POLITECNICO DI TORINO

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange

ECCELLENZA 2018 · 2022

Wednesday, May 22, 2019 at 10:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

Giulia GIORDANO

Assistant Professor & Delft Technology Fellow at Delft University of Technology

Control-theoretic tools for the structural analysis of biological systems

Prof. Giacomo Como introduces the seminar

Abstract

Biological systems can be modelled as dynamical networks resulting from the interaction of myriads of dynamic subsystems, arranged in several concurrent control loops; interactions occur according to a given topology, which can be visually represented as a graph, or a hyper-graph. Control-theoretic methods allow us to reveal and explain the complexity of interlaced feedback loops in biological systems (systems biology), and to design feedback loops in the cell to induce the desired behaviours (synthetic biology). Biological phenomena are characterised by astounding robustness despite huge uncertainties and environmental fluctuations.

In this seminar, Prof. Giordano will present a "structural" approach to understanding the robustness of biological systems, which exhibit fundamental life-preserving properties exclusively due to their inherent structure (graph topology), regardless of the system parameters. The "BDC-decomposition" is presented as a local and global tool for the structural analysis of biological systems. Based on this decomposition, she will propose criteria to structurally assess stability and the sign of steady-state input-output influences. Prof. Giordano will also illustrate a structural classification of the transitions to instability (either oscillatory or multi-stationary) that can occur in systems having a sign-definite Jacobian or consisting of the sign-definite interaction of stable monotone subsystems.

Biography

Giulia Giordano received the B.Sc. and M.Sc. degrees summa cum laude in electrical engineering and the PhD degree in systems and control theory from the University of Udine, Italy, in 2010, 2012, and 2016, respectively. Since 2017 she has been an Assistant Professor at the Delft Center for Systems and Control, Delft University of Technology, The Netherlands. She visited the Control and Dynamical Systems group, California Institute of Technology, Pasadena, CA, USA, in 2012 and the Institute of Systems Theory and Automatic Control at the University of Stuttgart, Germany, in 2015. Between 2016 and 2017 she was with the Department of Automatic Control and LCCC Linnaeus Center, Lund University, Sweden. Her main research interests include the study of dynamical networks, the analysis of biological systems and the control of networked systems. She received the EECI PhD Award 2016 for her thesis "Structural Analysis and Control of Dynamical Networks" and the NAHS Best Paper Award 2017 as a coauthor of the paper "A Switched System Approach to Dynamic Race Modelling," Nonlinear Analysis: Hybrid Systems, 2016. In 2018 she was awarded a Delft Technology Fellowship.

Save the date for the next event: May 28, 2019

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