Large-Scale Complex Networked Systems: Analysis and Control

Track Code: 9d8tb

Proposal for IFAC 2023 Open Invited Track

Organizers:

Xiaofan Wang (Shanghai University, China, xfwang@sjtu.edu.cn)

Ming Cao (University of Groningen, Netherlands, ming.cao@gmail.com)

Wei Ren (University of California, Riverside, USA, ren@ece.ucr.edu)

Hans Aalto (Neste Engineering Solutions, hans.aalto@neste.com)

Lin Wang (Shanghai Jiaotong University, wanglin@sjtu.edu.cn)

Abstract: In the past two decades, there have been more and more research interests in the analysis and control of large-scale complex networked systems, with application to communication networks, power grids, transportation networks, biological networks, social networks and so on. The aim of this track is to bring together different communities working on different aspects of complex networked systems. The track will discuss some fundamental issues on control of complex networks, including controllability and observability of complex networks, mathematical and algorithmic tools for analysis and design of large-scale networked systems, large-scale complex systems under cyber, physical or social constraints, optimal control and real-time economic optimization of large-scale complex systems, and potential applications to real-world systems.

IFAC Technical Committee: TC5.4 "Large-Scale Complex Systems"

Detailed description:

Large-scale complex systems have been traditionally characterized by a large number of variables, nonlinearities and uncertainties. Their decomposition into smaller, more manageable subsystems, possibly organized in a hierarchical form, has been associated with intense and time-critical information exchange and with the need for efficient decentralization and co-ordination mechanisms. It can be appreciated that several traditional subfields remain of increasing interest to the scientific community, such as decentralized and hierarchical control, model reduction and

optimization.

On the other hand, in the past two decades, empirical studies of complex networks have led to a variety of techniques and models to understand the organizing principles of complex networked systems. Significant progresses have been made in the following aspects:

1) *Discovering:* To reveal the global statistical properties of a network and to develop measures for these properties;

2) *Modeling:* To establish a mathematical model of a given network, enabling better understanding of the network statistical properties and the causes of their appearance.

3) *Analysis:* To find out the basic characteristics and essential features of nodes, edges, and the whole network, connected in a certain topology, to develop fundamental mathematical theories that can describe and predict the network dynamical behaviors.

4) *Control:* To develop effective methods and techniques that can be used to modify and improve network properties and performances, suggesting new and possibly optimal network designs and utilizations, particularly in the regards of network controllability and synchronizability.

The aim of this track is to bring together different communities working on different aspects of complex networked systems. The track will discuss some fundamental issues on control of complex networks, including controllability and observability of complex networks, mathematical and algorithmic tools for analysis and design of large-scale networked systems, large-scale complex systems under cyber, physical or social constraints, optimal control and real-time economic optimization of large-scale complex systems, and potential applications to real-world systems. We expect this track will add new dimensions for the developing area of control of complex networks.