

(Online) Traffic Flow Modeling, Control and Optimization in a Connected Environment

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數據科學大師講座

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Abstract

Advances in electronics, computers, sensor technologies, software tools and communications made it possible to establish a connected transportation system where vital for control and traffic management information is shared among users and infrastructure in a speedy manner. This kind of connectivity provides a unique opportunity to model, control and optimize traffic in ways not possible before. In this talk I will cover examples where models and control and optimization techniques are used to improve traffic flow, manage congestion, improve mobility and safety with benefits to the environment. I will emphasize the use of analysis and how mathematical models are chosen based on the problem under consideration. For large complex traffic networks the use of simple mathematical models is replaced with simulation models or digital twins which are part of the control and optimization decision making in order to generate more accurate results. One of the examples to be discussed in detail is integrated traffic flow control using variable speed limit, lane change and ramp metering control. Another example where simulation models are used in a co-simulation optimization approach is a centrally coordinated cyber physical freight routing system.

Biography

Petros Ioannou is a Professor in the Department of Electrical and Computer Engineering at the University of Southern California and holds the A.V 'Bal' Balakrishnan Endowed Chair. He also holds a courtesy appointments with the Department of Aerospace and Mechanical Engineering and Department of Industrial Systems Engineering. He is the founder and Director of the Center for Advanced Transportation Technologies and co founder and Associate Director for Research of the University Transportation Center METRANS at the University of Southern California. Dr Ioannou was the recipient of the Axelby Outstanding Paper Award by the IEEE Control System Society in 1984 and the recipient of a 1985 Presidential Young Investigator Award for his research in Adaptive Control. In 2009 he received the IEEE Intelligent Transportation Systems Society (ITSS) Outstanding Application Award and the 2009 IET Heaviside Medal for Achievement in Control. In 2012 he received the IEEE ITSS Research Award and in 2016 the IEEE Transportation Technologies Field Award. In 2022 he was inducted to the National Academy of Engineering, Academy Europaea and National Academy of Inventors.

Dr Ioannou is a Life Fellow of IEEE and Fellow of IFAC and AAAS. He is the author/co-author of 9 books and over 400 research papers in the area of controls and applications and intelligent transportation systems.