NETGCOOP 2014
International Conference on
NETwork Games, COntrol and OPtimization
Trento, October 29-31, 2014

Invited plenary speakers

Anders Rantzer

Title: Scalable Control of Monotone Systems

Abstract:
Classical control theory does not scale well for large systems like traffic networks, power networks and chemical reaction networks. However, many of these applications can be handled efficiently using the concept of positive system, exploiting that the set of positive states is left invariant by the dynamics.
Positive systems, and the nonlinear counterpart monotone systems, are common in many branches of science and engineering. In this presentation, we will highlight several fundamental advantages of monotone control systems: Verification and synthesis can be done with a complexity that scales linearly with the number of states and interconnections. Distributed controllers can be designed by convex optimization. Lyapunov functions and storage functions for nonlinear monotone systems can be built from scalar functions of the states, with dramatic simplifications as a result. In spite of a rich set of existing results, several fundamental questions in control of monotone systems remain open. For example, negative feedback can easily destroy monotonicity of the closed loop system. On the other hand, intuition tells us that something is wrong with a traffic control system where fewer cars leads to more congestion.
Hence, we need to better understand the limitations and potential of closed loop monotone systems.

Bio:
Anders Rantzer received a PhD in 1991 from KTH, Stockholm, Sweden. After postdoctoral positions at KTH and at IMA, University of Minnesota, he joined Lund University in 1993 and was appointed professor of Automatic Control in 1999. The academic year of 2004/05 he was visiting associate faculty member

at Caltech. Since 2008 he coordinates the Linnaeus center LCCC at Lund University. For the period 2013-15 he is also chairman of the Swedish Scientific Council for Natural and Engineering Sciences. Rantzer has been associate editor of IEEE Transactions on Automatic Control and several other journals. He is a winner of the SIAM Student Paper Competition, the IFAC Congress Young Author Price and the IET Premium Award for the best article in IEE Proceedings - Control Theory & Applications during 2006. He is a Fellow of IEEE and a member of the Royal Swedish Academy of Engineering Sciences. His research interests are in modeling, analysis and synthesis of control systems, with particular attention to uncertainty, optimization and distributed control.

Paola Goatin

Title: Optimization based control of networks of discretized PDEs: application to road traffic management.

Abstract:

Macroscopic traffic flow models derived from fluid dynamics are very popular nowadays both for vehicular and pedestrian flows. They offer a sound mathematical basis relying on well posedness results for hyperbolic non-linear conservation laws, as well as fast and efficient numerical tools consisting of finite volume schemes. In particular, traffic dynamics on road networks can be described by conservation laws coupled with suitable boundary conditions at junctions. This approach allows for efficient coordinated ramp-metering strategies resulting in better traffic performances than the state-of-the-art practitioners tools. We also extend the methodology to the case of multi-commodity flows intended to reduce traffic congestion by re-routing compliant users.

Bio:

Paola Goatin holds a PhD in Functional Analysis from the International School for Advanced Studies in Trieste (Italy), and a Habilitation (HDR) in Mathematics from Toulon University (France). She has been assistant professor at Toulon University, before joining INRIA as a research scientist in 2010. Her research activity focuses mainly on the analysis and numerical approximation of systems of partial differential equations of hyperbolic type. Targeted applications include traffic flow modeling and management. In particular, she currently holds an ERC Starting Grant for the project "Traffic Management by Macroscopic Models - TRAM3".

Fabio Camilli

Title: Mean Field Games on networks

Abstract:
Mean field game theory was introduced by Lasry and Lions to model games with a very large number of players. In this talk I will consider MFGs on networks.
As a toy model I will describe a simple optimization problem for the evolution of a large number of agents moving on a network. This model, called "What time does the meeting start?'', consists in finding the optimal arrival time for the agents at a place where the meeting is being held. The starting time of the meeting is defined by means of a quorum rule.
The evolution of agent on the network is described by a stochastic differential equation with appropriate transition conditions at a vertices which prescribes the probability of entering in a given edge. Corresponding transition conditions have to be given for the function describing the evolution of the distribution of the players.
I will discuss the appropriate transition conditions for the corresponding Mean Field Games system and I will present some numerical results.

Bio:
Fabio Camilli received a PhD from the University of Roma "La Sapienza".
He hold positions at the University of Torino and l'Aquila before joining "La Sapienza" as professor of Mathematical Analysis in 2010. His research interests include the analysis and numerical approximation of partial differential equations in relation to deterministic and stochastic optimal control theory.

Tamer Başar

Title: Stochastic Dynamic Teams and Games with Asymmetric Information

Abstract:

In any real application of stochastic decision making, be it in the cooperative team framework or the non-cooperative game setting, asymmetry in the information acquired by different decision makers (synonymously agents or players) naturally arises. Presence of asymmetric information, particularly in dynamic (multi-stage) decision problems, creates challenges in the establishment of existence of optimal solutions (in teams) and non-cooperative equilibria (in games) as well as in their characterization and computation. No unified theory exists (such as dynamic programming or maximum principle) that would be applicable to such problems. In this talk, I will discuss our efforts toward developing such a unified theory with regard to existence of solutions. For stochastic dynamic teams, the framework will encompass problems with non-classical information, such as Witsenhausen's counterexample (and its multi-dimensional extensions) and the Gaussian test channel (and its multi-relay versions with real-time information processing and transmission), among others, for which the existence of team-optimal solutions will be obtained. For stochastic dynamic games with asymmetric information, the existence of Nash equilibria will be established using the newly introduced refinement concept of "common information based Markov perfect equilibrium". The approach for games entails establishing an equivalence between the original game and an appropriately constructed one in a higher dimensional space, with symmetric and perfect information, and with virtual players. For dynamic teams, the approach first lifts the analysis to the space of behavioral strategies, establishing existence in that richer space, and then brings the solution down to the original team problem while respecting the informational relationships. Several examples will be provided to illustrate the solution technique, the underlying caveats, and the conditions involved. Some open problems and future directions for research will be identified.

Bio:
Tamer Başar has been with the University of Illinois at Urbana-Champaign since 1981, where he holds the academic positions of Swanlund Endowed Chair; Center for Advanced Study Professor of Electrical and Computer Engineering; Professor, Coordinated Science Laboratory; and Professor, Information Trust Institute. He is a member of the US National Academy of Engineering and of the European Academy of Sciences; Fellow of IEEE, IFAC, and SIAM; a past president of the IEEE Control Systems Society (CSS), the founding president of the International Society of Dynamic Games (ISDG), and a past president of the American Automatic Control Council (AACC). He has received several awards and recognitions over the years, including the highest awards of IEEE CSS, IFAC, AACC, and ISDG, the IEEE Control Systems Technical Field Award, and a number of international honorary doctorates and professorships. Dr. Başar has over 600 publications in systems, control, communications, and dynamic games, including books on non-cooperative dynamic game theory, robust control, network security, wireless and communication networks, and stochastic networks. He is the Editor-in-Chief of *Automatica* and editor of several book series.