IEEE CONTROL SYSTEMS SOCIETY TECHNICAL COMMITTEE ON DISCRETE EVENT SYSTEMS

Newsletter...................................... June 2016

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                              Editorial

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Welcome to the newsletter of the IEEE Control Systems Technical
Committee on Discrete Event Systems!

Personal note from the editor:

WELCOME TO THE JUNE 2016 NEWSLETTER.

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                              Activities
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2.1 Sponsored Activities

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2016 Conference on Decision and Control
Las Vegas, United States, Dec 12 - Dec 14, 2016
http://cdc2016.ieeecss.org/

2016 Multi-Conference on Systems and Control
Buenos Aires, Argentina, Sep 19 - Sep 22, 2016
http://www.msc2016.org/

2016 American Control Conference
Boston, United States, Jul 6 - Jul 8, 2016
http://acc2016.a2c2.org/

2.2 Technically Co-Sponsored activities

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14th International Conference on Control, Automation, Robotics and Vision (ICARCV
2016)
Phuket, Thailand, Nov 13 - Nov 15, 2016
http://www.icarcv.org/2016

20th International Conference on System Theory, Control and Computing (ICSTCC 2016)
Sinaia, Romania, Oct 13 - Oct 15, 2016
http://ace.ucv.ro/icstcc2016/

3rd Conference on Control and Fault-Tolerant Systems (SysTol' 16)
Barcelona, Spain, Sep 7 - Sep 9, 2016
http://systol16.cs2ac.upc.edu/

The 35th Chinese Control Conference
Chengdu, China, Jul 27 - Jul 29, 2016
http://ccc2016.swjtu.edu.cn/

2016 IEEE Conference on Norbert Wiener in the 21st Century: Thinking Machines in
the Physical World
Melbourne, Australia, Jul 13 - Jul 15, 2016
http://21stcenturywiener.org/

24th Mediterranean Conference on Control and Automation (MED' 16)
Athens, Greece, Jun 21 - Jun 24, 2016
http://www.med2016.org/

12th World Congress on Intelligent Control and Automation (WCICA 2016)
Guilin, China, Jun 12 - Jun 17, 2016
http://wcica2016.org/

2016 International Conference on Unmanned Aircraft Systems (ICUAS' 16)
Arlington, United States, Jun 7 - Jun 10, 2016
http://www.uasconferences.com/

2.3 DES TC meeting during ACC2016
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We are going to have our TC meeting this year during ACC' 2016 at Boston.

Date and time: 7am - 8am, July 7, 2016

Venue: Room Maine (light breakfast will be served)

Tentative Agenda:
1. Introduction — Missions of our Technical Committee;
2. Professor Lafortune will talk about the journal of Discrete Event Dynamic Systems;
3. Discussions on activities to promote the field of DES.

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Contributed by: Jin Dai (jdai1@nd.edu)

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(1) Safety Controller Synthesis for Incrementally Stable Switched Systems Using Multiscale Symbolic Models

Author: Antoine Girard, Gregor G?ssler, and Sebti Mouelhi

Abstract

We propose an approach to the synthesis of safety controllers for a class of switched systems, based on the use of multiscale symbolic models that describe transitions of various durations and whose sets of states are given by a sequence of embedded lattices approximating the state-space, the finer lattices being accessible only by transitions of shorter duration. We prove that these multiscale symbolic models are approximately bisimilar to the original switched system provided it enjoys an incremental stability property attested by the existence of a common Lyapunov function or of multiple Lyapunov functions with a minimal dwell-time. Then, for specifications given by a safety automaton, we present a controller synthesis algorithm that exploits the specificities of multiscale symbolic models. We formalize the notion of maximal lazy safety controller which gives priority to transitions of longer durations; the shorter transitions and thus the finer scales of the symbolic model are effectively explored only when safety cannot be ensured

at the coarser level and fast switching is needed. We propose a synthesis algorithm where symbolic models can be computed on the fly, this allows us to keep the number of symbolic states as low as possible. We provide computational evidence that shows drastic improvements of the complexity of controller synthesis using multiscale symbolic models instead of uniform ones.

Full-text available at:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7274688&filter%3DAND%28p_IS_Number%3A7478173%29

(2) Event-Triggered Stabilization of Linear Systems Under Bounded Bit Rates

Author: Pavankumar Tallapragada and Jorge Cort®¶s

Abstract

This paper addresses the problem of exponential practical stabilization of linear time-invariant systems with disturbances using event-triggered control and bounded communication bit rate. We consider both the case of instantaneous communication with finite precision data at each transmission and the case of non-instantaneous communication with bounded communication rate. Given a prescribed rate of convergence, the proposed event-triggered control implementations opportunistically determine the transmission instants and the finite precision data to be transmitted on each transmission. We show that our design exponentially practically stabilizes the origin while guaranteeing a uniform positive lower bound on the inter-transmission and inter-reception times, ensuring that the number of bits transmitted on each transmission is upper bounded uniformly in time, and allowing for the possibility of transmitting fewer bits at any given time if more bits than prescribed were transmitted earlier. We also characterize the necessary and sufficient average data rate for exponential practical stabilization. Several simulations illustrate the results.

Full-text available at:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7272079&filter%3DAND%28p_IS_Number%3A7478173%29

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JUN 2016

(1) Distributed event-triggered coordination for average consensus on weight-balanced digraphs

Author: Cameron Nowzari and Jorge Cort®¶s

Abstract

This paper proposes a novel distributed event-triggered algorithmic solution to the multi-agent average consensus problem for networks whose communication topology is described by weight-balanced, strongly connected digraphs. The proposed event-triggered communication and control strategy does not rely on individual agents having continuous or periodic access to information about the state of their neighbors. In addition, it does not require the agents to have a priori knowledge of any global parameter to execute the algorithm. We show that, under the proposed law, events cannot be triggered an infinite number of times in any finite period (i.e., no Zeno behavior), and that the resulting network executions provably converge to the average of the initial agents° Ø states exponentially fast. We also provide weaker conditions on connectivity under which convergence is guaranteed when the communication topology is switching. Finally, we also propose and analyze a periodic implementation of our algorithm where the relevant triggering functions do not need to be evaluated continuously. Simulations illustrate our results and provide comparisons with other existing algorithms.

Full-text available at:
http://www.sciencedirect.com/science/article/pii/S0005109816300164

(2) Distributed event-triggered control of diffusion semilinear PDEs

Author: Anton Selivanov and Emilia Fridman

Abstract

We introduce distributed event-triggered networked control of parabolic systems governed by semilinear diffusion PDEs. Sampled in time spatially distributed (either point or averaged) measurements are transmitted through a communication network to the controller only if a triggering condition is violated. We take into account quantization of the transmitted measurements and network-induced delays that are allowed to be larger than sampling intervals. We show that decentralized event-triggering mechanism can significantly reduce amount of transmitted measurements while preserving the system performance.

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SELECTIONS FROM DISCRETE EVENT DYNAMIC SYSTEMS: THEORY AND APPLICATIONS
VOLUME 26 ISSUE 2
JUN 2016

(1) Distributed supervisory control of discrete-event systems with communication delay

Author: Renyuan Zhang, Kai Cai, Yongmei Gan and W. M. Wonham

Abstract

This paper identifies a property of delay-robustness in distributed supervisory control of discrete-event systems (DES) with communication delays. In previous work a distributed supervisory control problem has been investigated on the assumption that inter-agent communications take place with negligible delay. From an applications viewpoint it is desirable to relax this constraint and identify communicating distributed controllers which are delay-robust, namely logically equivalent to their delay-free counterparts. For this we introduce inter-agent channels modeled as 2-state automata, compute the overall system behavior, and present an effective computational test for delay-robustness. From the test it typically results that the given delay-free distributed control is delay-robust with respect to certain communicated events, but not for all, thus distinguishing events which are not delay-critical from those that are. The approach is illustrated by a workcell model with three communicating agents.

(2) Minimal sensor activation and minimal communication in discrete-event systems

Author: David Sears and Karen Rudie

Abstract

This paper is an overview of the current research on minimal sensor activation and minimal communication in discrete-event systems. In problems of sensor activation agents observing a discrete-event system can turn the sensors for their observable

events on or off dynamically. In problems of communication agents observing a discrete-event system can communicate event observations to one another dynamically. In both cases, a result is that the observations made by an agent are dynamic. That is, whether or not an agent observes an event or receives a communication is dependent on other factors besides membership of certain events to certain predefined sets. We survey such problems and associated works where, additionally, the use of event sensors and communication of messages must be minimized with respect to certain criteria. The application areas considered are the diagnosis, state disambiguation and state estimation of discrete-event systems.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-015-0212-3

(3) On just-in-time control of timed event graphs with input constraints: a semimodule approach

Author: Guilherme Gomes da Silva and Carlos Andrey Maia

Abstract

Timed event graph (TEG) is a subclass of timed Petri nets that can be used to model discrete event systems subject to synchronization and time delay phenomena. Just-in-Time control in TEG can be defined as the determination of latest admission date of resources in order to respect a given demand profile. In this paper this kind of control problem is studied in situations in which the input dynamics are constrained to a given semimodule (a kind of linear vector space in a semiring context). We give necessary and sufficient conditions to solve the problem and present two computational methods to solve it. Application examples are presented to illustrate the applicability of the results.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-014-0200-z

(4) Infinitesimal perturbation analysis of a single-stage fluid queue with loss feedback and non-responsive competing traffic

Author: Richelle V. Adams

Abstract

In this paper we perform Infinitesimal Perturbation Analysis (IPA) for a single-stage stochastic fluid queue that is shared between two competing sources, one that employs additive loss-feedback congestion control and the other that

employs no congestion-control (i.e., it is unresponsive). This scenario is applicable within the realm of computer communication networks particularly at bottleneck router queues where multiple and diverse flows compete for bandwidth. We optimize the tradeoff between total loss volume and queue workload (a measure for queueing delay). Although a sound knowledge of the system°Øs dynamics is required to derive the IPA gradient estimators, no knowledge of the underlying probability distributions governing the system is required. What results are fairly simple counting processes, whose values can be computed directly from an ongoing live stream of traffic.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-014-0203-9

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SELECTIONS FROM INTERNATIONAL JOURNAL OF CONTROL
PUBLISHED ONLINE MAY AND JUNE 2016

(1) Observer-based Event-driven Fault-tolerant Control for a Class of System with State-dependent Uncertainties

Author: J. Feng and N. Li

Abstract

The method of designing an event-driven observer-based fault-tolerant controller is addressed for a state-dependent system with external disturbance and fault in this paper. An event-driven criterion is proposed to determine the updating of the controller based on the state of the Luenberger-type state-dependent observer. As a result, communication resources can be saved significantly while the desired H° fi performance is preserved. The observer error closed-loop system is rewritten as a time-varying delayed system. By employing a state-dependent integral function to be a Lyapunov function candidate, the error system is proved to be asymptotically stable. The observer gain, the controller gain and the event parameters in the event condition can be co-designed and obtained in terms of solution to a set of linear matrix inequalities(LMIs). At last, a numerical example and the tunnel diode circuit model are shown that the proposed method is effective, and the simulation results can reflect that the event-triggered scheme can lead to a larger release period than time triggering scheme.

Full-text available at:
http://www.tandfonline.com/doi/abs/10.1080/00207179.2016.1190986

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