

IEEE CONTROL SYSTEMS SOCIETY
TECHNICAL COMMITTEE ON DISCRETE EVENT SYSTEMS

Newsletter..... October 2019

(also available at
<http://discrete-event-systems.ieeecss.org/tc-discrete/newsletters>)

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1. Editorial

Welcome to the 2019 October issue of the newsletter,
also available electronically at
<http://discrete-event-systems.ieeecss.org/tc-discrete/newsletters>

You are welcome to submit new items to the newsletter (topics including schools, workshops, sessions, conferences, journals, books, software, positions).
To submit a new item, please use the following website:
<https://www.control.eng.osaka-cu.ac.jp/miscellaneous/css-tc-des/submission>
or email to kai.cai@eng.osaka-cu.ac.jp.

To subscribe, please email to kai.cai@eng.osaka-cu.ac.jp.
To unsubscribe, please reply to this email with the subject line UNSUBSCRIBE.

2. Selections of Journal Publications

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

2.1. Selections of Automatica
VOLUME: 108, October 2019

(1) Enforcing opacity by insertion functions under multiple energy constraints

Authors: Yiding Ji ; Xiang Yin ; Stephane Lafortune

Abstract: This paper investigates the enforcement of opacity by insertion functions subject to multiple quantitative constraints capturing resource or energy limitations. There is a malicious intruder attempting to infer secrets of the system from its observations. To prevent the disclosure of secrets, the insertion function inserts fictitious events to the output of the system to obfuscate the intruder. The system is initialized with several types of resources, referred to as energy. The energy is consumed or replenished with event occurrences while always consumed with event insertions. The insertion function must enforce opacity while

ensuring that each type of resource is never depleted. This problem is then reduced to a two-player game between the insertion function and the system (environment), with properly defined objectives. A game structure called the Energy Insertion Structure, denoted by is proposed, which provably contains solutions to the energy constrained opacity enforcement problem. Then we further study the bounded cost rate insertion problem on the insertion function's winning region of , which requires that the long run average rate of insertion cost be bounded. This problem is formulated as a multidimensional mean payoff game and a special method called hyperplane separation technique is applied to efficiently solve it.

Full-text available at: <https://www.sciencedirect.com/science/article/pii/S0005109819303243>

(2) Bisimilarity enforcing supervisory control of nondeterministic discrete event systems with nondeterministic specifications

Authors: Shigemasa Takai

Abstract: We consider a bisimilarity control problem for the plant and the specification modeled as nondeterministic automata. This problem requires us to synthesize a nondeterministic supervisor such that the supervised plant is bisimilar to the specification. We derive a new necessary and sufficient condition for the existence of a supervisor that solves the bisimilarity control problem. Although the complexity of verifying this existence condition is exponential in the numbers of states of the plant and the specification, it is smaller than that of the exhaustive search that uses the existing condition. We present how to synthesize a solution to the bisimilarity control problem if it exists. In addition, we give a polynomially verifiable necessary condition.

Full-text available at: <https://www.sciencedirect.com/science/article/pii/S0005109819303188>

(3) On scalable supervisory control of multi-agent discrete-event systems

Authors: Yingying Liu ; Kai Cai ; Zhiwu Li

Abstract: In this paper we study multi-agent discrete-event systems where the agents can be divided into several groups, and within each group the agents have similar or identical state transition structures. We employ a relabeling map to generate a template structure for each group, and synthesize a scalable supervisor whose state size and computational process are independent of the number of agents. This scalability allows the supervisor to remain invariant (no recomputation or reconfiguration needed) if and when there are agents removed due to failure or added for increasing productivity. The constant computational effort for synthesizing the scalable supervisor also makes our method promising for handling

large-scale multi-agent systems. Moreover, based on the scalable supervisor we design scalable local controllers, one for each component agent, to establish a purely distributed control architecture.

Full-text available at: <https://www.sciencedirect.com/science/article/pii/S000510981930305X>

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2.2. Selections of the IEEE Transactions on Automatic Control
VOLUME: 64, ISSUE: 10, October 2019

(1) Opacity Enforcement Using Nondeterministic Publicly Known Edit Functions

Authors: Yiding Ji ; Xiang Yin ; Stephane Lafortune

Abstract: This note investigates enforcement of opacity by nondeterministic edit functions. The edit functions alter the system's output by inserting fictitious events or erasing observed events. The edit decisions are randomly made while not known by the outside environment a priori. There is an intruder characterized as a passive observer with malicious goals to infer the secrets of the system. We require that opacity be enforced when the intruder may or may not know the implementation of edit functions. This requirement is termed as private and public safety. We also restrict the operation of edit functions by defining edit constraints. Then, the opacity enforcement problem is transformed to a three-player game among the edit function, the environment, and a dummy player, which helps to determine edit decisions. A game structure called the all edit structure (AES) is introduced to characterize the interaction among those players. It embeds all privately safe edit functions and may also embed publicly safe edit functions. Based on the AES, we present an algorithm that provably synthesizes nondeterministic edit functions that satisfy both private safety and public safety.

Full-text available at: <https://ieeexplore.ieee.org/document/8635328>

(2) Robust Fault Diagnosis of Stochastic Discrete Event Systems

Authors: Xiang Yin ; Jun Chen ; Zhaojian Li ; Shaoyuan Li

Abstract: We investigate the problem of robust fault diagnosis of stochastic discrete-event systems against model uncertainty. In this problem, we assume that the actual behavior of the system is unknown a priori and the true model of the system belongs to a set of possible models described by probabilistic automata. The goal of this problem is to almost successfully detect the occurrence of fault in the sense that, first, no false alarm can be made, and second, the misdetection rate is smaller than a given threshold ϵ after some delay K even without knowing the true model a priori. A condition termed as robust (ϵ, K) -diagnosability is proposed to capture the existence of such a robust diagnoser that

satisfies the above-mentioned requirements. We also propose the notions of robust ϵ -diagnosability and robust A-diagnosability, which require that a given misdetection rate ϵ can be achieved with some delay and any arbitrarily small misdetection rate can be achieved, respectively. For each condition, an effective verification algorithm is also proposed. Our results generalize previous works on fault diagnosis of stochastic discrete-event systems by taking model uncertainty and specific misdetection rate into account.

Full-text available at: <https://ieeexplore.ieee.org/document/8618423>

(3) Verification of Fault-predictability in Labeled Petri Nets Using Predictor Graphs

Authors: Dan You ; ShouGuang Wang ; Carla Seatzu

Abstract: A fault-predictable discrete event system (DES) is a system where any fault can be correctly predicted before its occurrence. This paper studies the verification of fault-predictability in bounded and unbounded DESs modeled by labeled Petri nets (PNs). An approach based on the construction of a Predictor Net and a Predictor Graph (PG) is proposed. In particular, a necessary and sufficient condition for fault-predictability is derived by characterizing the structure of the PG. Furthermore, two rules are proposed to reduce the size of a given PN, which allows one to analyze the fault-predictability of the original net by verifying the fault-predictability of the reduced net.

Full-text available at: <https://ieeexplore.ieee.org/document/8633388>

(4) Codiagnosability Analysis of Discrete-Event Systems Modeled by Weighted Automata

Authors: Gustavo S. Viana ; Marcos V. Moreira ; Joao C. Basilio

Abstract: In building failure diagnosis systems for discrete-event systems (DES), two performance indexes must be specified: first, the maximum time the diagnosis system takes to detect the failure occurrence, usually referred to as T-diagnosability, and second, if no time information is available, how many events must occur after the failure in order for the diagnosis system to detect and isolate its occurrence, usually referred to as K-diagnosability. In this technical note, we consider the problem of verifying if these specifications can be met for DES modeled by finite-weighted automaton; we regard the ordinary finite automaton as a particular case of weighted automaton with all weights equal to one. The resulting algorithms have polynomial time complexity, being the lowest worst case computational complexity among those already proposed in the literature for T- and K-codiagnosability verification of finite-state automata.

Full-text available at: <https://ieeexplore.ieee.org/document/8633327>

(5) Event-Triggered Risk-Sensitive State Estimation for Hidden Markov Models

Authors: Jiapeng Xu ; Daniel W. C. Ho ; Fangfei Li ; Wen Yang ; Yang Tang

Abstract: An event-triggered risk-sensitive state estimation problem for hidden Markov models is investigated in this work. The event-triggered scheme considered is fairly general, which covers most existing event-triggered conditions. By utilizing the reference probability measure approach, this estimation problem is reformulated as an equivalent one and solved. We show that the event-triggered risk-sensitive maximum a posteriori probability estimates can be obtained based on a newly defined unnormalized information state, which has a linear recursive form. Furthermore, the explicit solutions for two major classes of event-triggered conditions are derived if the measurement noise is Gaussian. A numerical comparison is provided to illustrate the effectiveness of the proposed results

Full-text available at: <https://ieeexplore.ieee.org/document/8621063>

(6) Temporal Logic Task Planning and Intermittent Connectivity Control of Mobile Robot Networks

Authors: Yiannis Kantaros ; Meng Guo ; Michael M. Zavlanos

Abstract: In this paper, we develop a distributed intermittent communication and task planning framework for mobile robot teams. The goal of the robots is to accomplish complex tasks, captured by local linear temporal logic formulas, and share the collected information with all other robots and possibly also with a user. Specifically, we consider situations where the robot communication capabilities are not sufficient to form reliable and connected networks, while the robots move to accomplish their tasks. In this case, intermittent communication protocols are necessary that allow the robots to temporarily disconnect from the network in order to accomplish their tasks free of communication constraints. We assume that the robots can only communicate with each other when they meet at common locations in space. Our distributed control framework jointly determines local plans that allow all robots to fulfill their assigned temporal tasks, sequences of communication events that guarantee information exchange infinitely often, and optimal communication locations that minimize a desired distance metric. Simulation results verify the efficacy of the proposed controllers.

Full-text available at: <https://ieeexplore.ieee.org/document/8612974/>

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2.3. Selections of the IEEE Transactions on Automation Science and Engineering

VOLUME: 16, ISSUE: 4, October 2019

(1) Optimal Information Release for Mixed Opacity in Discrete-Event Systems

Authors: Behnam Behinaein ; Feng Lin ; Karen Rudie

Abstract: Opacity is a property of a system that captures whether certain event sequences (or certain states) are indistinguishable from other event sequences (or states) in the system. Opacity is used in analyzing privacy, secrecy, and other aspects of systems modeled by discrete-event systems. In this paper, we introduce the concept of minimal information release policies for non-opacity and the concept of mixed opacity. Mixed opacity policies are introduced as a holistic approach for solving problems that involve a combination of releasing information to make some objectives of the system opaque while making some other objectives non-opaque. We present a set of algorithms for information release under a mixed opacity policy. These algorithms compute policies in a system such that two given sublanguages are opaque, and at the same time, two other sublanguages in the same system are non-opaque. The application of mixed opacity is demonstrated on the Dining Cryptographers Problem. Note to Practitioners ^o™Many organizations and companies must deal with maintaining privacy and secrecy and the protection of their intellectual property while at the same time revealing information to their employees so that they can properly do their jobs. In addition, to maintain transparency, companies and organizations must also reveal information to the public. In this paper, discrete-event system^oØs modeling is used to produce policies that capture the balance between privacy and transparency.

Full-text available at: <https://ieeexplore.ieee.org/document/87347778>

(2) Structural Liveness Analysis of Automated Manufacturing Systems Modeled by S4PRs

Authors: Yanxiang Feng ; Keyi Xing ; MengChu Zhou ; Feng Tian ; Huixia Liu

Abstract: This paper presents a liveness analysis method for sequential automated manufacturing systems (AMSs), which can be modeled by a class of Petri nets named systems of sequential systems with shared resources (S 4 PR). We show that deadlocks in S 4 PR can be characterized by the saturation of its structural object named a perfect activity circuit (PA-circuits). Thus, S 4 PR is live if and only if no PA-circuits in it is saturated at all reachable states. A PA-circuits of an S 4 PR may not be saturated at any state; hence, we propose an integer linear program (ILP) to determine whether a PA-circuits can be saturated or not. Then an algorithm is proposed to compute the set of PA-circuits that may be saturated. This

presented method nontrivially generalizes deadlock characterization and liveness condition of ordinary Petri nets to a broader class of nonordinary ones. Note to Practitioners^o™In the context of AMS, liveness is the most important property since it implies that there is no partial deadlock during the system evolution, and hence, all part types can be produced smoothly. We study the problem of liveness for AMS with the most general resource allocation and flexible routing, which can be modeled by S 4 PRs or disjunctive/conjunctive (D/C) resource allocation systems (RASs). Given such a complex AMS, based on its Petri net model, this paper presents a sufficient and necessary liveness condition by utilizing the structural properties, and develops an algorithm to identify all the structural objects that may lead the systems to deadlocks. This paper is significant in liveness-enforcing supervisor design for S 4 PR.

Full-text available at: <https://ieeexplore.ieee.org/document/8688640>

(3) Interactive-Control-Model for Human-Computer Interactive System Based on Petri Nets

Authors: Zhijun Ding ; Haojie Qiu ; Ru Yang ; Changjun Jiang ; MengChu Zhou

Abstract: In human@Ccomputer interactive systems (HCISs), there are not only autonomous robots completely controlled by computers but also semiautonomous robots requiring human control. To avoid the errors in a procedure of interaction, a control model is needed. This paper proposes a systematic strategy with specific algorithms to construct an interactive-control-model based on Petri nets owing to their ability to describe concurrence and other system features. Instead of cumbersome iterations of deadlock detection in the existing studies, this paper introduces the concept of implicit constraints and the related implicit-conflict-marking-search algorithm to excavate them. In the algorithm, only the status of a single robot is needed to analyze the system instead of the status of all system components, which is an important innovation in this paper since this can well help one resolve the state explosion issue. Several examples are provided to show the feasibility of the proposed method. The proposed idea in this paper can be readily applied to practical HCISs. Note to Practitioners^o™This paper is motivated by the problem of avoiding unexpected situations that may cause industrial accidents in mobile robot systems. Practitioners need to have a control model of the system in order to solve this problem. Existing approaches usually find constraints of a mobile robot system while modeling, which increases the number of iterations. This paper suggests a new approach to find all constraints and then builds a control model for mobile robot systems systematically. With a control model, practitioners can obtain allowed or not allowed operations so as to avoid unexpected situations. Experimental results show the effectiveness of this approach.

Full-text available at: <https://ieeexplore.ieee.org/document/8653384>

(4) Comments "Predictability of Failure Event Occurrences in Decentralized Discrete-Event Systems and Polynomial-Time Verification"

Authors: Ratnesh Kumar ; Shigemasa Takai

Abstract: We show that the notion of copredictability studied in the considered paper is equivalent to the already existing notion of uniformly bounded coprognosability introduced in a 2010 article of Kumar and Takai. In fact, a weaker, more general notion of coprognosability, which does not need a uniform bound for prognosing an impending failure, was also introduced by Kumar and Takai in 2010. It was shown that for the case of regular languages, the two notions (the one with a uniform bound and the other without it) coincide. As a result, the algorithm for testing coprognosability for regular languages presented by Kumar and Takai in their 2010 paper also tests the copredictability concept in the considered paper, which presented a test of its own. Finally, the fact that copredictability is stronger than codiagnosability in the absence of unobservable cycles was also shown in the 2010 article of Kumar and Takai, and it is another result that is reproduced in the considered paper.

Full-text available at: <https://ieeexplore.ieee.org/document/8758793>

2.4. Selections of Control Engineering Practice VOLUME: 91, October 2019

(1) Fault diagnosis based on identified discrete-event models

Authors: Marcos V. Moreira ; Jean-Jacques Lesage

Abstract: Fault diagnosis of Discrete-Event Systems consists of detecting and isolating the occurrence of faults within a bounded number of event occurrences. Recently, a new model for discrete-event system identification with the aim of fault detection, called Deterministic Automaton with Outputs and Conditional Transitions (DAOCT), has been proposed in the literature. The model is computed from observed fault-free paths, and represents the fault-free system behavior. In order to obtain compact models, loops are introduced in the model, which implies that sequences that are not observed can be generated leading to an exceeding language. This exceeding language is associated with possible non-detectable faults, and must be reduced in order to use the model for fault detection. After detecting the fault occurrence, its isolation is carried out by analyzing residuals. In this paper, we present a fault diagnosis scheme based on the DAOCT model. We show that the proposed fault diagnosis scheme is more efficient than other approaches proposed in the literature, in the sense that the exceeding language can be drastically reduced, reducing the number of non-detectable fault

occurrences, and, in some cases, reducing also the delay for fault diagnosis. A practical example, consisting of a plant simulated by using a 3D simulation software controlled by a Programmable Logic Controller, is used to illustrate the results of the paper.

Full-text available at: <https://www.sciencedirect.com/science/article/abs/pii/S0967066119301170>

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2.5. Selections of Information Sciences VOLUME: 501, October 2019

(1) Supervisory control of a class of Petri nets with unobservable and uncontrollable transitions

Authors: Dan You ; ShouGuang Wang; Carla Seatzu

Abstract: This paper uses Petri nets (PNs) as a modeling tool to deal with the forbidden state problem of discrete event systems (DESS) in the presence of both unobservable and uncontrollable events. First of all, it is proved that two state specifications are equivalent if their admissible marking sets coincide. Motivated by this result, we focus on studying how to compute optimal policies with respect to a state specification that is an admissible linear constraint. Thanks to many approaches in the literature that allow one to efficiently transform an arbitrary linear constraint into an admissible one with the admissible marking set unchanged, the proposed result remains useful in the more general case of arbitrary linear constraints. Specifically, focusing on ordinary PNs subject to an admissible linear constraint, we propose an optimal control policy whose computation mainly lies in the computation of the unobservable minimal decrease, a parameter depending on the current observation and the given constraint. A procedure to compute such a parameter with polynomial complexity is proposed provided that a particular subnet, called observation subnet, is acyclic and backward-conflict and backward-concurrent free (BBF). As a result, under such assumptions, the optimal control policy could be computed with polynomial complexity.

Full-text available at: <https://www.sciencedirect.com/science/article/pii/S0020025518308156>

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2.6. Selections of the IEEE/CAA Journal of Automatica Sinica VOLUME: 6, ISSUE: 9, September 2019 (Contributed by: Mengchu Zhou)

(1) Guided Crowd Evacuation: Approaches and Challenges

Authors: Min Zhou, Hairong Dong, Petros A. Ioannou, Yanbo Zhao, Fei-Yue Wang

Abstract: Evacuation leaders and/or equipment provide route and exit information for people and guide them to the expected destinations,

which could make crowd evacuation more efficient in case of emergency. The purpose of this paper is to provide an overview of recent advances in guided crowd evacuation. Different guided crowd evacuation approaches are classified according to guidance approaches and technologies. A comprehensive analysis and comparison of crowd evacuation with static signage, dynamic signage, trained leader, mobile devices, mobile robot and wireless sensor networks are presented based on a single guidance mode perspective. In addition, the different evacuation guidance systems that use high-tech means such as advanced intelligent monitoring techniques, AI techniques, computer technology and intelligent inducing algorithms are reviewed from a system's perspective. Future researches in the area of crowd evacuation are also discussed.

Full-text available at: <https://ieeexplore.ieee.org/document/8823571>

(2) Modelling of a Human Driver's Interaction with Vehicle Automated Steering Using Cooperative Game Theory

Authors: Xiaoxiang Na, David J. Cole

Abstract: The introduction of automated driving systems raised questions about how the human driver interacts with the automated system. Non-cooperative game theory is increasingly used for modelling and understanding such interaction, while its counterpart, cooperative game theory is rarely discussed for similar applications despite it may be potentially more suitable. This paper describes the modelling of a human driver's steering interaction with an automated steering system using cooperative game theory. The distributed Model Predictive Control approach is adopted to derive the driver's and the automated steering system's strategies in a Pareto equilibrium sense, namely their cooperative Pareto steering strategies. Two separate numerical studies are carried out to study the influence of strategy parameters, and the influence of strategy types on the driver's and the automated system's steering performance. It is found that when a driver interacts with an automated steering system using a cooperative Pareto steering strategy, the driver can improve his/her performance in following a target path through increasing his/her effort in pursuing his/her own interest under the driver-automation cooperative control goal. It is also found that a driver's adoption of cooperative Pareto steering strategy leads to a reinforcement in the driver's steering angle control, compared to the driver's adoption of non-cooperative Nash strategy. This in turn enables the vehicle to return from a lane-change maneuver to straight-line driving swifter.

Full-text available at: <https://ieeexplore.ieee.org/document/8823572>

(3) Solving Multi-Area Environmental/Economic Dispatch by Pareto-Based Chemical-Reaction Optimization Algorithm

Authors: Junqing Li, Quanke Pan, Peiyong Duan, Hongyan Sang, and

Kaizhou Gao

Abstract: In this study, we present a Pareto-based chemical-reaction optimization (PCRO) algorithm for solving the multi-area environmental/economic dispatch optimization problems. Two objectives are minimized simultaneously, i.e., total fuel cost and emission. In the proposed algorithm, each solution is represented by a chemical molecule. A novel encoding mechanism for solving the multi-area environmental/economic dispatch optimization problems is designed to dynamically enhance the performance of the proposed algorithm. Then, an ensemble of effective neighborhood approaches is developed, and a self-adaptive neighborhood structure selection mechanism is also embedded in PCRO to increase the search ability while maintaining population diversity. In addition, a grid-based crowding distance strategy is introduced, which can obviously enable the algorithm to easily converge near the Pareto front. Furthermore, a kinetic-energy-based search procedure is developed to enhance the global search ability. Finally, the proposed algorithm is tested on sets of the instances that are generated based on realistic production. Through the analysis of experimental results, the highly effective performance of the proposed PCRO algorithm is favorably compared with several algorithms, with regards to both solution quality and diversity.

Full-text available at: <https://ieeexplore.ieee.org/document/7875277>

3. Conferences

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

3.1. 2019 Conference on Decision and Control
Nice, France, December 11–13, 2019
<https://cdc2019.ieeecss.org/>

3.2. 2020 Workshop on Discrete Event Systems
Rio de Janeiro, Brazil, May 13–15, 2020
<https://wodes2020.eventos.ufrj.br>

3.3. 2020 American Control Conference
Denver, Colorado, USA, July 1–3, 2020
<http://acc2020.a2c2.org>

3.4. 2020 IFAC World Congress
Berlin, Germany, July 12–17, 2020
<https://www.ifac2020.org>

4. Call For Papers

4.1. Invited Session in IFAC WC'20 on Cyber-Security and Safety of Discrete Event Systems

Dr. Xiang Yin and Dr. Kai Cai are planning to organize an invited session on "Cyber-Security and Safety of Discrete-Event Systems" at IFAC World Congress'20, to be held in Berlin, Germany, from July 12 to 17, 2020 (<https://www.ifac2020.org/>).

The objective of this invited session is to present recently developed novel approaches devoted to the analysis and design of safety-critical networked control systems using DES models. This session will be sponsored by IEEE CSS TC on Discrete Event Systems.

We seek submissions including but not limited to the following topics:

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

If you are interested, please contact Dr. Xiang Yin (yinxiang@sjtu.edu.cn) as soon as possible but no later than Oct. 13, 2019. The paper submission deadline is (currently) Oct. 31, 2019.

4.2. Open Invited Tracks in IFAC WC'20 on "Supervisory Control Theory and Reactive Synthesis for Cyber Physical System Design"

Abstract: Supervisory Control Theory (SCT) and Reactive Synthesis (RS) are two techniques for the automatic design of a digital system from a given specification which are recently applied to Cyber Physical System (CPS) design. Both methods mostly evolved independently in two distinct research fields, namely control theory and computer science. It is the main purpose of this invited session to enhance the mutual understanding of benefits and limitations of SCT and RS methods in the context of CPS design and to motivate collaborative efforts within their intersection.

Track proposed by: Schmuck, Anne-Kathrin; Cai, Kai

Code for submitting contributions: 853th

4.3. Open Invited Tracks in IFAC WC'20 on "Control for Computing Systems"

Abstract: Computing systems, large (data centers in the Cloud or HPC for scientific applications) or small (embedded architectures), have a growing need to be dynamically flexible and reconfigurable w.r.t. their environments and workloads, and to be automated with control loops in order to be efficient, safe and responsive. Whereas computing for control is a well-established domain, the converse control for computing systems is a relatively novel approach, explored only in recent years. The aim of this open invited track is to propose a multi-disciplinary gathering around computing systems as a new application area for control theory, with challenges in the modeling of these unfamiliar systems, and identification of the relevant control techniques for problems where automation has not been introduced yet.

This track targets computing systems as an application domain of various approaches to control design, e.g. Control Design, Nonlinear Control, Optimal Control, Robust Control, Discrete Event and Hybrid Systems.

Track proposed by: Kerrigan, Eric C.; Rutten, Eric

Code for submitting contributions: 4w968

4.4. Open Invited Tracks in IFAC WC'20 on "Control for Smart Cities"

Abstract: The modern societies have witnessed tremendous development and changing in cities in the past decades. Control has played critical component in this process. The purpose of this open invited track is to gather up-to-date models, methods, stories, and experiences in the field of Control for Smart Cities. There are indeed many exciting things going on in this field, from smart buildings to intelligent transportation, from mobility to healthcare, from water system to pollution control, from energy efficiency to cyber security, just to name a few. In order to make cities smart, a technological infrastructure is required to connect networks of sensors and actuators embedded throughout the urban terrain, and to interact with wireless mobile devices. Smart city is a great example for cyber-physical systems and internet of things. Development in these highly related fields are also welcome to this track, with a focus on the application to Control for Smart City.

Track proposed by: Jia, Qing-Shan; Dotoli, Mariagrazia; Parisio, Alessandra; Cassandras, Christos G.; Malikopoulos, Andreas

Code for submitting contributions: aiead

4.5. 2020 Workshop on Discrete Event Systems

The interdisciplinary field of Discrete Event Systems (DES) combines different formalisms, methodologies and tools from control, computer science and operations research. The research activity in this field is driven by the needs of many different applications domains:

manufacturing, process control, supervisory systems, software engineering, transportation, etc.

The 15th Workshop on Discrete Event Systems aims at providing researchers from different fields (control theoreticians and control engineers, software engineers and computer scientists, operations research specialists) with an opportunity to exchange information and new ideas, and to discuss new developments in the field of DES theory and applications.

The workshop will cover all topics in DES theory and applications, including (but not limited to) the following:

- Formalisms and modeling methodologies: Petri nets, automata, state charts, process algebras, max-plus algebra, queueing networks;
- Control of discrete-event systems with emphasis on supervisory control and on real time control;
- Performance evaluation, optimization and scheduling;
- Diagnosis, fault detection, test, identification;
- Discrete approaches for hybrid systems;
- Event-driven methods in systems and control;
- Applications including manufacturing systems, transportation systems, power production, distributed systems, software engineering, home automation, workflow, telecommunication systems, biological systems;
- Automation methods and software tools enabling efficient handling of industrial-sized systems.

WODES 2020 will be held at Military Institute of Engineering (IME), which, together with Polytechnic School of the Federal University of Rio de Janeiro, is the oldest engineering school of all Americas. It is located at the pleasant neighborhood of Urca, opposite to Praia Vermelha (Red Beach) and next to the Cable Station to Sugar Loaf. It stays a few minutes away from the famous beaches of Copacabana, Ipanema and Leblon.

Important Dates

- Special Session Proposals Due: October, 31st 2019
- Submission Site Opens: November, 10th 2019
- Initial Paper Submission Due: December, 16th 2019
- Decision Notification: February, 17th 2020
- Registration Site Opens: February, 24th 2020
- Final Submissions Due: March, 9th 2020

5. International Graduate School on Control

Introduction to Discrete Event Systems

Instructors: Stephane Lafortune, Christos Cassandras

Marseille, France, June 8–12, 2020

Registration:

<http://www.eeci-igsc.eu/>

Course summary:

Discrete event systems are dynamic systems with discrete state spaces and event-driven dynamics. They arise when modeling the high-level behavior of cyber-physical systems or when modeling computing and software systems. Discrete event models can be purely logical, or they may include timing and stochastic information. This course will have two parts.

In the first half, we will study logical discrete event systems, focusing primarily on automata models. We will consider estimation, diagnosability, and opacity analysis for partially-observed systems, then supervisory control under full and partial observation. In the second half, we will study the performance analysis, control, and optimization of timed DES, using stochastic timed automata models. We will describe the use of discrete event simulation and review elementary queueing theory and Markov Decision Processes used to study stochastic timed DES. We will then present Perturbation Analysis (PA) theory as a method to control and optimize common performance metrics for DES. Finally, we will explain how to extend DES into Hybrid Systems, limiting ourselves to basic modeling and simple extensions of PA theory.

No prior knowledge of discrete event systems will be assumed. The course will rely on the textbook co-authored by the instructors.

Course outline:

0. Overview of DES and contrast to time-driven systems
1. Introduction to discrete event modeling formalisms
2. Analysis of logical discrete event systems
3. Supervisory control under full and partial observation
4. Timed Models of DES
5. DES (Monte Carlo) computer simulation
6. Review of queueing theory and Markov Decision Processes
7. Perturbation Analysis and Rapid Learning methods
8. From DES to Hybrid Systems