

**SEMINARIO DIDATTICO - SCIENTIFICO****Exploiting the Fundamental Diagram of Urban Networks for Feedback-Based Gating****Prof. Markos Papageorgiou**

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Traffic signal control for urban road networks has been an area of intensive research efforts for several decades, and various algorithms and tools have been developed and implemented to increase the network traffic flow efficiency. Despite the continuous advances in the field of traffic control under saturated conditions, novel and promising developments of simple concepts in this area remains a significant challenge, because some proposed approaches that are based on various meta-heuristic optimization algorithms can hardly be used in a real-time environment. To address this problem, the recently developed notion of network fundamental diagram (NFD) for urban networks is exploited to improve mobility in saturated traffic conditions. Specifically, a simple control design model is first developed, followed by the appropriate design of a simple, but highly efficient feedback regulator for well-targeted gating action. As a case study, the proposed methodology is applied to the urban network of Chania, Greece, using microscopic simulation. The results show that, with the proposed feedback gating scheme, the total delay in the network decreases significantly; the mean speed increases accordingly; while the reliability of the traffic conditions across different simulation replications features also a strong increase; compared to the base (non-gating) case. Additional investigations demonstrate that equivalent quality results are achievable even with very few real-time measurements from the oversaturated network, i.e. at a strongly reduced implementation cost compared to what is needed for the capture of the complete NFD. Related future work is outlined.



Markos Papageorgiou received the Diplom-Ingenieur and Doktor-Ingenieur (honors) degrees in Electrical Engineering from the Technical University of Munich, Germany, in 1976 and 1981, respectively. He was a Free Associate with Dorsch Consult, Munich (1982-1988), and with Institut National de Recherche sur les Transports et leur Sécurité (INRETS), Arcueil, France (1986-1988). From 1988 to 1994 he was a Professor of Automation at the Technical University of Munich. Since 1994 he has been a Professor at the Technical University of Crete, Chania, Greece.

He was a Visiting Professor at the Politecnico di Milano, Italy (1982), at the Ecole Nationale des Ponts et Chaussées, Paris (1985-1987), and at MIT, Cambridge (1997, 2000); and a Visiting Scholar at the University of California, Berkeley (1993, 1997, 2001, 2011) and other universities.

Dr. Papageorgiou is author or editor of 5 books and of some 400 technical papers. His research interests include automatic control and optimisation theory and applications to traffic and transportation systems, water systems and further areas. He was the Editor-in-Chief of Transportation Research – Part C (2005-2012). He also served as an Associate Editor of IEEE Control Systems Society – Conference Editorial Board, of IEEE Transactions on Intelligent Transportation Systems and other journals. He is a Fellow of IEEE. He received a DAAD scholarship (1971-1976), the 1983 Eugen-Hartmann award from the Union of German Engineers (VDI), and a Fulbright Lecturing/Research Award (1997). He was a recipient of the IEEE Intelligent Transportation Systems Society Outstanding Research Award (2007) and of the IEEE Control Systems Society Transition to Practice Award (2010). He was presented the title of Visiting Professor by the University of Belgrade, Serbia (2010). The Dynamic Systems and Simulation Laboratory he has been heading since 1994, received the IEEE Intelligent Transportation Systems Society ITS Institutional Lead Award (2011). He was awarded an ERC Advanced Investigator Grant (2013-2017).

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