PROGRAMME for NetDyn2024 Workshop & The Network Network Kickoff (TNN)

Time	Activity	Speaker/description
09.00 - 09.30	Talk	***"Continuum limit of the adaptive Kuramoto model"*** **Rok Cestnik**, Centre for Mathemtaical Sciences, LU
09.30 - 10.00	Talk	***"A Universal Route to Explosive Phenomena"*** **Christian Kuehn**, Dept. of Mathematics, TUM
10.00 - 10.30	Talk	***"Occupancy Processes with an Application to Evolving Networks"*** **Davide Sclosa**, Dept. of Mathematics, Vrije Universiteit Amsterdam
10.30 - 11.00	COFFEE BREAK	
11.00 - 11.30	Talk	***"The Diversity and the Controlled Collective Behaviour of a Population"*** **Li Qiu**, Dept. of Electronic & computer Science Eng., Hong Kong University
11.30 - 12.00	Talk	***"On Control of Large-scale Networks"*** **Anders Rantzer**, Dept. of Automatic Control, LU
12.00 - 13.30	LUNCH BREAK	
13.30 - 14.30	TNN kickoff meeting: The Network Network	Open discussion on how to continue activities (networking, research, etc) on network sciences at Lund University.

VENUE

Location: Room: MH:333. Matematikhuset, Centre for Mathematical Science, Lund University, Sweden
Date/Time: Monday August 26, 2024, starting at 9.00.
Website (updated): http://erikmartens.net/?page=activities#NetDyn24_workshop

DESCRIPTION

This 1-day workshop comprises a series of talks on network dynamical systems. We discuss recent advances in mathematics, but also keep a focus on applications in biology and technology, such as neuroscience, power grids, cognition and others. A special focus lies in the study of adaptive networks, i.e., where dynamics occur on both the nodes (vertices) and links (edges) on a network (graph) and may co-depend --- co-evolutionary networks in short.

The Network Network (TNN): This meeting is a networking and kickstart event. An important goal of the workshop is to connect researchers with interest in network theory and dynamics, inside and outside of Lund University together to create a platform to discuss theory and applications of networks and exchange ideas to collaborate. We will have a session to discuss possibilities for a continuation of regular activities related to networks and dynamical systems, such as a lecture series.

REGISTRATION

Please send an email with your name and institution to rok.cestnik 'AT' math.th.se (OR: erik.martens 'AT' math.lth.se) with **SUBJECT: NetDyn2024.**
Note: Sandwich and coffee at lunch will be reserved for registered participants.

(Please turn over)

BOOK OF ABSTRACTS

Speaker: Rok Cestnik, Centre for Mathematical Sciences, Lund University, Sweden
Title: Continuum limit of the adaptive Kuramoto model
Abstract: We investigate the dynamics of the adaptive Kuramoto model in the continuum limit with slow adaptation. This model is distinguished by dense multistability, where multiple states coexist for the same system parameters. The underlying cause of this multistability is that some oscillators can lock at different phases or switch between locking and drifting depending on their initial conditions. We identify new states, such as two-cluster states. To simplify the analysis we introduce an approximate reduction of the model via row-averaging of the coupling matrix. We derive a self-consistency equation for the reduced model and present a stability diagram illustrating the effects of positive and negative adaptation. Our theoretical findings are validated through numerical simulations of a large finite system. Comparisons to previous work highlight the significant influence of adaptation on synchronization behavior.

Speaker: Davide Sclosa, Dept. of Mathematics, Vrije Universiteit Amsterdam
Title: Occupancy Processes with an Application to Evolving Networks
Abstract: Occupancy processes are a large class of stochastic processes on graphs, which include many interacting particle systems and random graph models as particular cases. For large graphs both expected behavior and deviations from the expected behavior are controlled dynamical systems. In this talk I present a recent result and discuss interplay and limitations of probabilistic and deterministic approaches. Moreover, I will give an application to the analysis of dynamic random graphs in which edges turn on and off based on the state of the adjacent edges. In particular, I will show how simple coupling rules between edges lead to Erdős–Rényi random graphs that evolve chaotically over time.

Speaker: Christian Kuehn, Dept. of Mathematics, TU Munich, Germany (online)
Title: A Universal Route to Explosive Phenomena
Abstract: Critical transitions are observed in many complex systems. This includes the onset of synchronization in a network of coupled oscillators or the emergence of an epidemic state within a population. “Explosive” first-order transitions have caught particular attention in a variety of systems when classical models are generalized by incorporating additional effects. Here, we give a mathematical argument that the emergence of these first-order transitions is not surprising but rather a universally expected effect: Varying a classical model along a generic two-parameter family must lead to a change of the criticality. To illustrate our framework, we give thwo explicit examples of the effect in distinct physical systems: a model of adaptive epidemic dynamics and a higher-order/polyadic generalization of the Kuramoto model.

Speaker: Li Qiu, Dept. of Electronic & Computer Science Engineering, Hong Kong University of Science and Technology, China
Title: The Diversity and the Controlled Collective Behaviour of a Population
Abstract: If we have a heterogeneous population controlled by a distributed interaction network and if all the interactions have a uniform mechanism which can be delicately designed, then whether the population can be made to exhibit a desirable collective behaviour depends on the diversity of the population and the quality of the interaction. In this talk, for several scenarios, we will define the population diversity and the interaction quality, and we will then present such a dependence. The results presented in this talk come from the recent study of matrix phases.

Speaker: Anders Rantzer, Dept. of Automatic Control, Lund University, Sweden
Title: On Control of Large-scale Networks
Abstract: Classical control theory does not scale well for large systems like traffic networks, power networks and chemical reaction networks. To change this situation, new approaches for analysis and synthesis of controllers are being developed. In this lecture we will present some classes of networked control problems for which scalable distributed controllers can be optimised efficiently.