复杂系统与网络科学研究中心

Research Center for Complex Systems and Network Sciences

第四十二届复杂系统与网络科学研究中心论坛

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

2020 年 9 月 4 日（14:00-18:00）

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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
东南大学数学学院

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

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时间：2020 年 9 月 4 日，周五（14:00-18:00）
会议方式：“zoom”平台线上视频会议
会议号：62035038316
会议密码：629637
会议链接：https://zoom.com.cn/j/62035038316

Adaptive Control of Euler-Lagrange Systems via Artificial Delay: Theory and Applications

Spandan Roy, International Institute of Information Technology Hyderabad

14:00-15:00

Aerial Robotics: Challenges and Opportunities Outside the Lab

Lorenzo Marconi, University of Bologna

15:00-16:00

Traffic Flow Modeling and Control for Mixed Traffic

Maria Laura Delle Monache, Inria Grenoble Rhône-Alpes

16:00-17:00

Traffic Flow on a Ring with a Single Autonomous Vehicle: An Interconnected Stability Perspective

Paolo Frasca, Univ. Grenoble Alpes, CNRS, Inria, Grenoble INP, GIPSA-Lab

17:00-18:00

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

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Adaptive Control of Euler-Lagrange Systems via Artificial Delay: Theory and Applications

Spandan Roy（International Institute of Information Technology Hyderabad）

Abstract

This talk will present how to design adaptive control for Euler-Lagrange Systems via artificial introduction of a time delay, often referred to as time-delay estimation (TDE). Compared to the conventional adaptive controllers, the main feature of this method is to compensate for the uncertainties without a priori knowledge of their structure and bounds. Being primarily built for Euler-Lagrange systems, TDE based designs have found applications in various fields such as robotic manipulator, unmanned aerial and ground vehicles, humanoids, smart actuators to name a few. During the talk, some real-life multiple-degrees-of-freedom robotic applications will be shown where adaptive TDE designs have been successfully implemented.

About the Speaker

Spandan Roy received the B.Tech degree in Electronics and Communication Engineering from Techno India (Salt Lake), West Bengal University of Technology, India in 2011, the M.Tech. degree in Mechatronics from Academy of Scientific and Innovative Research (AcSIR), India in 2013 and Ph.D. degree in Control and Automation from Indian Institute of Technology Delhi (IITD), India in 2018.

He was a Scientist Trainee from 2013 to 2014 at CSIR-Central Mechanical Engineering Research Institute, India. He is currently an assistant professor at the Robotics Research Center, International Institute of Information Technology Hyderabad, India. Previously, he was a postdoctoral researcher in Delft Center for System and Control, Delft University of Technology, The Netherlands. His research interests include adaptive-robust control, switched systems and its applications in Euler-Lagrange systems and Robotics.

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Aerial Robotics: Challenges and Opportunities Outside the Lab

Lorenzo Marconi（University of Bologna）

Abstract

Research perspectives on drones specifically motivated by their use in relevant application contexts outside the lab are present. The use of drones in real life environments unveils challenging control problems that are hardly imaginable within an indoor flight arena and that inspire new research areas well broader than the specific motivating context. Two main application areas are thoroughly presented. The first deals with aerial inspection of infrastructures requiring the physical contact between the drone and the inspected surface. Besides presenting industrial needs and economical impacts in the field, the talk will address specific research challenges pertaining to structural properties of the aerial robot and of the onboard control required to face dramatically different aerial scenarios. The second is about the use of drones for search and rescue applications in hostile environments, with a specific focus on quick localization of victims buried by avalanches. The talk will report ongoing research activities carried out at European level jointly with professional search and rescue teams, showing the technological challenges raised in the field and the potentials of automatic control algorithms that are revolutionizing actual search manual strategies. Besides addressing technical research problems, the talk will also touch aspects about social innovation and financial sustainability of aerial technologies in certain fields, by identifying "orphan markets" in which control technologies can play a role.

About the Speaker

Lorenzo Marconi graduated in 1995 in electrical engineering and obtained the Ph.D. degree in Automatic Control in 1998 from the University of Bologna where is now full professor. He is coauthor of more than 250 technical publications on the subject of linear and nonlinear feedback design. His current research interests include nonlinear control, output regulation, control of autonomous vehicles. He was the recipient of the Outstanding Application Paper Award in 2005 from IFAC for a coauthored paper published on Automatica, of the 2014 IEEE Control Systems Magazine Outstanding Paper Award, and recipient of the 2018 0. Hugo Schuck Best Paper Award assigned by the American Automatic Control Council. Fellow of IEEE for "contributions to feedback design of nonlinear systems and unmanned aerial vehicles".

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Traffic Flow Modeling and Control for Mixed Traffic

Maria Laura Delle Monache（Inria Grenoble Rhône-Alpes）

Abstract

We present a class of coupled PDE-ODE models describing the interaction of autonomous vehicles with the surrounding traffic. The traffic flow is described with a scalar conservation law while each autonomous vehicle trajectory is described by an ODE. The presence of the vehicles can induce a moving bottleneck, hindering traffic flow or act as tracer vehicles in the flow to collect measurements along their trajectory to estimate the bulk flow. We will prove analytically and numerically how to reconstruct the correct traffic density using only the collected density measure from the autonomous vehicles. We will propose some control strategies for the problem and show theoretical, numerical and experimental results.

About the Speaker

Maria Laura Delle Monache is a research scientist in the Networked Controlled Systems team at Inria and in GIPSA-Lab (Department of Control) at the University of Grenoble (France). She received the B.S. degree (2009) in industrial engineering from the University of L'Aquila, Italy, the M.S. degree (2011) in mathematical engineering from the University of L'Aquila, and the University of Hamburg, Germany, and the Ph.D. (2014) in applied mathematics from the University of Nice-Sophia Antipolis, France. Prior to joining Inria, she was a Postdoctoral researcher at Rutgers University - Camden. Her research interest is mainly related to the mathematical and engineering aspects of traffic flow. In particular, she is interested in mathematical modeling and control of traffic flow applications.

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Traffic Flow on a Ring with a Single Autonomous Vehicle: An Interconnected Stability Perspective

Paolo Frasca（Univ. Grenoble Alpes, CNRS, Inria, Grenoble INP, GIPSA-Lab）

Abstract

In recent years, field experiments have been performed on ring roadways with human-driven vehicles or with a mix of human-driven and autonomous vehicles. While these experiments demonstrate the potential for controlling traffic flows by a small number of autonomous vehicles, the theoretical framework about such a possibility is to a large extent incomplete. Indeed, most work on mixed traffic focused on classical asymptotical stability notions, neglecting that human drivers are prone to the interconnected instability known in the literature as string instability. This presentation shows how to enhance the existing theories to meet the questions raised by the field experiments. It starts from the observation that the standard notion of string stability on a ring roadway is too demanding for a mixed traffic scenario: therefore, a new interconnected stability definition, named weak ring stability, is proposed. This new interconnected stability notion, in combination with classical stability, is able to explain phenomena observed in field experiments and to highlight possibilities and limitations of traffic control via sparse autonomous vehicle. Furthermore, it allows designing AV controllers with improved string stability specifications, at the price of reducing the sparsity of the autonomous vehicles.

About the Speaker

Paolo Frasca received the PhD degree in mathematics for Engineering Sciences from Politecnico di Torino, Italy, in 2009. From 2013 to 2016, he has been an assistant professor with the University of Twente, the Netherlands. Since October 2016, he is a CNRS researcher with GIPSAlab, Grenoble, France. His research interests include theory of network systems and cyber-physical systems, with applications to robotic, sensor, infrastructural, and social networks.