复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四十三届复杂系统与网络科学研究中心论坛

The Forty-third Workshop of Research Center for Complex Systems and Network Sciences

2020 年 10 月 17 日（14:00-16:40）

程

序

册

论坛资助：国家自然科学基金委
东南大学数学双一流学科建设
东南大学十大科学技术问题专项经费：网络群体智能
东南大学数学学院

主办：东南大学复杂系统与网络科学研究中心
江苏省网络群体智能重点实验室 数学学院
复杂工程系统测量与控制教育部重点实验室 自动化学院
复杂网络应用与安全研究中心 网络空间安全学院
东南大学

Inquiry: Simone Baldi (103009004@seu.edu.cn)

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时间：2020 年 10 月 17 日，周六（14:00-16:40）
地点：榴园宾馆二楼东大厅（江苏省南京市玄武区进香河路 38 号）
Zoom 会议号：67132877766
会议密码：844791
参会链接:https://zoom.com.cn/j/67132877766

Towards the Design of Safety Critical Cyber Physical Systems: A Formal Approach

Xiang Yin (殷翔), Shanghai Jiao Tong University

14:00-14:30

Subspace Identification of Dynamical Network Systems

Chengpu Yu (俞成浦), Beijing Institute of Technology

14:30-15:00

Distributionally Robust Fault Detection for Linear Stochastic Systems

Yiming Wan (万一鸣), Huazhong University of Science and Technology

15:00-15:30

15:30-15:40 Coffee break

Control, Optimization and Planning of Max-Plus Linear Systems

Jia Xu (许佳), Tongji University

15:40-16:10

Adaptive Control for Switched Linear Systems

Shuai Yuan (袁帅), Harbin Institute of Technology

16:10-16:40

Inquiry: Simone Baldi (103009004@seu.edu.cn)

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Towards the Design of Safety Critical Cyber Physical Systems: A Formal Approach

Xiang Yin (殷翔), Shanghai Jiao Tong University

Abstract

Cyber-physical systems are at the core of key infrastructure in our society. Ever-increasing demands for safety, security, and certification of these critical systems put stringent constraints on their design and necessitate the use of formal model-based approaches. This talk presents recently developed formal methodologies for analysis and control of cyber-physical systems. We focus on the design of safety-critical cyber-physical systems. We will present correct-by-construction design approach for controller synthesis. Then we will discuss how to use formal model-based approach for the purpose of fault diagnosis. Finally, we will discuss how to leverage formal techniques for security analysis of CPS.

About the Speaker

Xiang Yin was born in Anhui, China, in 1991. He received the B.Eng degree from Zhejiang University in 2012, the M.S. degree from the University of Michigan, Ann Arbor, in 2013, and the Ph.D degree from the University of Michigan, Ann Arbor, in 2017, all in Electrical Engineering. He joined the Department of Automation, Shanghai Jiao Tong University in 2017, where is an Associate Professor. His research interests include control and diagnosis of discrete-event systems, formal methods, security and their applications to cyber and cyber-physical systems. Dr. Yin received the Outstanding Reviewer Awards from Automatica, the IEEE Transactions on Automatic Control and the Journal of Discrete Event Dynamic Systems. Dr. Yin also received the IEEE Conference on Decision and Control (CDC) Best Student Paper Award Finalist in 2016. He is the co-chair of the IEEE CSS Technical Committee on Discrete Event Systems. He is also a member of the IEEE CSS Conference Editorial Board. Dr. Yin received the Thousand Youth Plan in 2017.

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Subspace Identification of Dynamical Network Systems

Chengpu Yu(俞成浦), Beijing Institute of Technology

Abstract

Along with the popular application of network systems in all sorts of research areas, the network model identification becomes a hot research topic in the system identification community. The identification problems of small-scale and large-scale network systems are discussed separately. (i) The small-scale network identification (or gray-box identification) boils down to solving a non-convex optimization problem. A low-rank optimization approach is presented which can yield good initial estimates, resulting in more chances to reach the global optimal solution to the non-convex optimization problem. (ii) To deal with the identification of a large-scale network system, the network is partitioned into many subnetworks and each subnetwork is to be identified using its own input and output data. A spatio-temporal subspace identification method is proposed for the subnetwork identification, and sufficient conditions are provided for the consistent identification.

About the Speaker

Chengpu Yu received the Ph.D. degree in electrical engineering from Nanyang Technological University, Singapore, in 2014. From June 2014 to August 2017, he has been a PostDoc at Delft Center for Systems and Control. Since 2018, he has been with Beijing Institute of Technology as a full Professor. His research interests include system identification and distributed optimization. So far, he has published more than 20 first-author papers on renowned journals in the system control area, and he is recipient of several research fundings supported by NSFC.

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Distributionally Robust Fault Detection for Linear Stochastic Systems

Yiming Wan (万一鸣), Huazhong University of Science and Technology

Abstract

The practical application of any statistical fault detection (FD) method has to address the unavailability of noise probability distributions. Although such probability distributions can be estimated from data, the inexactness of estimated distributions is unavoidable due to limited data size. This talk will present a distributionally robust approach to the design of a statistical FD test subject to inexact distribution information. It introduces moment-based and entropy-based ambiguity sets to describe the inexact distribution information. Over such ambiguity sets, a scalar FD test is designed to maximize the worst-case fault detection rate (FDR) while ensuring a predefined worst-case false alarm rate (FAR). Extensions to a vector FD test is also included for further performance improvement. The design using the moment-based ambiguity set has a closed-form solution, but it is more conservative than using the entropy-based ambiguity set. A continuous stirred tank reactor example is used to demonstrate the efficacy of the proposed design compared to the celebrated generalized likelihood ratio test.

About the Speaker

Yiming Wan is currently an Associate Professor in the School of Artificial Intelligence and Automation, Huazhong University of Science and Technology, Wuhan, China. He received the Ph.D. degree in Control Science & Engineering from Tsinghua University in 2013. From 2013 to 2016, he was a postdoc researcher at Delft Center for Systems and Control, the Delft University of Technology, The Netherlands. During 2016-2018, he was a Research Associate at Department of Chemical Engineering, Massachusetts Institute of Technology, the United States. His main research interests include fault diagnosis, optimal and robust estimation.

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Control, Optimization and Planning of Max-Plus Linear Systems

Jia Xu (许佳), Tongji University

Abstract

Many man-made complex systems can be modeled as discrete-event systems, where the evolution of the systems are driven by the occurrence of events. This talk discusses a modeling framework for discrete-event systems called max-plus algebra, including max-plus linear (MPL) systems, stochastic MPL systems, and switching MPL systems. Several approaches for the optimal control problem of those systems are also presented.

About the Speaker

Jia Xu received the BSc degree from the School of Mathematics and Statistics, Shandong University at Weihai and then became a master student in Tongji University. She received the PhD degree from the Delft Center for Systems and Control, Delft University of Technology, The Netherlands. Currently, she is a postdoc at the Department of Control Science and Engineering, College of Electronic and Information Engineering, Tongji University. Her current research interests include control of discrete-event and hybrid systems, model predictive control, optimization, distributed control.

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Adaptive Control for Switched Linear Systems

Shuai Yuan (袁帅), Harbin Institute of Technology

Abstract

As a special class of hybrid systems, switched systems can be utilized to model complex systems that are characterized by hybrid dynamics and arise in many fields, covering automotive industry, aircraft and air traffic, and smart buildings, etc. The talk will begin with a motivation example in smart buildings that is subject to switching dynamics and parametric uncertainties. Furthermore, different adaptive control schemes will be introduced to address the parametric uncertainties of switched systems, which involves some techniques based on linear interpolation, differential Lyapunov equations, and differential Riccati equations. In the end, a practical example with an automatic HVAC system will be used to illustrate the adaptive control schemes.

About the Speaker

袁帅，哈尔滨工业大学航天学院副教授、硕士生导师。他于 2011 年 7 月本科毕业于哈尔滨工业大学机械制造专业，于 2014 年 6 月硕士毕业于华中科技大学机械电子专业，于 2018 年 7 月博士毕业于荷兰代尔夫特理工大学控制专业，并获得优等（cum laude）博士毕业生荣誉。研究方向包括自适应系统、自适应最优控制、极值搜索算法及其在航空航天和机器人领域的应用研究，在 Automatica，IEEE Trans、IEEE CDC 等期刊/会议上发表学术论文 30 余篇。担任 IEEE 系统人控制论协会认知计算分会成员，IEEE 控制协会系统辨识与自适应控制委员会委员，IFAC 自适应与学习系统委员会委员，《Optimal Control Applications and Methods》和《International Journal of Adaptive Control and Signal Processing》的客座编委，以及多个控制领域期刊审稿人，并获得 2018 年 IEEE Transactions on Cybernetics 杰出审稿人称号。