Pinning control from the inverse optimal control approach: with applications to complex networks

Mr David Israel Rodríguez-Castellanos
Cinvestav unidad Guadalajara, Mexico

Date and Time: Friday, 27 February 2015, 4:30pm – 5:30pm
Venue: Room B6605, City University of Hong Kong
Reception starts at 4:15pm
(Language: English)

Abstract

This seminar presents pinning control for complex networks. The technique consists in applying controllers to a small fraction of nodes to achieve global synchronization. This task is facilitated by using structural and dynamical properties of the given network. Thus, the regulation of the network behavior is ensured while avoiding redundant control efforts.

The basic problem is: having a complex network with different coupling strengths (weights) in its connections and nodes with complex (chaotic) but unknown dynamics, how to design a pinning control law, which is optimal related to the states and the disturbances, to ensure the entire network be able to track a reference? This problem can be seen as imposing a desired behavior into an array of complex systems. It is desirable that this control strategy does not require having the same coupling strength for all the connections in the network, differing from most publications.

Consequently, a strategy based on the inverse optimal control principle is applied for pinning the weighted complex networks. Furthermore, the recurrent high-order neural networks are used as identifiers for nonlinear dynamical systems with unknown nodes states and coupling strengths. As a first attempt, the regulation of a complex network with unknown weights by applying inverse optimal control strategy is addressed, obtaining two results. One is general for nodes having uniformly decreasing dynamics, and the other more particular, for chaotic systems.

Finally, the study of trajectory tracking is outlined, which extends the original concept and task of pinning control.

About the Speaker

Mr David Israel Rodríguez-Castellanos received the M.Sc. in Electronic and Computation Engineering University of Guadalajara, Mexico in 2011; he is currently a PhD candidate at the Cinvestav unidad Guadalajara, Mexico. His research interest includes: chaos control, complex systems, nonlinear control especially pinning control, inverse optimal control and neural control.