

Department of Mechanical Engineering
Russell Severance Springer Colloquium
presents

“Towards Scale-Free Control of Large-Scale Traffic Networks”

Carlos Canudas-de-Wit

*Director of Research at the CNRS
GIPSA-Lab, Grenoble, France*

Tuesday, April 18, 2017

11:00 am – 12:00 pm

3110 Etcheverry Hall

Coffee & Cookies will be served.

ABSTRACT

The talk discuss new research lines addressing the optimal control of time-varying dynamic large-scale traffic networks. The driving idea consists in aggregating the whole network in sub-networks having some suitable control properties, allowing the optimal games to be more tractable. The talk start with a recall of controllability and observability properties in 1-D traffic network and provide an detailed example in how to partition the systems and how to solve the associated time-varying optimal games [1]. Then we discuss recent work on how such ideas can be extended to 2-D graphs in relation with the problem of games played over networks and focus our attention on the importance of the topology of communication between nodes. We analyze the topology of the graph and its importance in the structure of the game. We show that, by condensing the strongly connected components of the control graph into super-nodes, it is possible to give a hierarchical interpretation to the network game. According to this analysis, we assign to each node a level of priority and define a sequential procedure to steer the response of the network to a Nash equilibrium. Given a certain topology, this equilibrium is unique and it depends on the particular topology and the set of local cost function (Ref.2). The talk finalize by discussing new avenues for organizing such large-scale complex networks, by proposing a new aggregation procedure that combines, complexity reduction (scale-free graph structure), physical preservation properties, and control targets. In connection with this goal, some preliminary results concerning the aggregation of the whole Grenoble Traffic network will be presented.

[1] D. Pisarski and C. Canudas-de-Wit. "Nash Game Based Distributed Control Design for Balancing of Traffic Density over Freeway Networks. IEEE Transactions on Control of Network Systems, IEEE, 2016, 3 (2), pp.149-161.

[2] G. Casadei, C. Canudas De-Wit. Networks Games: Condensation of the Graph as a Hierarchical interpretation of the Game, IFAC WC'17. Toulouse, France.

BIOGRAPHY

Canudas-de-Wit, Carlos was born in Villahermosa, Tabasco, Mexico in 1958. He received his B.Sc. degree in electronics and communications from the Technological Institute of Monterrey, Mexico in 1980. In 1984 he received his M.Sc. in the Department of Automatic Control, Grenoble, France. He was visitor researcher in 1985 at Lund Institute of Technology, Sweden. In 1987 he received his Ph.D. in automatic control from the Polytechnic of Grenoble (Department of Automatic Control), France. Since then he has been working at the same department as "Director of Research at the CNRS", where He teaches and conducts research in the area of control systems. He is the current leader of the NeCS GIPSA-Lab (CNRS)-INRIA team on Networked Controlled Systems. He has established several industrial collaboration projects with major French companies (FRAMATOME, EDF, CEA, IFREMER, RENAULT, SCHNEIDER, ILL, IFP, ALSTOM). He has been associate editor of the IEEE-Transaction on Automatic Control, from 1992 to 1997, AUTOMATICA, from 1999 to 2002. He is currently Associated Editor of: the Asian Journal of Control (since 2010), IEEE Transaction on Control System Technology (Since 2013), and the IEEE Transaction on Control of System Networks (since 2013). He holds the presidency of the European Control Association (EUCA) for the period 2013-15, and served at the IEEE Board of Governors of the Control System Society 2011-2014. He holds the ERC Advanced-Grant 2015 Scale-FreeBack for the period 2016-2021. He is IEEE-Fellow of the IEEE Control System Society. He is also IFAC-Fellow. His research publications includes: 200 International conference papers, and 65 published papers in international journals, 5 books, 10 Book chapter, and holds 11 Patents. He has supervised more than 34 Ph. D. students, 11 Post-docs, and more than 35 Ms. He holds the ERC Scale-FreeBack (Scale-free Control for Complex Physical Network Systems) Advanced Grant from 2016-21, see <http://scale-freeback.eu>