IEEE Control Systems Society
Technical Committee on Discrete Event Systems

Newsletter March 2023

Editor: Xiang Yin
Chair, IEEE CSS Technical Committee on DES
Associate Professor
Department of Automation, 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 2023 March 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

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

1.1. Discrete Event Dynamic Systems Theory and Applications

Volume: 66, Issue: 3, March 2022

- **Design and verification of pipelined circuits with Timed Petri Nets**
  Authors: Rémi Parrot ; Mikaël Briday ; Olivier H. Roux
  Abstract: A fundamental step in circuit design is the placement of pipeline stages, which can drastically increase the data throughput. *Retiming* allows optimizing the pipeline with regard to a criterion, for example the required number of registers. This article presents an extension of Timed Petri Net to model synchronous electronic circuits, in order to explore the design space of pipelines. The Timed Petri Nets "à la Ramchandani" with a maximal step firing rule, have notably been used for the modeling of electronic circuits. The RTPN extension, through the *reset* which model the pipeline stages, and through the *delayable* transitions which relax some temporal constraints, makes it possible to widen the design space of pipelined systems, and thus to deal with both the retiming and the verification. After a formal definition of this model, we present a method to explore pipelines verifying temporal properties. We apply our approach to a time-multiplexing property allowing the mutualization of operators while minimizing the number of registers.

- **Overview of networked supervisory control with imperfect communication channels**
  Authors: Yuting Zhu ; Liyong Lin ; Ruochen Tai ; Rong Su
  Abstract: This paper presents an overview of the networked supervisory control frameworks for discrete event systems with imperfect communication networks, which are divided into the centralized setup, the decentralized setup and the distributed setup. The state-of-the-art works on networked supervisory control of discrete-event systems addressing the channel imperfections that are caused by channel delays, data losses or non-FIFO channels are discussed. By presenting the key concepts and main results of each representative work, we analyze the pros and cons of different approaches. Finally, we also provide a summary of the existing works, which roughly follow two different lines of thinking and result in two different verification or synthesis approaches. The first approach utilizes simple, non-networked plant models but relies on the development of sophisticated concepts of network controllability and observability to capture network imperfections, while the second approach embeds relatively complex yet verifiable channel models into the model of the networked plant and adopts the standard concepts of controllability and observability for the (verification and) synthesis of networked supervisors. Some future research topics are also presented.

- **Cost-optimal timed trace synthesis for scheduling of intermittent embedded systems**
  Authors: Antoine Bernabeu ; Jean-Luc Béchennec ; Mikael Briday, Sebastien Faucou ; Olivier Roux
  Abstract: Intermittent computing is an emerging paradigm for systems without batteries and powered by intermittent energy sources. This paradigm promises a more energy-efficient design of computing systems. It seems particularly well suited to the field of connected sensors that form the first level of the Internet of Things. This application domain requires a reactive computing model. The definition of an intermittent and reactive model is a problem that has not yet been fully explored in the literature. In this paper, we focus on the modeling and analysis of intermittent reactive systems. We first introduce an extension of Time Petri Nets with cost to model the different dimensions of the system: concurrency, real time, energy consumption and reward representing the gains generated by the system when it has succeeded in carrying out certain actions. We then aim to synthesize optimal runs of the model that achieve the highest possible reward under a given cost (energy) constraint. We propose a symbolic algorithm for constrained-cost state space computation and prove its termination. We then present algorithms for the synthesis of the optimal traces from an exhaustive or partial state space exploration. We finally illustrate the cost-optimal traces synthesis on a case study and show how that can be used online for joint management of computing time and energy.

Back to the contents

1.2. IEEE Transactions on Automatic Control

Volume: 68, Issue: 3, March 2023

- **Distributed Pinning Set Stabilization of Large-Scale Boolean Networks**
  Authors: Shiyong Zhu ; Jianquan Lu ; Liangjie Sun ; Jinde Cao
  Abstract: In this article, we design the distributed pinning controllers to globally stabilize a Boolean network (BN), especially a sparsely connected large-scale one, toward a preassigned subset of states through the node-to-node message exchange. Given an appointed set of states, system nodes are partitioned into two disjoint parts, whose states are, respectively, fixed or arbitrary with respect to the given state set. With such node division, three parts of pinned nodes are selected and the state feedback controllers are accordingly designed such that the resulting BN satisfies all three conditions: the information of the arbitrary-state nodes cannot be passed to the others, the subgraph of network structure induced by the fixed-state nodes is acyclic, and the fixed states of these nodes are compatible with the preassigned state set. If the network structure of controlling BN is acyclic, the stabilizing time is revealed to be no more than the diameter of the resulting subgraph plus one. Based on this, we further design the pinning controllers with the constraint of stabilizing time. Noting that the overall procedure runs in an exponentially increasing time complexity with respect to the largest number of functional variables in the dynamics of pinned nodes, the sparsely connected large-scale BNs can be well addressed in a reasonable amount of time. Finally, we demonstrate the applications of our theoretical results in a T-cell large granular lymphocyte (T-LGL) survival signal network with 29 nodes and a T-cell receptor signaling network with 90 nodes.
- **State Distribution of Markovian Jump Boolean Networks and Its Applications**
  Authors: Min Meng ; Gaoxi Xiao
  Abstract: This article investigates the state distribution of Markovian jump Boolean networks subject to stochastic disturbances based on the measured outputs. The considered disturbances are modeled as independent and identically distributed processes with known probability distributions. An iterative algorithm is proposed to compute conditional probability distributions of the current state and one-step predicted state based on the knowledge of the output measurements. The obtained conditional probability distributions can be applied to study the optimal state estimation, reconstructibility, and fault detection of Markovian jump Boolean networks.

Back to the contents

1.3. Automatica

Volume: 149, March 2023

- **Minimax Persistent Monitoring of a network system**
  Authors: Samuel C. Pinto ; Shirantha Welikala ; Sean B. Andersson ; Julien M. Hendrickx ; Christos G. Cassandras
  Abstract: We investigate the problem of optimally observing a finite set of targets using a mobile agent over an infinite time horizon. The agent is tasked to move in a network-constrained structure to gather information so as to minimize the worst-case uncertainty about the internal states of the targets. To do this, the agent has to decide its sequence of target-visits and the corresponding dwell-times at each visited target. For a given visiting sequence, we prove that in an optimal dwelling time allocation the peak uncertainty is the same among all the targets. This allows us to formulate the optimization of dwelling times as a resource allocation problem and to solve it using a novel efficient algorithm. Next, we optimize the visiting sequence using a greedy exploration process, using heuristics inspired by others developed in the context of the traveling salesman problem. Numerical results are included to illustrate the contributions.
- **Self-triggered multi-mode control of Markovian jump systems**
  Authors: Zhiru Cao ; Yugang Niu ; Yuanyuan Zou
  Abstract: This paper is concerned with the problem of self-triggered multi-mode control for a

class of Markovian jump systems, in which the system states are transmitted to the controller via a communication network with limited bandwidth. In order to achieve the desired performance of the closed-loop system via utilizing a controller with fewer modes, a mode monitoring mechanism related to the system modes is employed to describe the jumping characteristics among different controller modes. Based on the mode monitoring mechanism, a multi-mode controller is constructed, in which the number of controller modes may be fewer than the one of system modes. Moreover, a self-triggered strategy is developed to reduce network loads, according to which the next triggering instant on state transmission is calculated via the past and current transmitted states at the triggering instants. By introducing a sufficiently small scalar, a solving algorithm is proposed for obtaining the self-triggered multi-mode controller gains to ensure the stochastic stability of the closed-loop system with the given $\mathcal{L}_2$ gain performance. Finally, the simulation results are provided to illustrate the proposed self-triggered control scheme.

Back to the contents

1.4. IEEE Transactions on Cybernetics

Volume: 53, Issue: 3, March 2023

- **A State Space Approach to Decentralized Fault SE-Coprognosability of Partially Observed Discrete Event Systems**
  Authors: Yingrui Zhou ; Zengqiang Chen ; Zhipeng Zhang ; Yuanhua Ni ; Zhongxin Liu
  Abstract: The problem of fault prognosis in the context of discrete event systems (DESs) is a crucial subject to study the security and maintenance of cyberphysical systems. In this article, the decentralized fault prognosis of partially observed DESs is analyzed with a universal state-estimate-based protocol. It follows (M, K) as the performance bound of any expected decentralized prognosers, where any fault can be predicted K steps before its occurrence and the fault is guaranteed to occur within M steps once a corresponding fault alarm is issued. To determine whether expected decentralized prognosers exist, the notion of state-estimate-coprognosability (SE-coprognosability) under the case of one fault type is proposed. Compared with existing other kinds of coprognosability, SE-coprognosability is a more generalized concept. Meanwhile, combining the formal method and algebraic state space approach, a novel state estimation algorithm is presented and based on which, the verification of SE-coprognosability is also solved.
- **Event-Triggered Control for Markov Jump Systems Subject to Mismatched Modes and Strict Dissipativity**
  Authors: Jie Tao ; Zehui Xiao ; Jiawei Chen ; Ming Lin ; Renquan Lu ; Peng Shi ; Xiaofeng Wang
  Abstract: In order to save network resources of discrete-time Markov jump systems, an event-triggered control framework is employed in this article. The threshold parameter in the event-triggered mechanism is designed as a diagonal matrix in which all elements can be adjusted according to system performance requirements. The hidden Markov model is introduced to characterize the asynchronization between the controller and controlled system. The effect of randomly occurring gain fluctuations is taken into account during the controller design. For the purpose of guaranteeing that the closed-loop system is stochastically stable and satisfies the strictly (D_1, D_2, D_3)-γ-dissipative performance, sufficient conditions are constructed by employing the Lyapunov function and stochastic analysis. After linearization, the proposed controller gains are obtained by solving the linear matrix inequalities. Ultimately, a practical example of the dc motor device is used to illustrate the effectiveness of the proposed new design technique.

Back to the contents

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

Volume: 53, Issue: 3, March 2023

- **Robust Petri Net Controllers for Flexible Manufacturing Systems With Multitype and Multiunit Unreliable Resources**
  Authors: Huixia Liu ; Yanxiang Feng ; Junhong Li ; Jianchao Luo
  Abstract: It is inevitable that resource failures occur in real production processes, and sometimes

many different types of unreliable resource failures may occur. Once there are resource failures, the stagnation states of production caused by these failures, called as failure blockings (FBs), tend to appear. Hence, both deadlocks and FBs can arise to reduce production efficiency sharply. Designing robust control policies for such an automated system is thus very important. Our work focuses on a novel robust Petri net controller of flexible manufacturing systems with multitype and multiunit of unreliable resources. First, under the assumption that all resources are reliable, these systems are modeled by a class of Petri nets called systems of simple sequential processes with resources (S^3PRs). For each operation place that is a holder of an unreliable resource, the corresponding repair place and related transitions are added to the net and an (S^3PR) with unreliable resources (S^3PR_u) is developed. For an S^3PR_u, the formal definition of FBs is then proposed. Such an FB is characterized by a maximal perfect resource-transition circuit (MPC). Next, the concept of a critical set of MPCs is introduced. For any two adjacent MPCs in such a critical set, one input transition of the former and one output transition of the latter are connected by passing through resource places. A ξ-resource is a one-unit resource shared by two or more MPCs that do not contain each other. For an S^3PR_u without ξ-resources and critical sets of MPCs, a control place corresponding to an MPC is added to the net with its output arcs to the input transitions of the MPC. However, for an S^3PR_u with ξ-resources or critical sets of MPCs, the output arcs of each control place are added to the source transitions of the original net. Thus, a novel robust controller of an S^3PR_u is synthesized. Such a robust controller can guarantee that as long as at least one unit of each type of unreliable resources can work normally, all kinds of parts can be processed to complete smoothly their tasks through any one of their process routes. Finally, three examples are provided to illustrate the efficiency of the proposed robust controller.

- **Stabilization of Delayed Boolean Networks Using Constrained State Pinning Control**
  Authors: Liqing Wang ; Zheng-Guang Wu ; Tingwen Huang ; Prasun Chakrabarti
  Abstract: Pinning control is applied to ensure the stabilization of Boolean networks (BNs) with time delay parameter. The time delay parameter in this article follows an independent identical distribution. Using semi-tensor product of matrices, the considered BN with time delay is converted to a high dimensional switching BN and the switching signal is the time delay signal. Different from general switching BN, the structure matrices of all subsystems are independent with each other, structure matrices of all subsystems for the high dimensional switching BN depend on the original BN structure matrix. Pinning control is designed to guarantee the global stochastic stability of the considered system. Furthermore, the global stochastic stability of BN with time delay parameter is proved to be equivalent to the stability of BN without time delay parameter, which greatly reduces the computational complexity and simplifies the control design. For the considered BN with finite cycles, constrained pinning control is applied with limitation that only one state of each undesired cycle is under control. With this constraint, the minimal number of pinning control nodes is further investigated. Some algorithms are presented to obtain the new structure matrix, with which, pinning control can be solved by the obtained methods. Both numerical examples and biological example illustrate the effectiveness of the results.

Back to the contents

2 Call for Participants & Registrations

2.1 2023 Virtual Talk Series on Discrete Event Systems

Dear members of the TC and previous participants,

We are excited to announce the 2023 edition of the Virtual Talk Series on Discrete Event Systems for which we invite everyone to register here:
https://tc-des.mpi-sws.org/registration-2023/

As in previous years, registration is free and only required for security reasons. Please feel free to forward this announcement to any interested person! We think that this year's series compasses an exciting and diverse program again.

In January and February the VTS will feature a Virtual Workshop on Control Software Synthesis for CPS happening Wednesdays, January 18th 2023 and February 15th 2023 at 1pm UTC. From March to December the VTS will host two PhD forums and multiple 'classical' talks, happening, as usual, Thursdays 1pm UTC with confirmed speakers being:

- Laurent Hardouin, University of Angers, France
- Cristian Mahulea, University of Zaragoza, Spain
- Tomas Masopust, Faculty of Science, Palacky University in Olomouc, Czechia
- Anca Muscholl, LaBRI, Univ. of Bordeaux, France
- Sophie Pinchinat, Univ. Rennes, France

We are still in the process of finalizing the program of the VTS and will circulate the website with the final program when it is available.

One last remark: You will see that the virtual workshop mentioned above also has a separate registration site. If you register to the VTS, you do NOT need to register for the workshop separately. If you plan to ONLY attend the workshop, we kindly ask you to register on the workshop registration site.

We are looking forward to your active participation.

Kind regards,

Anne-Kathrin Schmuck on behalf of all TC co-chairs

3 Conferences

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

3.1 **2023 ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)**
San Antonio, USA, May 9-12, 2023
https://iccps.acm.org/2023/

3.2 **2023 IEEE International Conference on Robotics and Automation (ICRA)**
London, United Kingdom, May 29-June 02 2023, 2023
https://www.icra2023.org/

3.3 **2023 American Control Conference (ACC)**
San Diego, USA, May 31 - June 2, 2023
https://acc2023.a2c2.org/

3.4 **2023 IFAC World Congress (IFAC)**
Yokohama, Japan, July 9-14, 2023
https://www.ifac2023.org/

3.5 **2023 IEEE Conference on Control Technology and Applications (CCTA)**
Bridgetown, Barbados, August 16-18, 2023.
https://ieeeccta.org/

3.6 **2023 IEEE International Conference on Automation Science and Engineering (CASE)**
Auckland, New Zealand, August 26-29, 2023.
https://case2023.org/

3.7 **2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC)**
Maui, Hawaii, October 14, 2023.
https://ieeesmc2023.org/

3.8 **2023 IEEE Conference on Decision and Control (CDC)**
Singapore, December 13-15, 2023.
https://cdc2023.ieeecss.org/

Back to the contents

4 Books

4.1 Analysis and Control for Resilience of Discrete Event Systems

Authors: Joao Carlos Basilio, Christoforos N. Hadjicostis and Rong Su

Description: System resilience captures the ability of the system to withstand a major disruption within acceptable performance degradation and to recover within an acceptable time frame. In this monograph we consider two possible sources of major disruptions, i.e., component faults and cyber intrusions. A component fault is an indigenous activity that renders unavailability or inaccessibility of certain functions within a component, either permanently or temporarily. It typically generates safety and performance concerns. Cyber intrusion on the other hand is an exogenous activity that tampers privacy, confidentiality, availability, or integrity of the system. These two sources are not always independent from each other. For example, a cyber intrusion may trigger a component fault, whereas a component fault may open a door for cyber intrusion, e.g., by keeping it undetected. For cyber intrusion, we will focus on opacity, which describes the systems ability to hide certain secrets from an external observer (or eavesdropper), and sensor and actuator attacks that exploit the systems existing controller to generate undesirable behaviours.

In this monograph, we provide a detailed account of most recent research outcomes on fault diagnosis, opacity analysis and enhancement, and cyber security analysis and enforcement, within suitable discrete event system modelling frameworks. In each case, we describe basic problem statements and key concepts, and then point out the key challenges in each research area. After that, we present a thorough review of state-of-the-art techniques, and discuss their advantages and disadvantages. Finally, we highlight key research directions for further exploration.

ISBN: 978-1-68083-856-5
https://www.nowpublishers.com/article/Details/SYS-024

4.2 Introduction to Discrete Event Systems (Third Edition)

Authors: Christos Cassandras and Stéphane Lafortune

Description: Christos Cassandras and Stéphane Lafortune are happy to announce the publication of the third edition of their textbook, Introduction to Discrete Event Systems, by Springer in November 2021. The first two editions of this popular textbook were published in 1999 (Kluwer Academic Publishers) and 2008 (Springer), respectively. This unique textbook comprehensively introduces the field of discrete event systems, offering a breadth of coverage that makes the material accessible to readers of varied backgrounds. The book emphasizes a unified modeling framework that transcends specific application areas, linking the following topics in a coherent manner: language and automata theory, supervisory control, Petri net theory, Markov chains and queueing theory, discrete-event simulation, and perturbation analysis and concurrent estimation techniques. The third edition is a superset of the second one, with new material added based on our teaching of discrete event systems courses at Boston University and at the University of Michigan, and they reflect active research trends in discrete event systems since the publication of the second edition.

Topics and features:
- detailed treatment of automata and language theory in the context of discrete event systems, including application to state estimation and diagnosis
- comprehensive coverage of centralized and decentralized supervisory control
- timed models, including timed automata and hybrid automata - stochastic models for discrete event systems and controlled Markov chains
- discrete event simulation - an introduction to stochastic hybrid systems
- sensitivity analysis and optimization of discrete event and hybrid systems
- new in the third edition: opacity properties, enhanced coverage of event diagnosis and of supervisory control under partial observation, overview of latest software tools, updated treatment of Infinitesimal Perturbation Analysis and of concurrent estimation

This proven textbook is essential to students and researchers in a variety of disciplines where the study of discrete event systems is relevant: control, communications, computer engineering, computer science, manufacturing engineering, transportation networks, operations research, and industrial engineering. This book is available through SpringerLink as an e-book (PDF and EPUB formats) or as a print-on-demand hard cover at https://link.springer.com/book/10.1007/978-3-030-72274-6 The e-book is available for free download at Springer subscribing institutions.

ISBN 978-3-030-72272-2 ISBN 978-3-030-72274-6 (eBook)
https://doi.org/10.1007/978-3-030-72274-6

4.3 Hybrid Dynamical Systems – Fundamentals and Methods

Authors: Hai Lin and Panos Antsaklis

Description: This book is based on courses on hybrid systems, cyber-physical systems, and formal methods taught by the authors in the past years. It is a graduate level textbook and provides an accessible and comprehensive introduction to the theory of hybrid systems with a balanced treatment on fundamentals and methods from both control theory and computer science. It also serves as a reference book for researchers in the fields of hybrid dynamical systems, cyber-physical systems, formal methods and robotics.

More information may be found at the books Springer webpage:

https://link.springer.com/book/10.1007/978-3-030-78731-8

4.4 A New Framework for Discrete-Event Systems

Author: Kuize Zhang

Description: Real-world problems are often formulated as diverse properties of different types of dynamical systems. Hence property verification and synthesis have been long-standing research interests. The supervisory control framework developed in the 1980s provides a closed-loop property enforcement framework for discrete-event systems which usually consist of discrete states and transitions between states caused by spontaneous occurrences of labeled events. In this comprehensive review, the author develops an open-loop property enforcement framework for discrete event systems which scales better and can be implemented in more models. The author demonstrates the practicality of this framework using a tool called concurrent composition, and uses this tool to unify multiple inference-based properties and concealment-based properties in discrete-event systems. In the second part, the author introduces a new model called labeled weighed automata over monoids (LWAMs). LWAMs provide a natural generalization of labeled finite-state automata in the sense that each transition therein carries a weight from a monoid, the weight of a run is the product of the weights of the runs transitions. This book introduces the reader to a new paradigm in discrete event dynamic systems. It provides researchers, students and practitioners with the basic theory and a set on implementable tools that will have a significant impact on systems of the future.

More information may be found at the books publisher webpage:

https://www.nowpublishers.com/article/Details/SYS-028

Back to the contents

5 Software Tools

5.1 DESpot 1.10.0 Released

DESpot is a discrete-event system (DES) software, research tool. It supports both flat projects (collection of plant and supervisor DES), and Hierarchical Interface-Based Supervisory Control (HISC) projects.

DESpot 1.10.0 supports a number of new Features:

- DESpot now targets version 4.8.7 of the Qt libraries, RedHat Enterprise Linux 7.x, and MS Windows 10 with MS Visual Studios 2019.
- Support for defining template DES, and then instantiating multiple copies for flat or HISC projects.
- Now includes curved transition arrows for DES diagrams, and the ability to export DES diagrams to EPS.
- Support for verification of timed controllability, including BDD-based algorithms.
- Support for Fault-Tolerant (FT) Supervisory Control, including both timed and untimed controllability and nonblocking BDD-based algorithms, for several fault scenarios.
- Support for specifying decentralized supervisory control structure for a project, and verifying co-observability.

To find out more information and to download a copy, see: http://www.cas.mcmaster.ca/~leduc/DESpot.html

DESpot is open source software, released under the GNU General Public license (GPL), version 2.

DESpot is written in C++ and uses the QT GUI libraries. At the moment, DESpot is available as source code and as a Windows' installer. It runs under Linux, and Windows.

5.2 Eclipse ESCET™ version 0.8 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 toolkits website at https://www.eclipse.org/escet/.

In December 2022, ESCET version 0.8 has been released and can be downloaded from https://www.eclipse.org/escet/download.html. The main changes in this version are

- This release is based on Eclipse 2022-06, rather than Eclipse 2021-06. Eclipse 2022-06 may show for all projects in your existing workspace a warning that they dont have an explicit encoding set. The solution is described in the full release notes.
- Eclipse 2022-06 may automatically use a dark theme if your operating system is configured to use a dark theme. The Console view, Application view, and CIF simulator windows now support dark mode as well (in addition to the ones from version 0.7).
- Eclipse ESCET now bundles Java 17 rather than Java 11.
- Very long lines in the Console view and text editors now render correctly on Windows.
- CIF has improved type checking for the = and != binary expressions to support more expressions. For example, both expressions x = 1 and 1 = x are now supported, with x a real-valued variable.
- The CIF data-based synthesis tool now has a second hyper-edge creator, the linearized hyper-edge creator, which may improve performance. The legacy hyper-edge creator is still used by default.
- A new CIF example model and a new CIF benchmark model have been added. Furthermore, the CIF benchmarking models now come with scripts to easily benchmark data-based synthesis.
- he CIF to Supremica transformation, the CIF to UPPAAL transformation, and CIF PLC code precondition checks have improved output. The preconditions themselves have not changed.

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.

5.3 IDES: An Open-Source Software Tool

IDES, the discrete-event systems software tool in Karen Rudie's lab is now available as open-source software at https://github.com/krudie/IDES. More information on IDES can also be found at https://www.ece.queensu.ca/people/K-Rudie/qdes.html#fndtn-software.

5.4 MDESops

MDESops is an open-source tool written in Python for analysis and control of discrete event systems modeled as finite-state automata. It includes a growing set of operations on automata, including: (i) manipulation of models (e.g., parallel composition, observer); (ii) diagnosis and opacity verification; (iii) common supervisory control functions (e.g., computation of supremal controllable and normal sublanguages); and (iv) more advanced functions on synthesis of attackers and of resilient supervisors in the presence of sensor deception attacks. The repository is a Git server maintained by the EECS Department at the University of Michigan, USA. Download from https://gitlab.eecs.umich.edu/M-DES-tools/desops.

5.5 Supremica 2.7, New Version

The development team has just released a new version of Supremica, Waters/Supremica IDE 2.7.

Supremica is a DES and SCT drawing and calculation tool, that includes a multitude of efficient algorithms for modeling, verification, and synthesis of maximally permissive supervisors. In addition there are general algorithms for standard operations like synchronization, minimization, determinization, etc. Supremica also handles finite automata extended with bounded discrete variables. A feature-full simulation tool is also included.

New in this version:

- Conditional blocks or IF statements can now be created in the components list or on label blocks to allow conditional compilation of automata or events. They can also be used as an alternative to guard/action blocks.
- Update to Log4j 2.17.1 to avoid the Log4shell vulnerability.

Supremica is free to use for education and research; for commercial use, please contact fabian@chalmers.se. Download from www.supremica.org.

5.6 UltraDES 2.2 Release

UltraDES is an open-source library to the modeling, analysis and control of DES, written using C# in .NET Standard 2.0, which allows its use in multiple platforms, such as Windows, Linux, Mac, IOS, Android, so on. The library is under development at LACSED (Laboratory of Analysis and Control of Discrete Event Systems, at the Universidade Federal de Minas Gerais, Brazil) and has basic operations with automata as long as the monolithic, modular and local modular supervisory control (Alves et. al., 2017).

The main improvements of the UltraDES 2.2 version are:

- Supervisor Reduction Algorithm (Su and Wonham, 2004)
- Supervisor Localization (Cai and Wonham, 2010)
- Basic Petri Nets Functions (incidence matrix, coverability/reachability graph, Petri Net marking simulation, etc.)

Knowing that many researchers/students are not familiar with the C# language, we created an experimental python wrapper, that is less object oriented and easier to use.

Another initiative to improve the usability of UltraDES was the creation of a Web Application, developed using Blazor/WebAssembly, that allows the use of UltraDES online. This version is more limited in processing power and memory but it is useful for small examples and teaching.

We invite the community to download and contribute. Algorithms implemented may be integrated to the main distribution. Just let us know. Contact Lucas Alves lucasvra@ufmg.br or Patricia Pena ppena@ufmg.br for more information. Bugs should be informed using the UltraDES GitHub page.
Link: `https://github.com/lacsed/UltraDES`.

Back to the contents