IEEE CONTROL SYSTEMS SOCIETY TECHNICAL COMMITTEE ON DISCRETE EVENT SYSTEMS

Newsletter..... May 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 MAY 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

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 (SysTol16)
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 (MED16)
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 (ICUAS16)
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/

Selections of Journal Publications

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

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Selections from the IEEE Transactions on Automatic Control
VOLUME: 61, ISSUE: 5,
MAY 2016

(1) Synthesis of Maximally Permissive Supervisors for Partially-Observed Discrete-Event Systems

Author: Xiang Yin and Stephane Lafortune

Abstract

We present new results on the synthesis of safe, non-blocking, and maximally permissive supervisors for partially observed discrete event systems. We consider the case where the legal language is a non-prefix-closed sublanguage of the system language, i.e., non-blockingness must be ensured in addition to safety. To solve this problem, we define a new bipartite transition system, called the Non-blocking All Inclusive Controller (NB-AIC), that embeds all safe and non-blocking supervisors. We present an algorithm for the construction of the NB-AIC and discuss its properties. We obtain the necessary and sufficient conditions for the

solvability of the maximally permissive control problem. We then provide a synthesis algorithm, based on the NB-AIC, that constructs a supervisor that is safe, non-blocking and maximally permissive, if one exists. This is the first algorithm with such properties.

Full-text available at:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7165606&filter%3DAND%28p_IS_Number%3A7458216%29

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SELECTIONS FROM AUTOMATICA
VOLUME: 67
APR 2016

(1) A Unified Approach to Time-aggregated Markov Decision Processes

Author: Yanjie Lia and Xinyu Wu

Abstract

This paper presents a unified approach to time-aggregated Markov decision processes (MDPs) with an average cost criterion. The approach is based on a framework in which a time-aggregated MDP constitutes a semi-Markov decision process (SMDP). By analyzing the performance sensitivity formulas of this SMDP, a number of optimization algorithms for time aggregated MDPs, including those previously reported in the literature, can be developed in a simple and intuitive way.

Full-text available at:
http://www.sciencedirect.com/science/article/pii/S0005109815005543

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SELECTIONS FROM THE IEEE Transactions on Control Systems Technology
VOLUME:24, ISSUE: 3
MAY 2016

(1) Optimal-Behavior-Based Dynamic Calibration of the Automotive Diesel Engineg

Author: Ke Fang, Zongyan Li, Kamil Ostrowski, A. Thomas Shenton, Peter G. Dowell, and Richard M. Sykes

Abstract

This paper presents a novel automotive engine management system (EMS) calibration methodology for rapid dynamometer test-bed data collection and mapping I.C. engine controllers with significant dynamic and transient performance requirements. This paper applies the methodology to an industrial state of the art WAVE-RT model of a 1.5 L Turbo EU6.1 Diesel engine acting as a virtual dynamometer based engine. The approach directly yields a feedforward controller in a nonlinear polynomial structure that can be either directly implemented in the EMS or converted into a dynamic or static lookup table format. The methodology is based on multistage blackbox modeling and dynamic system optimization. The process can exploit the power of global constrained numerical optimization codes and use system identification techniques with dynamic design of experiments. The objective of the engine controller optimization is to improve the fuel economy while maintaining specified (legislated) limits on emissions and map smoothness for driveability. The key contribution is a novel approach to obtaining a feedforward dynamic calibration controller from the system identification of the computed optimal behavior. Model structure selection techniques are shown to be usefully employed to further improve the accuracy of the system identification and so enhance the control performance of the dynamic controllers. The results indicate that the dynamic calibration methodology leads to a considerably reduced requirement for testing time and an improvement of between 1.9% and 2.6% in fuel economy over extra urban driving cycle without violating the emission constraints compared with current steady-state model-based calibration methods.

Full-text available at:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7283576&filter%3DAND%28p_IS_Number%3A7454797%29

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SELECTIONS FROM THE IEEE Transactions on Systems, Man, and Cybernetics: Systems
VOLUME 46 ISSUE 5
MAY 2016

(1) Sleptsov Nets Run Fast

Author: Dmitry A. Zaitsev

Abstract

We show that Sleptsov place-transition nets (that allow transition firing in multiple instances at a step) run fast by implementing multiplication and division operations in polynomial time. In comparison, Petri nets (PNs) implement the mentioned operations in exponential time. Moreover, PNs are obtained as a special case of Sleptsov nets (SNs) using loops with places having unit marking attached to each transition. In addition, we develop basics of an SN programming technology including basic operations and program composition rules. We provide examples of programs written in SN language for encryption/decryption with the RSA algorithm, calculation of fuzzy logic functions, and parallel calculation of the solutions to Laplace equations. SN computers promise hyper-performance because of a concurrent programming style consisting of a concise graphical language and small granulation of parallel processes on the level of separate events.

Full-text available at:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7145481&filter%3DAND%28p_IS_Number%3A7452440%29

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

(1) Block-structured supermarket models

Author: Quan-Lin Li and John C.S. Lui

Abstract

Supermarket models are a class of parallel queueing networks with an adaptive control scheme that play a key role in the study of resource management of, such as, computer networks, manufacturing systems and transportation networks. When the arrival processes are non-Poisson and the service times are non-exponential, analysis of such a supermarket model is always limited, interesting, and challenging.

This paper describes a supermarket model with non-Poisson inputs: Markovian Arrival Processes (MAPs) and with non-exponential service times: Phase-type (PH) distributions, and provides a generalized matrix-analytic method which is first combined with the operator semigroup and the mean-field limit. When discussing such a more general supermarket model, this paper makes some new results and advances as follows: (1) Providing a detailed probability analysis for setting up an infinite-dimensional system of differential vector equations satisfied by the expected fraction vector, where the invariance of environment factors is given as an important result. (2) Introducing the phase-type structure to the operator semigroup and to the mean-field limit, and a Lipschitz condition can be established by means of a unified matrix-differential algorithm. (3) The matrix-analytic method is used to compute the fixed point which leads to performance computation of this system. Finally, we use some numerical examples to illustrate how the performance measures of this supermarket model depend on the non-Poisson inputs and on the non-exponential service times. Thus the results of this paper give new highlight on understanding influence of non-Poisson inputs and of non-exponential service times on performance measures of more general supermarket models.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-014-0199-1

(2) Towards railway traffic management using switching Max-plus-linear systems

Author: Bart Kersbergen, J��nos Rudan, Ton van den Boom, and Bart De Schutter

Abstract

In this paper we present a railway traffic model and a model predictive controller for online railway traffic management of railway networks with a periodic timetable. The main aim of the controller is to recover from delays in an optimal way by changing the departure of trains, by breaking connections, by splitting joined trains, and - in the case of multiple tracks between two stations - by redistributing the trains over the tracks. The railway system is described by a switching max-plus-linear model. We assume that measurements of current running and dwell times and estimates of future running times and dwell times are continuously available so that they can be taken into account in the optimization of the system��s control variables. The switching max-plus-linear model railway model is used to determine optimal dispatching actions, based on the prediction of the future arrival and departure times of the trains, by recasting the dispatching problem as a Mixed Integer Linear Programming (MILP) problem and solving it. Moreover, we use properties from max-plus algebra to rewrite and reduce the model such that the MILP problem can be solved in less time. We also apply the algorithm to a model of the Dutch railway network.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-014-0205-7

(3) Synchronization of a class of cyclic discrete-event systems describing legged locomotion

Author: Gabriel A. D. Lopes, Bart Kersbergen, Bart De Schutter, Ton van den Boom, and Robert Babuska

Abstract

It has been shown that max-plus linear systems are well suited for applications in synchronization and scheduling, such as the generation of train timetables, manufacturing, or traffic. In this paper we show that the same is true for multi-legged locomotion. In this framework, the max-plus eigenvalue of the system matrix represents the total cycle time, whereas the max-plus eigenvector dictates the steady-state behavior. Uniqueness of the eigenstructure also indicates uniqueness of the resulting behavior. For the particular case of legged locomotion, the movement of each leg is abstracted to two-state circuits: swing and stance (leg in flight and on the ground, respectively). The generation of a gait (a manner of walking) for a multi-legged robot is then achieved by synchronizing the multiple discrete-event cycles via the max-plus framework. By construction, different gaits and gait parameters can be safely interleaved by using different system matrices. In this paper we address both the transient and steady-state behavior for a class of gaits by presenting closed-form expressions for the max-plus eigenvalue and max-plus eigenvector of the system matrix and the coupling time. The significance of this result is in showing guaranteed stable gaits and gait switching, and also a systematic methodology for synthesizing controllers that allow for legged robots to change rhythms fast.

Full-text available at:
http://link.springer.com/article/10.1007/s10626-014-0206-6

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SELECTIONS FROM INTERNATIONAL JOURNAL OF CONTROL
ONLINE PUBLICATION MAY

(1) Disturbance attenuation for Markov jump linear system over an additive white Gaussian noise channel

Author: Yang Song, Jie Yang, Min Zheng, and Chen Peng

Abstract

This paper studies the stabilisability and the performance of stochastic disturbance attenuation of a Markov jump linear system whose feedback channel is subject to an additive white Gaussian noise. First an inequality of differential entropy of random vectors under Markov switching is presented. Then by the concept of entropy power and the theory of information, a necessary condition to stabilise the system is obtained. This requires that the signal-to-noise ratio in the feedback channel is bigger than a specified value. Furthermore, to evaluate the performance of disturbance attenuation, a lower bound of the maximum fluctuation of the system state is presented.

Full-text available at:
http://www.tandfonline.com/doi/full/10.1080/00207179.2016.1164343

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