上海交通大学自动化系
Department of Automation
Shanghai Jiao Tong University

系统控制与信息处理教育部重点实验室
Key Laboratory of System Control and Information Processing, Ministry of Education

学术报告会

时　间：7月20日(周五) 10:00-11:00

地　点：电院群楼2-406会议室

Invertibility of Boolean control networks with applications to biological systems

Kuize Zhang

Royal Institute of Technology

Abstract:

Invertibility is an interesting and classical control-theoretic problem, which implies that the input sequence of a control system can be determined by the output sequence. We adopted the theory of symbolic dynamics to characterize it for Boolean control networks (BCNs). First, it was shown that a BCN generates a continuous mapping from the space of infinite input sequences to the space of infinite output sequences. Based on it, the concept of invertibility of BCNs was defined by the bijectivity of the mapping. Second, using the theory of symbolic dynamics, an equivalent test criterion for invertibility was given; and then an algorithm to construct the inverse BCN for an invertible BCN based on the semi-tensor product of matrices was designed. Third, as an application of invertibility to systems biology, it was proved that the BCN model proposed by Fauré et al. (2006) is not invertible, i.e., arbitrarily controlling mammalian cell cycles is unfeasible, at the theoretical level.

Biography:

Kuize Zhang received the B.S. and Ph.D. degrees in Mathematics and Systems Engineering from Harbin Engineering University, China, in 2009 and 2014, respectively. Since April 2015, he has been an Associate Professor with the College of Automation, Harbin Engineering University. He held visiting positions at University of Turku, Finland (Sep. 2012-- Sep. 2013), and the Chinese Academy of Sciences (Jan. -- Oct., 2015). He was a project officer of Nanyang Technological University, Singapore (Oct. 2013 -- Oct. 2014), postdoc at Chinese Academy of Sciences (Nov. 2015 -- Nov. 2017), and postdoc at Technical University of Munich (Sep. 2016 -- Aug. 2017). He is currently a postdoc at KTH Royal Institute of Technology, Sweden. His current research interests include formal methods, Boolean networks, discrete event systems, etc. Dr. Zhang is a Senior Member of IEEE (2017-present), and received the 2016 Chinese Association of Automation (CAA) Outstanding Doctoral Thesis Nomination Award.