

Newsletter..... February 2016

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Editorial

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

Personal note from the editor:

WELCOME TO THE FEBRUARY 2016 NEWSLETTER.

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Activities

2.1 Sponsored Activities

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 \blacklozenge 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 \blacklozenge 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 \blacklozenge 16)

Arlington, United States, Jun 7 – Jun 10, 2016

<http://www.uasconferences.com/>

13th International Workshop on Discrete Event Systems (WODES 2016)
Xi'an, China, May 30 – Jun 1, 2016
<http://wodes2016.diee.unica.it/>

2016 5th International Conference on Systems and Control (ICSC'16)
Marrakech, Morocco, May 25 – May 27, 2016
<http://lias.labo.univ-poitiers.fr/icsc/icsc2016/>

14th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and
Wireless Networks
Tempe, United States, May 9 – May 13, 2016
<http://www.wi-opt.org/>

Announcement

Title: DESpot 1.6.0-1 Released With Support for DES Templates

Contributed by: Ryan Leduc (leduc@mcmaster.ca)

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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.

New to DESpot 1.6.0-1 is the addition of support for defining template DES, and then instantiating multiple copies for flat or HISC projects. If you have multiple DES identical up to relabelling, this will be a big time saver. This version also includes several important bug fixes for the HISC project interface.

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

DESpot Features:

- * Supports flat DES projects and HISC projects, including low data events.
- * DESpot comes with a detailed help browser. A web version, including many screen shots, can be found here:

<http://www.cas.mcmaster.ca/~leduc/despotHF/resources/helpfiles/HelpBrowser.htm>
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- * DESpot has a graphical DES editor, including export to postscript, and PNG graphic formats.
- * DESpot can verify the three main HISC properties individually, or as a group using the "Check Project" menu item. Check project runs each property check in a separate thread, so if you have a quad-core CPU, you could see around a 3x speedup.
- * DESpot now includes the bddHISC algorithms. bddHISC can verify an HISC project, or do HISC synthesis using binary-decision diagram (BDD) based algorithms capable of handling individual components at least as large as 10^{15} states.
- * DESpot allows the entry of timed DES (TDES) projects for use with sampled-data supervisory control.
- * DESpot has a built in DES simulator that includes graphical simulation of the DES. DESpot can also use the HISC structure to accelerate the simulation.
- * DESpot supports multi-level HISC projects including experimental support for multi-level HISC with low data events for the non-BDD algorithms. Multi-level synthesis is not yet supported.
- * 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, Windows, and Mac OS X.

Selections of Journal Publications

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

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Selections from the IEEE Transactions on Automatic Control
VOLUME: 61, ISSUE: 2,
FEBRUARY 2016

(1) Corrective Control of Composite Asynchronous Sequential Machines Under Partial Observation

Authors: Jung-Min Yang

Abstract

In this note, we address the corrective control problem of composite asynchronous sequential machines. A number of input/state asynchronous machines subject to adversarial inputs form cascade compositions, wherein their states are unobservable except for the final state. The objective is to design a corrective controller so that the closed-loop system maintains the normal input/output behavior against unauthorized state transitions caused by adversarial inputs. The existence of a controller depends on finding an input sequence that achieves the deterministic corrective action while accommodating uncertainty under partial observation.

Full-text available at:

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7117364&filter%3DAND%28p_IS_Number%3A7393629%29

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SELECTIONS FROM THE IEEE TRANSACTIONS ON CONTROL SYSTEMS

TECHNOLOGY

VOLUME: 24 ISSUE: 2
MARCH 2016

(1) Robust Landing and Sliding Maneuver Hybrid Controller for a Quadrotor Vehicle

Authors: David Cabecinhas, Roberto Naldi, Carlos Silvestre, Rita Cunha, and Lorenzo Marconi

Abstract

This paper addresses the design and experimental evaluation of a robust controller for a quadrotor landing maneuver comprising the approach to a landing slope and sliding on that slope, before coming to a complete halt. During the critical landing flight phase, the dynamics of the vehicle change with the type of contact with the ground, and a hybrid automaton, whose states reflect the several dynamic behaviors of the quadrotor, is employed to model the vehicle throughout the complete maneuver. The quadrotor landing problem is broken down as separate maneuver generation and robust trajectory tracking problems, which are combined to achieve a successful maneuver that is robust to possible uncertainties. The experimental results are provided to attest to the feasibility of the proposed landing procedure.

Full-text available at:

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7243336&filter%3DAND%28p_IS_Number%3A7410136%29

(2) Optimal Control of Multiroom HVAC System: An Event-Based Approach

Authors: Zijian Wu, Qing-Shan Jia and Xiaohong Guan

Abstract

Building energy saving is of great practical interest due to the increasing energy consumption in buildings. The optimal control of the heating, ventilation, and air-conditioning (HVAC) systems leads to great energy saving potential. However, this problem is challenging due to the exponentially increasing state space and policy space. In this brief, we consider this important problem and make the following major contributions. First, we formulate the multiroom HVAC control problem as an event-based optimization, where decisions are made only when certain events occur. The size of the event space is significantly smaller than that of the state space. Second, to further simplify the calculation process, we develop an approximate solution method which focuses on local-event-based policies. These policies control the terminal devices in a room using solely the information in that room. Third, we demonstrate the performance of this method through two sets of numerical examples. In the small-scale two-room example, it is shown that our method can achieve a near-optimal solution. In the large-scale example, it is shown that the local-event-based approach can achieve a policy which is better than the threshold-based control method, hysteresis control method, and predictive control method.

Full-text available at:

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7165607&punumber%3D87%26filter%3DAND%28p_IS_Number%3A7410136%29%26pageNumber%3D2

SELECTIONS FROM THE IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS:
SYSTEMS

VOLUME 46, ISSUE 2

FEBRUARY 2016

(1) On Qualitative Analysis of Fault Trees Using Structurally Persistent Nets

Authors: Ricardo J. Rodríguez

Abstract

A fault tree (FT) defines an undesired top event, characterizing it using logic combinations of lower-level undesired events. In this paper, we focus on coherent FTs, i.e., the logic is restricted to AND/OR formulas. FT analysis is used to identify and assess the minimal cut sets (MCSs) of an FT, which define the minimal set of events leading to the undesired state. The dual of MCS is minimal path set (MPS). MCS and MPS are commonly used for qualitative evaluation of FTs in safety and reliability engineering. This paper explores computation of the MCS/MPS of an FT by means of structural analysis (namely, computation of minimal p-semiflows) of a Petri net (PN) that represents the FT. To this end, we propose a formal definition of a coherent FT and a transformation from this model to a PN subclass (namely, structurally persistent nets). We also prove the relationship between minimal p-semiflows and MCS/MPS in an FT. In addition, we propose an algorithm that uses linear programming techniques to compute the MCS/MPS in an FT. Finally, we put our findings into practice by qualitatively evaluating the FT of a pressure tank system.

Full-text available at:

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7122350&filter%3DAND%28p_IS_Number%3A7381703%29

(2) The Reversible Released Form of Petri Nets and Its Applications to Soundness of Workflow Nets

Authors: Ferucio Laurentiu Tiplea and Ioana Leahu

Abstract

The reversible released form (RRF) of Petri nets is introduced as an extension of the released form. This new form introduces undo transitions in order to reverse the effect of some of the transitions of the original Petri net. It is shown that the RRF preserves the soundness property of workflow (WF) nets: a WF net is sound if and only if its RRF is sound too. Then, various properties of the RRF of circuit-based Petri nets are investigated, and complexity results of the soundness property of circuit-based WF nets are derived.

Full-text available at:

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7108043&filter%3DAND%28p_IS_Number%3A7381703%29

SELECTIONS FROM AUTOMATICA

VOLUME 64

FEBRUARY 2016

(1) Compartmental flow control: Decentralization, robustness and optimality

Authors: Franco Blanchini, Elisa Franco, Giulia Giordano, Vahid Mardanlou and Pier Luca Montessoro

Abstract

We consider the flow control problem for a general class of compartmental nonlinear systems, which can be associated with a graph whose nodes represent subsystems with their own internal dynamics, and whose arcs represent flow links among them. We consider a network-decentralized control: each agent controls a link between two nodes and decides its actions based on the states of these nodes only. We first provide general necessary and sufficient stabilizability conditions, proving that suitable network-decentralized strategies assure robust stability. We also show that, if all the subsystems at the nodes are marginally stable, a proper network-decentralized strategy asymptotically assures the minimum-norm flow, without requiring communication among agents.

Full-text available at:

<http://www.sciencedirect.com/science/article/pii/S000510981500446X>

SELECTIONS FROM DISCRETE EVENT DYNAMIC SYSTEMS: THEORY AND APPLICATIONS
ARTICLES NOT ASSIGNED TO AN ISSUE

(1) On-line compositional controller synthesis for AGV

Authors: Johan Girault, Jean-Jacques Loiseau and Olivier H. Roux

Abstract

This paper deals with the on-line design of a supervisor to coordinate an automated guided vehicle (AGV) fleet. This supervisor ensures the system safety (no collision) and a good coordination between vehicles (no blocking situations). It is the so-called Wonham-Ramadge supervisor, it is the least restrictive, and ensures controllability and nonblocking. We propose a compositional procedure to resolve this problem allowing an efficient on-line synthesis. A calculation on the fly is made at every attribution of a new mission for an AGV, to actualize the supervisor and adapt it to the new situation. This compositional approach allows to increase the number of AGV taken on compared to the monolithic approach. We show on some tests the efficiency of this method for the on-line synthesis of supervisor to coordinate a fleet of mobile robots for real cases.

Full-text available at:

<http://link.springer.com/article/10.1007/s10626-015-0222-1>

(2) Supervisory control synthesis for deterministic context free specification languages Enforcing controllability least restrictively

Authors: Anne-Kathrin Schmuck, Sven Schneider, Jörg Raisch and Uwe Nestmann

Abstract

This paper describes two steps in the generalization of supervisory control theory to situations where the specification is modeled by a deterministic context free language (DCFL). First, it summarizes a conceptual iterative algorithm from Schneider et al. (2014) solving the supervisory control problem for language models. This algorithm involves two basic iterative functions. Second, the main part of this paper presents an implementable algorithm realizing one of these functions, namely the calculation of the largest controllable marked sublanguage of a given DCFL. This algorithm least restrictively removes controllability problems in a deterministic pushdown automaton realizing this DCFL.

Full-text available at:

<http://link.springer.com/article/10.1007/s10626-015-0221-2>

(3) Synchronizing sequences on a class of unbounded systems using synchronized Petri nets

Authors: Marco Pocci, Isabel Demongodin, Norbert Giambiasi and Alessandro Giua

Abstract

Determining the state of a system when one does not know its current initial state is a very important problem in many practical applications as checking communication protocols, part orienteers, digital circuit reset, etc. Synchronizing sequences have been proposed in the 60s to solve the problem on systems modeled by finite state machines. This paper presents a first investigation of the synchronizing problem on unbounded systems, using synchronized Petri nets, i. e., nets whose evolution is driven by external input events. The proposed approach suffers from the fact that no finite space representation can exhaustively answer to the reachability problem but we show that synchronizing sequences may be computed for a particular class of unbounded synchronized Petri nets.

Full-text available at:

<http://link.springer.com/article/10.1007/s10626-016-0225-6>

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SELECTIONS FROM INTERNATIONAL JOURNAL OF CONTROL
PUBLISHED ONLINE JANUARY AND FEBRUARY 2016

(1) Decentralised consensus for multiple Lagrangian systems based on event-triggered strategy

Authors: Xiangdong Liu, Changkun Du, Pingli Lu and Dapeng Yang

Abstract

This paper considers the decentralised event-triggered consensus problem for multi-agent systems with Lagrangian dynamics under undirected graphs. First, a distributed, leaderless, and event-triggered consensus control algorithm is presented based on the definition of generalised positions and velocities for all agents. There is only one triggering function for both the generalised positions and velocities and no Zeno behaviour exhibited under the proposed consensus strategy. Second, an adaptive event-triggered consensus control algorithm is proposed for such multi-agent systems with unknown constant parameters. Third, based on sliding-mode method, an event-triggered consensus control algorithm is

considered for the case with external disturbance. Finally, simulation results are given to illustrate the theoretical results.

Full-text available at:

<http://www.tandfonline.com/doi/full/10.1080/00207179.2015.1118663>

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