



Traffic Flow of Urban Air Mobility: Modeling, Control, and Simulation

Speaker: Jack Haddad, Associate Professor of Transportation Engineering with the Civil and Environmental Engineering faculty, the Technion – Israel Institute of Technology

Tuesday, May 30th, 2023

10:00 AM – 11:00 AM

Location: EEB 132

Zoom: <https://usc.zoom.us/j/94759707407?pwd=NGJOMERvNmlyWGtqRkh0dkdDc0dzZz09>

Meeting ID: 947 5970 7407 **Passcode:** 144534

Abstract:

In this talk, we will focus on traffic flow modeling, control, and simulation of urban air mobility. The imminent penetration of low-altitude passenger and delivery aircraft into the urban airspace will give rise to new urban air transport systems, which we call low-altitude air city transport (LAAT) systems. As the urban mobility revolution approaches, we must investigate (i) the individual and collective behavior of LAAT aircraft in cities, and (ii) ways of controlling LAAT systems. Future LAAT systems exemplify a new class of modern large scale engineering systems — networked control systems. They are spatially distributed, consist of many interconnected elements with control loops through digital communication networks such that the system signals can be exchanged among all components through a common network. Therefore, a decentralized controller design in framework of the unilateral event-driven paradigm is considered. Inspired by controlled urban road networks, in this talk we first establish the concept of Macroscopic Fundamental Diagram (MFD) for LAAT systems and develop a collective and aggregate aircraft traffic flow model. Then, based on that, we design an adaptive boundary feedback flow control which is robust to various anomalies in technical devices and network communication links for LAAT systems.

Bio: Jack Haddad is an Associate Professor of Transportation Engineering with the Civil and Environmental Engineering faculty, the Technion – Israel Institute of Technology, and the Head of the Technion Sustainable Mobility and Robust Transportation (T-SMART) Laboratory. He received all his degrees B.Sc. (2003), M.Sc. (2006), and Ph.D. (2010) in Transportation Engineering from the Technion. He served as a post-doctoral researcher (2010-2013) at the Urban Transport Systems Laboratory (LUTS), EPFL, Switzerland. His current research interests include urban air mobility, autonomous vehicles, traffic flow modeling and control, large-scale complex networks, advanced transportation systems management, and public transportation.



Dr. Haddad serves as an Associate Editor for two journals: Transportation Research Part C and IEEE Transactions on Intelligent Transportation Systems. He was a recipient of the European Union Marie Curie, Career Integration Grant (CIG), and a recipient of two Israel Science Foundation (ISF) grants. He is currently the head of the Technion Transportation Research Institute (TRI), and the Assistant to the Senior Executive Vice President for Equal Opportunities. He is also a Visiting Faculty Researcher at Google.

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