



复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第十六届复杂系统与网络科学研究中心论坛

**The Sixteenth Workshop of
Research Center for Complex Systems and
Network Sciences**

2015年12月25日—12月27日

程 序 册

论坛资助：国家自然科学基金委（61175119）
东南大学数学系、东南大学江苏省自动化优势学科

主办：东南大学复杂系统与网络科学研究中心
东南大学数学系

<http://math.seu.edu.cn/csns/Seminar/>

Inquiry: Jianquan Lu 卢剑权 (jquma@seu.edu.cn); Jinde Cao 曹进德 (jdcao@seu.edu.cn)



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The Sixteenth Workshop of Research Center for Complex Systems and Network Sciences

时间: 2015年12月26日

地点: 东南大学数学系第一报告厅 (九龙湖校区图书馆5楼)

开幕式介绍 曹进德 教授 (东南大学)

12月26日上午	卢剑权 东南大学 (主持)		
9:00-9:45	Synchronization and Control for Differential Equations with Discontinuous State on the Right-Hand Sides	重庆师范大学	杨鑫松
9:45-10:30	Synchronization/consensus of complex networks under event-based mechanism	合肥工业大学	李露露
10:30-10:45	茶歇		
10:45-11:30	Some control problems on Boolean control networks	浙江师范大学 东南大学	刘洋
11:30-13:30	午餐		
12月26日下午	温广辉 东南大学 (主持)		
13:30-14:15	Pinning control of multi-agent systems with second-order nonlinear dynamics	河南工业大学	宋强
14:15-15:00	Synchronization of heterogeneous dynamic networks via distributed impulsive control: error estimation, optimization and design	华东理工大学	和望利
15:00-15:20	茶歇		
12月26日下午	梁金玲 东南大学 (主持)		
15:20-16:05	Fault-Tolerant Consensus of Multi-Agent System With Distributed Adaptive Protocol	华中农业大学	陈舜
16:05-16:50	复数值 RBF 网络的学习及应用	苏州大学	黄鹤

闭幕辞 曹进德 东南大学

Inquiry: Jianquan Lu 卢剑权 (jqluma@seu.edu.cn); Jinde Cao 曹进德 (jdcao@seu.edu.cn)



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Synchronization and Control for Differential Equations with Discontinuous State on the Right-Hand Sides

杨鑫松
重庆师范大学

Abstract

In this talk, we mainly focus on the existence of Filippov solution of neural networks with discontinuous activation functions and mixed time-delays (time-varying discrete delay and infinite-time distributed delay) and some synchronization control methods for differential equations with discontinuous state on the right-hand sides. Firstly, sufficient conditions for the global existence of Filippov solutions to neural networks with discontinuous activation functions and the mixed delays are given by strict mathematical proof. Then, some novel control schemes are designed to guarantee that several discontinuous chaotic systems can be driven to realize synchronization, including exponential synchronization and finite-time synchronization.

About the speaker

杨鑫松，重庆师范大学数学科学学院教授，硕士导师，2006年毕业于云南大学数学系，获硕士学位，访问过东南大学、香港城市大学、香港大学。是美国数学评论的评论员以及20多个SCI刊物的审稿人。目前发表科研论文60多篇（第一作者40多篇），总共被SCI源刊引用1000多次，单篇最高引用131次，H-index指数19，其中在2015年10月ISI Web of Knowledge上有ESI高被引论文7篇（他引总次数进入全球前1%的论文），发表的杂志包括SIAM Journal on Control and Optimization, IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Circuits and Systems – I, IEEE Transactions on Fuzzy Systems, IEEE Transactions on Automatic Control等国际顶级杂志（均为第一作者）。所带硕士生一人获国家奖学金，正在主持国家自然科学基金面上项目一个；主持和参与完成国家项目以及省级项目多个。研究领域包括：复杂网络的同步与控制，右端不连续系统的稳定与控制，时滞随机微分方程的稳定性与控制等。



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Synchronization/consensus of complex networks under event-based mechanism

李露露
合肥工业大学

Abstract

In this talk, we firstly discuss a kind of event-based consensus problem in directed networks with arbitrary finite communication delays. A new distributed event-triggered scheme is proposed for the considered multi-agent network model. For the proposed event-triggered protocol, we prove that the multi-agent network will achieve consensus asymptotically. Further, we discuss the pinning cluster synchronization problem of coupled complex networks under event-based mechanism. A self-triggered pinning cluster synchronization algorithm is proposed, and a set of iterative procedures is given to compute the event-triggered time instants. Numerical simulations are given to demonstrate the potentials of our analytic results.

About the speaker

李露露，合肥工业大学副教授。2013年毕业于香港城市大学数学系，获哲学博士学位。目前主持国家自然科学基金2项。主要研究方向为复杂动态网络和多智能体系统的群体行为分析、非线性系统分析等。在国内外学术期刊 IEEE Trans. Circuits & Systems-I、Neural Networks、IET Control Theory & Applications 等学术期刊发表论文多篇。



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Some control problems on Boolean control networks

刘洋

1. 浙江师范大学 2. 东南大学

Abstract

In this talk, we will introduce the semi-tensor product of matrices, based on which, Boolean networks can be expressed in algebraic forms. Some basic results and new conclusions will be presented on the controllability, stabilization, and synchronization of Boolean control networks.

About the speaker

刘洋, 浙江师范大学数学系副教授、硕士生导师、系副主任。浙江师范大学本科, 同济大学博士, 现为东南大学在职博士后, 普渡大学、澳门大学访问学者。获上海市优博, 入选省高校中青年学科带头人。从事多复分析和系统控制理论的研究工作。主持国家自然科学基金 2 项, 省基金 2 项, 博后一等资助 1 项。在 IEEE TAC, IEEE TFS, IEEE TNNLS, Automatica, Neural Computation 等期刊发表论文 40 余篇。



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Pinning control of multi-agent systems with second-order nonlinear dynamics

宋 强
河南工业大学

Abstract

In this talk, we consider the second-order leader-following consensus problem for multi-agent systems with nonlinear dynamics based on the pinning control approach. Some techniques are presented to address several challenging issues in the pinning control of multi-agent systems. We first show that the followers whose out-degrees are bigger than their in-degrees should be chosen as pinned candidates. Then, by using the M-matrix theory, we further investigate the effects of the locations of pinned agents, the number of pinned agents and the values of pinning feedback gains on leader-following consensus. In particular, we analytically prove that leader-following consensus may be easier to be achieved by pinning more agents or increasing the pinning feedback gains. A selective pinning scheme is proposed for nonlinear multi-agent systems with directed network topologies. Numerical results are given to verify the theoretical analysis.

About the speaker

宋强，博士，目前为河南工业大学电气工程学院副教授（校聘教授），曾在加拿大和香港访学多年。研究方向为复杂动态网络与多智能体系统的协同控制，主持在研的国家自然科学基金面上项目一项，担任多种期刊的长期审稿人，2014 年被 IET Control Theory and Applications 评为优秀审稿人。近年在控制领域重要期刊发表论文十余篇（第一作者的 IEEE 汇刊长文四篇，Systems & Control Letter 论文一篇，International Journal of Robust and Nonlinear Control 论文两篇），其中两篇关于网络系统牵制控制的论文为 2013 至 2015 年度的 ESI 高被引论文。

Inquiry: Jianquan Lu 卢剑权 (jqiuma@seu.edu.cn); Jinde Cao 曹进德 (jdcao@seu.edu.cn)



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Synchronization of heterogeneous dynamic networks via distributed impulsive control: error estimation, optimization and design

和望利
华东理工大学

Abstract

This talk focuses on leader-follower synchronization in heterogeneous dynamic networks via distributed impulsive control. The goal is to drive the followers to approximately synchronize with the leader within a nonzero error bound, referred to as quasi-synchronization. Some fundamental and yet challenging problems will be addressed: (1) How to obtain a tight quasi-synchronization error bound; (2) How many and which nodes should be controlled; (3) How to design the coupling strength, to select the pinned nodes and to determine the impulse intervals to optimize the error bound or to achieve quasi-synchronization within a prescribed error bound. It is interesting to find that a large coupling strength will destroy synchrony, in contrast to continuous pinning control. Furthermore, the common requirement that the leader has a directed path to every node is needed only in the case that the impulse intervals can be arbitrarily small. A new concept, referred to as impulse pinning controllability, is introduced to the case that impulses cannot take place too frequently. To this end, an optimization of the error bound is discussed and formulated. Under a prescribed error bound, the design problem of the coupling strength, pinned nodes and impulse intervals is solved. Finally, three examples are given to verify the theoretical results.

About the speaker

和望利，华东理工大学副教授，硕士生导师。分别于2005年、2009年获东南大学学士、博士学位，江苏省优秀博士论文获得者。2010年1月-2011年11月在华东理工大学控制科学与工程博士后流动站从事博士后研究。2010年1月至2011年7月在澳大利亚中昆士兰大学从事访问博士后研究；2013年12月-2014年2月至香港大学机械工程系、2014年10月-2014年12月至香港城市大学混沌与复杂网络中心、2015年1月-2015年2月至德国柏林洪堡大学和波茨坦气候影响研究所从事访问研究工作。2015年受聘于首都大学东京的客座副教授。主要研究领域为复杂网络和多智能体系统的协同分析、控制及应用。在 *Automatica*、*IEEE 汇刊* 和 *美国物理研究所会刊* 等国际期刊和会议上发表论文 20 余篇。2013 年入选华东理工大学首批“教学科研骨干发展支持项目”，2014 年获连续资助。主持国家自然科学基金面上项目、青年基金项目、教育部留学回国人员基金等，现为中国自动化学会青年工作委员会委员。

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Fault-Tolerant Consensus of Multi-Agent System With Distributed Adaptive Protocol

陈舜
华中农业大学

Abstract

In this talk, fault-tolerant consensus in multi-agent system using distributed adaptive protocol is investigated. Firstly, distributed adaptive online updating strategies for some parameters are proposed based on local information of the network structure. Then, under the online updating parameters, a distributed adaptive protocol is developed to compensate the fault effects and the uncertainty effects in the leaderless multi-agent system. Based on the local state information of neighboring agents, a distributed updating protocol gain is developed which leads to a fully distributed continuous adaptive fault-tolerant consensus protocol design for the leaderless multi-agent system. Furthermore, a distributed fault-tolerant leader-follower consensus protocol for multi-agent system is constructed by the proposed adaptive method. Finally, a simulation example is given to illustrate the effectiveness of the theoretical analysis.

About the speaker

陈舜，男，博士，华中农业大学副研究员。在东南大学获得学士、硕士学位，香港城市大学获得博士学位。已发表 IEEE Transaction 系列长文两篇。感兴趣领域为：故障分析，多智能体系统，复杂网络，机器学习，金融数学等。



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复数值 RBF 网络的学习及应用

黄鹤

苏州大学电子信息学院

Abstract

在这个报告中，我们将先介绍一些 RBF 网络的基础知识。然后给出两个复数值 RBF 网络的学习算法，其中一个是基于最大距离的算法，另一个是基于聚类估计 (CE) 和重复加权提升搜索 (RWBS) 的算法。同时，我们给出这两个算法在模式识别和信道均衡中的应用。

About the speaker

黄鹤，现任苏州大学电子信息学院副教授，获香港城市大学博士学位，主要研究兴趣为神经网络的学习与应用、递归神经网络的动力学分析和随机系统分析等，担任 Neurocomputing 和 Circuits, Systems, & Signal Processing 的编委，出版专著 1 部，在 IEEE 汇刊和 Neural Networks 等期刊上发表论文多篇。