual assumption on discrete-event systems, whose evolution is dictated by the asynchronous occurrence of events, in practice, there is always some knowledge on the time associated with event occurrence; e.g., in a manufacturing system, it is also possible to have an estimation on the time the parts take to go from the beginning of a conveyor belt up to different sensors located along the conveyor. In this paper, the time information is given by the time interval within which an event must occur after the system reaches some state, and we take advantage of this information to improve the accuracy of the fault diagnosis system.

Back to the contents

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

Volume: 55, July 2025

- **Design of Optimal Transition-Based Supervisors for Flexible Manufacturing Systems via Resource Requirement Graphs**

  Authors: Yao Lu; Yufeng Chen; Christoforos N. Hadjicostis; Zhiwu Li

  Abstract: In this article, we introduce a novel weighted digraph, namely, a resource requirement graph, to address deadlock problems in flexible manufacturing systems (FMSs) modeled with Petri nets. A liveness-enforcing supervisor consisting of recovery transitions designed to be enabled at pre-partial deadlocks is synthesized. First, a resource requirement graph is directly derived from a Petri net model of an FMS and is used to represent competition relations for shared resources by various processes. Subsequently, the notion of pre-partial deadlock, described as a set of linear inequalities, is introduced by analyzing a resource requirement graph. Then, an algorithm is presented to develop a supervisor consisting of recovery transitions that are only enabled at the identified pre-partial deadlocks. The controlled Petri net model of an FMS under the designed supervisor is shown to be live with all initial reachable markings retained. The method proposed in this article offers computational efficiency since the resource requirement graph is structurally compact compared to its counterpart net model. Finally, several examples are provided to demonstrate the developed techniques.

Back to the contents

2 Conferences

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

2.1 **2025 International Conference on Automation Science and Engineering (CASE)**
Los Angeles, California, USA, August 17-21, 2025.
https://2025.ieeecase.org/

2.2 **2025 IEEE Conference on Control Technology and Applications (CCTA)**
San Diego, California, USA, August 25-27, 2025.
https://ccta2025.ieeecss.org/

2.3 **2025 IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)**
Porto, Portugal, September 9-12, 2025.
https://etfa2025.ieee-ies.org/

2.4 **2025 International Conference on Systems, Man, and Cybernetics (SMC)**
Vienna, Austria, October 5-8, 2025.
https://www.ieeesmc2025.org/

2.5 **2025 IEEE Conference on Decision and Control (CDC)**
Rio de Janeiro, Brazil December 9-12, 2025.
https://cdc2025.ieeecss.org/

2.6 **2026 International Workshop on Discrete Event Systems (WODES)**
Eindhoven, the Netherlands, June 8-10, 2026.

2.7 **2026 IFAC World Congress (IFAC WC)**
Busan, Republic of Korea, August 23-28, 2026.
https://ifac2026.org/

Back to the contents

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).

Back to the contents

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.

Managing Guest Editor:
Raphael Jungers - UCLouvain, raphael.jungers@uclouvain.be

Co-Guest Editors:
Nikolaos Athanasopoulos - Queen's University Belfast, n.athanasopoulos@qub.ac.uk
Jyotirmoy Deshmukh - University of Southern California, jyotirmoy.deshmukh@usc.edu
Melkior Ornik – University of Illinois Urbana-Champaign, mornik@illinois.edu
Rafal Wisniewski – Aalborg University, raf@es.aau.dk
Naijun Zhan - Chinese Academy of Science, znj@ios.ac.cn

4.2 Journal option IFAC World Congress – Nonlinear Analysis: Hybrid Systems

Dear Colleagues and Friends,

We would like to announce the following great opportunity at the upcoming IFAC World Congress: IFAC journals and conferences teaming up!!

Journal Option IFAC World Congress – Nonlinear Analysis: Hybrid Systems:

TC 1.3 (Discrete-event and Hybrid systems) and TC 1.5 (Networked Systems)

Founded in 1957, the International Federation of Automatic Control (IFAC) is a multi-national federation that promotes automatic control and its applications in the fields of engineering, science and the impact of control technology on society. The IFAC World Congress (WC) is the flagship event of the IFAC. The 23rd edition of the IFAC WC will be held in August 23 - 28, 2026 at Busan, Republic of Korea.

With this occasion we are happy to announce that Nonlinear Analysis: Hybrid Systems (NAHS), which is a Q1-IFAC/Elsevier journal, will publish two special issues dedicated to the papers falling within the scope of

- TC 1.3. Discrete Event and Hybrid Systems
- TC 1.5. Networked Systems.

The manuscript submission timeline is available at
https://www.ifac2026.org/fairContents.do?FAIRMENU_IDX=21648&hl=ENG

The interested authors will first submit their manuscript to IFAC PaperPlaza for the IFAC WC and obtain a submission number. They will then submit the same manuscript to the journal's Editorial Manager (EM) site, indicating the WC paper number. The review process will be handled by the special issue Associate Editors on EM, who will also report through PaperPlaza the review results to the IFAC WC. **To avoid joint submissions to IFAC WC with multiple journal options, no Reject decision will be provided before October 26, 2025.**

Alessandro Giua, Executive Guest Editor NAHS – TC 1.3
Constantin Morarescu, Executive Guest Editor NAHS – TC 1.5
Carla Seatzu, Chair IFAC TC 1.3
Luca Schenato, Chair IFAC TC 1.5
Maurice Heemels, Editor-in-Chief NAHS

Back to the contents

5 Software Tools

5.1 Eclipse ESCET™ version 8.0 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 June 2025, ESCET version 8.0 has been released and can be downloaded from https://www.eclipse.dev/escet/download.html. The main changes in this version are

- TBDD-based algorithms, like data-based synthesis and controller properties checks, can now handle negative integers. This means supervisors can be synthesized for a wider variety of models.
- TThe CIF to mCRL2 transformer has been improved significantly. This includes allowing models with multiple initial states, input variables, and state/even exclusion invariants.
- The CIF toolset now includes a new tool, the CIF multi-level splitter, which enables a form of non-monolithic synthesis. The multi-level splitter can be used to split a CIF specification into a multi-level tree of smaller co-operating partial specifications. The partial specifications can be synthesized individually, which is typically more efficiently than synthesizing the entire original specification. The resulting supervisors, synthesized from the partial specifications, can then together be used to control the system. See the tool's documentation for more information:

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.

Back to the contents

6 Open Positions

6.1 PhD position on Formal analysis and control of multi-agent cyber-physical systems

Dear colleagues,

The Control Systems Group at Eindhoven University of Technology (TU/e) is looking for a highly motivated PhD student to join our research team for a project focused on developing novel methodologies for the formal analysis and control of multi-agent cyber-physical systems (CPS). The project integrates techniques from control theory, formal methods, and multi-agent planning to address key challenges in the design of intelligent autonomous systems operating in dynamic and uncertain environments.

Job Description:
Our modern society increasingly relies on complex multi-agent CPS –such as smart transportation networks, implantable medical devices, and intelligent power grids– where networked platforms seamlessly integrate discrete computation with continuous physical control processes. As these systems grow in scale and interconnectivity, they must satisfy high-level spatio-temporal specifications while ensuring safety, security, and functional reliability within intricate infrastructures. Failures in design or implementation can compromise trust, privacy, and economic interests of the society built upon them. The primary focus of this project is to develop novel distributed planning and control approaches for multi-agent CPS, in which each agent adaptively makes decisions by taking into account the interactions with other agents as well as environmental uncertainties. The considered multi-agent systems are subject to high-level requirements expressed through formal languages, such as linear temporal logics and spatio-temporal logics, with additional emphasis on security considerations. The doctoral student will develop novel planning and control approaches to address these requirements, enabling complex multi-agent CPS to be secure-by-design and capable of intelligent decision-making, even under uncertainties. The student will also assist in the integration and experimental evaluation of the proposed techniques. These developments will contribute to the resilience, autonomy, and intelligence of real-world autonomous systems. The position includes contributing to the educational programs in which the Control Systems group is active.

Job Requirements:

- A master's degree (or an equivalent university degree) in Engineering Sciences, Mathematics, or Physics.
- A research-oriented attitude.
- Ability to work in an interdisciplinary team and interested in collaborating with industrial partners.
- Motivated to develop your teaching skills and coach students.
- Fluent in spoken and written English (C1 level).

The ideal candidate is preferred to meet the following criteria:

- Solid background in control theory or a related field
- Strong skills in mathematical modeling and algorithm implementation
- Familiarity with formal methods, or experience in robotics and real-world implementation, will be highly valued

If you're passionate about control systems theory, autonomy, and formal methods, or know someone who might be interested, feel free to reach out or share this opportunity. We look forward to your application and welcoming you to our research team!

The formal add with instructions on how to apply can be found on the TU/e website:
https://www.tue.nl/en/working-at-tue/vacancy-overview/phd-on-formal-analysis-and-control-of-multi-age
The position will remain open until satisfactory candidates are found.

Contact: Siyuan Liu (Email: siyliu@kth.se)

Best regards,
Siyuan

Back to the contents