



复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四届复杂系统与网络科学研究中心论坛

The Fourth Workshop of

Research Center for Complex Systems and Network Sciences

Distributed output synchronization of nonlinear multi-agent systems

徐大波

南京理工大学

Date and Time: Saturday, 8 June 2013, 09:30am – 10:30am

Venue: 东南大学九龙湖校区图书馆 5 楼数学系第一报告厅

Abstract

In recent decades, analysis and control of multi-agent systems (MAS) have been made a very active area due to a broad range of applications. However, fundamental challenges still lie in finding suitable tools on effective feedback control of the collective behavior. The leader-follower consensus or output synchronization problem is one of the central topics for multi-agent systems' cooperative or coordinate control. This talk is on distributed output synchronization (DOS) of nonlinear MAS. A notion of networked internal model is introduced for distributed control design of DOS based on a two-level network topology. A typical networked internal model with an input-to-state stability property is studied which is further applied to solve DOS of nonlinear MAS. The result shows that the complexity of internal model-based controller construction can be significantly reduced by virtue of networked internal models with some communications among controller stations.

About the Speaker

Dabo Xu received the B.Sc. degree in mathematics and applied mathematics at Qufu Normal University, Qufu, China, in 2003, the M.Sc. degree in operations research and cybernetics in Northeastern University, Shenyang, China, in 2006, and the Ph.D. degree in automation and computer-aided engineering in The Chinese University of Hong Kong, Hong Kong, China, in 2010. From Aug. 2009 to Nov. 2010, he was a research assistant and postdoctoral fellow at The Chinese University of Hong Kong. From Nov. 2010 to Nov. 2012, he was a research associate at The University of New South Wales at Canberra, Canberra, Australia. He is currently an Associate Professor at School of Automation, Nanjing University of Science and Technology, Nanjing, China. He received the Best Paper Award (with Y. Hong) at the 12th International Conference on Control, Automation, Robotics and Vision. His research interests include nonlinear feedback control and its application to electrical machines, power electronics, and automatic vehicles.



复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四届复杂系统与网络科学研究中心论坛

The Fourth Workshop of

Research Center for Complex Systems and Network Sciences

Graph Laplacian, Local Control, and Collective Behaviors of Multi-Agent Systems

林志赟

浙江大学

Date and Time: Saturday, 8 June 2013, 10:30am – 11:30am

Venue: 东南大学九龙湖校区图书馆 5 楼数学系第一报告厅

Abstract

Collective behaviors have arisen to permit cooperative functioning of a network of agents, which would never be achieved by individual members. The observation more recently inspires the design of autonomous multi-agent systems in engineering with a broad range of potential applications. Over the last decade, there have been emerged a huge amount of work on coordination and control of multi-agent systems to understand and design distributed mechanisms for group coordination and cooperation. The talk aims to provide a unified view for analysis and distributed control of certain collective behaviors based on graph Laplacian. The properties of graph Laplacian will be explored to establish the links between local control and collective behaviors. In particular, our recent work on generalized graph Laplacian will be discussed with applications to formation control and localization in sensor networks.

About the Speaker

Zhiyun Lin is a Professor of Systems Control at College of Electrical Engineering, Zhejiang University, China. He received his Ph.D. degree in Electrical and Computer Engineering from University of Toronto, Canada, in 2005. From 2005 to 2007, he was a postdoctoral researcher in the same department at University of Toronto. He then joined College of Electrical Engineering, Zhejiang University in 2007. In the past few years, he also held visiting professor positions at the Australian National University (Australia), University of Cagliari (Italy) and University of Newcastle (Australia). His current research interests include multi-agent systems, sensor networks, switched/ hybrid systems, and biped robots.



复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四届复杂系统与网络科学研究中心论坛

The Fourth Workshop of

Research Center for Complex Systems and Network Sciences

Distributed Controllers Design for Cooperative Control of Linear Multi-Agent Systems

李忠奎

北京大学

Date and Time: Saturday, 8 June 2013, 14:00pm – 15:00pm

Venue: 东南大学九龙湖校区图书馆 5 楼数学系第一报告厅

Abstract

The purpose of this talk is to present our recent results on the consensus and tracking problem of multi-agent systems with general linear agent dynamics. Problems such as "how to reach consensus", "how to track a leader with (unknown) bounded input", and "how to design consensus protocols" 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 without requiring any global information of the communication graph. The robustness of the proposed adaptive controllers is discussed. Distributed adaptive controllers which are robust with respect to bounded external disturbances are introduced. For the case with a leader of possibly unknown bounded input, distributed discontinuous and continuous controllers based on the sliding mode control idea are designed to solve the tracking problem.

About the Speaker

Dr. Zhongkui Li received the B.S. degree in pace engineering from the National University of Defense Technology, China, in 2005, and his Ph.D. degree in Dynamics and Control from Peking University, China, in 2010. From November 2008 to February 2009, he was a Research Assistant in City University of Hong Kong. From February 2011 to August 2011, he was a Research Fellow in Nanyang Technological University. From February 2012 to April 2012, he was a Postdoctoral Fellow with City University of Hong Kong. From August 2010 to April 2013, he was a Postdoctoral Research Associate with the School of Automation, Beijing Institute of Technology. Since April 2013, he has been with the State Key Laboratory for Turbulence and Complex Systems, Department of Mechanics and Aerospace Engineering, College of Engineering, Peking University, where he is currently an Assistant Professor.

Dr. Li was the recipient of the Natural Science Award (First Prize) from Ministry of Education of China in 2011 and the National Excellent Doctoral Thesis Award of China in 2012. His research interests include cooperative control of multi-agent systems and robust control.



复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四届复杂系统与网络科学研究中心论坛

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

Distributed Coordination of Multiple Lagrangian Systems

任伟

美国加州大学

Date and Time: Saturday, 8 June 2013, 15:30pm – 16:30pm

Venue: 东南大学九龙湖校区图书馆 5 楼数学系第一报告厅

Abstract

Many mechanical systems including autonomous vehicles, robotic manipulators, and walking robots are Lagrangian systems. In this talk, we focus on distributed coordination of multiple fully-actuated Lagrangian systems in the presence of only local interaction. We first introduce distributed coordinated tracking algorithms in the presence of a dynamic leader for networked Lagrangian systems under the constraints that the leader is a neighbor of only a subset of the followers and the followers have only local interaction. We then introduce distributed containment control algorithms with stationary or dynamic leaders under a directed network topology. As a special case, distributed leaderless synchronization will also be discussed. Simulation results will be presented to show the effectiveness of the proposed algorithms.

About the Speaker

Wei Ren received his Ph.D. degree in electrical engineering from Brigham Young University, Provo, UT, in 2004. From October 2004 to July 2005, he was a Postdoctoral Research Associate with the Department of Aerospace Engineering, University of Maryland, College Park, MD. He was an assistant professor (August 2005 to June 2010) and an associate professor (July 2010 to June 2011) with the Department of Electrical and Computer Engineering, Utah State University, Logan. Since July 2011, he has been with the Department of Electrical Engineering, University of California, Riverside, where he is currently an Associate Professor. His research focuses on distributed control of multi-agent systems and networked control systems. Dr. Wei's research work has gained world-wide recognition as one of the most distinguished researchers in the field, which has been well cited for more than 8000 times. Dr. Ren was the recipient of a National Science Foundation CAREER award in 2008. He is currently an Associate Editor for *Automatica* and *Systems and Control Letters*.