复杂网络控制论坛暨第十二届复杂系统与网络科学研究中心论坛

The Workshop of Complex Network Control and the 12th Workshop of Research Center for Complex Systems and Network Sciences

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论坛资助：西南石油大学理学院、计科院和科研处

主办单位：西南石油大学

协办单位：东南大学复杂系统与网络科学研究中心

Inquiry: 熊文军（xwenjun2@gmail.com）、李平（dping.li@gmail.com）

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开幕辞 刘志斌 西南石油大学

论坛 I（11 月 22 日周六上午）熊文军 西南石油大学（主持）

Date and Time: Saturday, Nov 22 2014,08:50am-09:00am

Venue:西南石油大学成都校区国家重点实验室 A403

网络化控制系统及其在飞行器协同控制中的应用

夏元清

北京理工大学 09:00am-09:45am

Distributed Networked System under Communication Information Constraints

何永昌

香港城市大学 09:45am-10:30am

茶歇：10:30am-10:50am

Distributed and Truncated Reduced-Order Observer Based Output Feedback Consensus of Multi-Agent Systems

周彬

哈尔滨工业大学 10：50am-11:20am

多个体系统的多项式轨迹跟踪控制

程龙

中科院自动化所研究员 11:20am-11:50am

论坛 II（11 月 22 日周六下午）李平 西南石油大学（主持）

Date and Time: Saturday, Nov 22 2014, 14:00pm-16:20pm

Venue:西南石油大学成都校区国家重点实验室 A403

General Algebraic Connectivity in Consensus of Multi-agent Systems

虞文武

东南大学 14:00pm-14:30pm

Distributed Consensus Control of Multi-Agent Systems: A Consensus Region Approach

李忠奎

北京大学 14:30pm-15:00pm

茶歇：15:00am-15:20am

具有不完全信息的二维系统的动力学分析

梁金玲

东南大学 15:20pm-15:50pm

Distributed Consensus-Tracking of General Multi-Agent Systems under Switching Directed Topologies

温广辉

东南大学 15:50pm-16:20pm

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网络化控制系统及其在飞行器协同控制中的应用

夏元清

北京理工大学

Abstract

首先对网络化控制系统的研究背景及研究现状进行了综述，其次介绍近年来课题组的主要研究内容，包括：量化、网络化滤波与融合、网络化预测控制、网络化故障诊断等。最后，进一步考虑了飞行器协同控制问题。

About the Speaker

北京理工大学自动化学院，教授，博士生导师。研究方向：物联网中的信息处理与控制；飞行器控制。在 Springer 和 Wiley 出版社出版英文专著八部，在 Automatic、IEEE Transactions on Automatic Control、IEEE Transactions on Systems, man and Cybernetic、IEEE Transactions on Industrial Electronics 等系列 IEEE 汇刊、Systems and Control Letters、International Journal of Robust and Nonlinear Control、International Journal of Control 等权威期刊上发表论文 100 多篇，获国家杰出青年科学基金、国家科技进步二等奖 1 项(排名第二)、北京市科学技术二等奖 1 项（排名第一）、教育部自然科学二等奖（排名第一）。

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Distributed Networked System under Communication Information Constraints

何永昌

香港城市大学

Abstract

A distributed network system (DNS) consists of a large number of small, inexpensive agents deployed over a vast region, in which each agent is capable of collecting, processing information and communication with neighboring agents. Node collaboration is the key for the success of DNSs due to the fact that each node itself is limited by communication range, power, and processing ability. An interesting aspect of the dynamics in DNSs is that certain types of globally collective behavior emerge from local interactions among the nodes. Consensus in DNSs requires the integration of the stability, control, filtering and sensing aspects of the information processing and computational analysis. In this talk, we shall present some recent work on the consensus performance of DNS under network induced imperfect communication. These constraints include partial-information transmission, packet loss, time-delay and quantization. In addition, this talk will also discuss some recent investigation on the event-triggered data transmission in discrete-time multi-agent consensus problem with communication delays.

About the Speaker

香港城市大学数学系教授、博士生导师，分别于 1982、1984、1986 年在英国 Salford(索爾福德)大学获学士、硕士及博士学位。2012 年被教育部聘为南京理工大学“长江学者奖励计划”讲座教授。主要致力于非线性系统，奇异系统，分布式网络化系统等方面的研究工作，先后主持了 20 余项科研项目，合作出版著作一部，发表 SCI 检索国际杂志论文 160 余篇，曾先后入选第一届、第二届“中国百篇最具影响优秀国际学术论文”，获 Asian Control Conference 2011 最佳论文奖。2014 年被汤森路透(Thomson Reuters) 选为“Highly cited researchers”。目前担任六个国际期刊的编委，如 Asian Journal of Control, Journal of Franklin Institute, IET Control Theory & Applications.

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Distributed and Truncated Reduced-Order Observer Based Output Feedback Consensus of Multi-Agent Systems

周彬
哈尔滨工业大学

Abstract

This talk is concerned with output feedback consensus of both continuous-time and discrete-time multi-agent systems(MASs) characterized by high-order linear systems with directed communication topologies. Distributed reduced-order observer based protocols are established by only using the relative outputs and inputs of neighboring agents. It is shown that consensus stability by the proposed output feedback protocols is equivalent to the consensus stability by state feedback protocol. Under the condition that the open-loop dynamics of the MASs is not exponentially unstable, a truncated reduced-order observer based protocol utilizing only the relative outputs of neighboring agents is also established. A numerical example is given to illustrate the effectiveness of the proposed approaches.

About the speaker

哈尔滨工业大学航天学院教授。曾分别于 2007 年、2009 年和 2012 年赴香港大学、澳大利亚西悉尼大学和美国弗吉尼亚大学进行访问研究。主要研究方向为时滞系统理论、约束系统理论、非线性控制理论、鲁棒控制理论及其在航天控制上的应用。以第一作者和通讯作者在控制领域的主流和权威杂志 IEEE Transactions on Automatic Control、Automatic、AIAA Journal of Guidance, Control and Dynamics、Systems & Control Letters、SIAM Journal on Control and Optimization 等上发表论文 70 余篇，其中包括在 IEEE Transactions on Automatic Control 与 Automatic 上发表的长文共 6 篇，是 40 多家国际著名杂志和 10 余个国际会议的活跃审稿人。曾获“2012 年度全国百篇优秀博士学位论文奖”、“国家自然科学基金优秀青年基金”资助、“第五届中国青少年科技创新奖”、“首届国家开发银行科技创新奖”、“哈尔滨工业大学 2010 年度优秀论文奖”和“黑龙江省第 12 届自然科学技术学术成果奖（一等）”等奖励。2011 年入选新世纪优秀人才支持计划。2012 年 12 月入选首批“哈尔滨工业大学青年拔尖人才选聘计划”并破格晋升为教授。

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多个体系统的多项式轨迹跟踪控制

程龙

中科院自动化所研究员

Abstract

轨迹跟踪控制是多个体系统协调控制中的一个关键问题。在轨迹规划的实践中，人们往往通过对给定的关键点进行插值（如三次样条插值）来确定待跟踪轨迹。这种方式下得到的轨迹由多项式来描述。同时由于有界闭集上的任何连续函数都可由多项式来逼近，因此研究多个体系统的多项式轨迹跟踪控制具有较强的应用背景。针对这类问题，我们首先研究了连续时间域单积分器多个体系统，提出了一种 PI^n 型（含有比例项和高阶积分项）的分布式跟踪控制协议，分析了该方法的可行性，并讨论了如何将个体动力学由单积分器向多重积分器推广的手段。同时，我们也给出了离散时间域内的相应结果。最后用两个在多机器人系统上的仿真例子验证了 PI^n 型控制方法的有效性。

About the speaker

程龙博士，中国科学院自动化研究所研究员。2004 年于南开大学自动化系获得工学学士学位，2009 年于中国科学院自动化研究所获得工学博士学位。曾赴加拿大 University of Saskatchewan 大学，美国 Northeastern University 大学和 University of California at Riverside 大学从事访问研究工作。目前已发表 SCI 论文 30 余篇，一篇论文获 IEEE Transactions on Neural Networks Outstanding Paper Award。目前担任《Neurocomputing》、《International Journal of Systems Science》等国内外刊物的编委。2014 年入选国家优秀青年基金项目和中国科学院卓越青年科学家计划。程龙博士的研究兴趣包括机器人智能控制与优化方法，多个体系统分布式协调控制等。

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General Algebraic Connectivity in Consensus of Multi-agent Systems

虞文武

东南大学

Abstract

This talk will discuss general algebraic connectivity representing consensus convergence rate in multi-agent systems with directed topologies. First, a new concept, general algebraic connectivity is proposed to study the global consensus problem with first-order dynamics in strongly connected networks and also in a broad class of networks containing spanning trees, for which ideas from algebraic graph theory, matrix theory, and Lyapunov methods are utilized. Based on this result, consensus in multi-agent systems with second-order nonlinear dynamics and directed topologies are further considered by applying general algebraic connectivity. Finally, some extensions for applying general algebraic connectivity will be given in pinning control of complex networks and some other topics.

About the speaker

2010 年博士毕业于香港城市大学电子工程系。现为东南大学教授、博士生导师、复杂系统与网络科学研究中心副主任，2013 年获得国家优秀青年科学基金。从事复杂网络与多智能体系统协同分析与控制相关研究，发表文章百余篇，SCI 杂志文章 70 余篇，引用 4000 余次，SCI H 指数 28；18 篇 ESI 高被引论文，入选 2014 Thomson Reuters 高引科学家；主持参与国内外基金项目 10 多项。曾获 2010 年江苏省科学技术奖一等奖（第三）、2012 年 Scopus“青年科学之星”信息科学领域金奖、国内外学术会议和机构最佳论文奖 5 篇等奖项。曾任国内外十多个会议的大会副主席、组委会主席、宣传主席、工业论坛与展览主席和程序委员会委员。应邀在美国、德国、意大利、澳大利亚、荷兰、中国等多所著名院校和研究所做学术报告。

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Distributed Consensus Control of Multi-Agent Systems: A Consensus Region Approach

李忠奎

北京大学

Abstract

Cooperative control of multi-agent systems (multiple autonomous vehicles) has received compelling attention from various scientific communities due to its broad applications in such areas as satellite formation flying, sensor networks, surveillance and reconnaissance, air traffic control, and future autonomous combat systems. Distributed systems of agents linked by communication networks only have access to local information from their neighboring agents, yet must cooperatively achieve global agreement on team activities. In the area of cooperative control of multi-agent systems, consensus is an important and fundamental problem. Consensus means that a team of agents reaches an agreement on a common value by interacting with each other. For the consensus control problem, the main task is to design appropriate controllers (usually called consensus protocols) to achieve consensus. Due to the large size of agents, the spatial distribution of actuators, limited sensing capability of sensors, and short wireless communication ranges, implementable consensus protocols for multi-agent systems should be distributed, depending on only the local information of each agent and its neighbors. The purpose of this talk is to present our recent results on designing distributed consensus protocols for multi-agent systems with general linear agent dynamics. Both the cases without a leader and with a leader of bounded unknown control input will be addressed. A unified approach built on the consensus region notion will be given. The traditional observer-based controller for a single agent will be extended to the multi-agent system setting. Distributed adaptive controllers will be introduced to achieve consensus and tracking in a fully distributed fashion.

About the speaker

北京大学工学院力学与工程科学系研究员，博士生导师。主要从事多自主体系统分布式协调控制、网络化控制系统等方面的研究工作，做出了一些有特色的创新性成果。撰写英文专著一本（Taylor & Francis / CRC Press），在国际重要学术期刊上发表 SCI 检索论文 30 多篇。曾获得 2012 年全国优秀博士学位论文奖，2013 年 IET Control Theory & Applications Premium Award（最佳论文奖），2009-2012 系统科学最佳论文奖，2011 年教育部自然科学一等（第七完成人），2012 年北京大学优秀博士论文奖一等奖等多项奖励。

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具有不完全信息的二维系统的动力学分析

梁金玲

东南大学

Abstract

This talk is concerned with the dynamical analysis for the two-dimensional (2-D) systems with incomplete information. Firstly, the history for introducing the 2-D model is briefly presented. Then, the stability is discussed for the 2-D system with time-varying delays and stochastic disturbances. When considering the network-induced phenomena, incomplete information including randomly occurring nonlinearities (RONs), randomly occurring saturations (ROSs) as well as exogenous noises are addressed when analyzing the 2-D system with mixed time delays which comprise both the discrete and the discrete distributed delays in states. Here, RONs and ROSs are considered, respectively, in the state-space model and the measurement output equation to reflect the nonlinear disturbance appearing in a random way and the limited communication capabilities of the sensors. Subsequently, state estimation problem, H-infinity filtering problem and H-infinity control problem are respectively investigated for 2-D systems with incomplete information.

About the speaker

东南大学教授、应用数学专业博士生导师。主要从事复杂网络的同步现象、基因调控网络的动力学分析以及生物时间序列数据建模与分析等方向的研究。现已在国内外重要学术刊物发表学术论文 70 余篇，论文发表后已被 SCI 他引 1800 余次。目前主持国家自然科学基金、江苏省自然科学基金等项目 4 项，主持完成国家自然科学青年基金等项目 3 项。2012 年 12 月，获得“第九届中国青年女科学家奖”；2013 年获得江苏省自然科学杰出青年基金资助；入选教育部 2012 年度“新世纪优秀人才支持计划”；被遴选为江苏省第四期“333 高层次人才培养工程”中青年科学技术带头人培养对象；获得 2007 年教育部自然科学二等奖（排名第二）；2012 年被评为第四届“青年科学之星”（信息科学领域，铜奖）。目前，梁金玲担任 5 个国际知名期刊的编委，并作为 50 余个 SCI 国际刊物的活跃审稿人。在 2011 年，她被评为国际顶级刊物 IEEE Transactions on Automatic Control 以及国际重要刊物 Asian Journal of Control 的年度杰出审稿人（全球仅 9 人获得 AJC 年度殊荣）。

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Distributed Consensus-Tracking of General Multi-Agent Systems Under Switching Directed Topologies

温广辉

东南大学

Abstract

Distributed consensus of multi-agent systems has recently received much attention from various scientific research communities. To ensure consensus in the whole group, agents need to communicate with their neighbors. However, the underlying topology among the agents may be time-varying, due to reasons such as limited communication range, commination link failures and actuator failures. In this talk, distributed consensus tracking for general multi-agent systems under switching directed topologies will be discussed. In the first part, the study of consensus tracking of general linear multi-agent systems under switching directed topologies will be shown. In the second part, several theoretical results on consensus tracking of multi-agent systems with general Lipschitz-type nodes and switching directed topologies will be given by showing that consensus tracking in such multi-agent systems can be achieved if the protocols are appropriately designed and the dwell-time for each possible topology is larger than a threshold value.

About the speaker

工学博士，现为东南大学数学系复杂系统与网络科学研究中心讲师。担任Mathematical Problems in Engineering (SCI IF: 1.383)的客座编辑，亚洲控制会议副编辑（Associate Editor for ASCC2013），中国复杂网络学术会议程序委员会委员。目前主持国家自然科学基金青年项目一项，江苏省自然基金青年项目一项，教育部博士点基金新教师项目一项，中央高校基本科研业务费重大引导项目一项和浙江省重中之重优势学科项目一项。主要研究兴趣包括复杂网络系统建模与分布式控制，鲁棒控制。在 IEEE Trans. Autom. Control，IEEE Trans. Circuits and Systems I&II，Systems and Control Letters，Int. J. Robust and Nonlinear Control 等学术杂志发表 SCI 学术论文 20 余篇，ESI 高被引论文 4 篇。曾获 2010 年中国复杂网络学术会议最佳学生论文奖（独立），2012 年中国控制决策会议张嗣瀛奖提名(排名第一)。