



Dr. Weijun Xie

The Coca-Cola Foundation Early Career Professor

The H. Milton Stewart School of ISE

Gatech

Atlanta, GA

Date: Friday, April 26, 2024

Time: 1:00 -- 1:50 pm

Location: D2 Lect 2

Fair and Risk-averse Urban Air Mobility Resource Allocation

Under Demand and Capacity Uncertainties

Abstract: Urban Air Mobility (UAM) is an emerging air transportation mode to alleviate the ground traffic burden and achieve zero direct aviation emissions. Due to the potential economic scaling effects, the UAM traffic flow is expected to increase dramatically once implemented, and its market can be substantially large. To be prepared for the era of UAM, we study the Fair and Risk-averse Urban Air Mobility resource allocation model (FairUAM) under passenger demand and airspace capacity uncertainties for fair, safe, and efficient aircraft operations. FairUAM is a two-stage model, where the first stage is the aircraft resource allocation, and the second stage is to fairly and efficiently assign the ground and airspace delays to each aircraft provided the realization of random airspace capacities and passenger demand. We show that FairUAM is NP-hard even when there is no delay assignment decision or no aircraft allocation decision. Thus, we recast FairUAM as a mixed-integer linear program (MILP) and explore model properties and strengthen the model formulation by developing multiple families of valid inequalities. The stronger formulation allows us to develop a customized exact decomposition algorithm with both Benders and L-shaped cuts, which significantly outperforms the off-the-shelf solvers. Finally, we numerically demonstrate the effectiveness of the proposed method and draw managerial insights when applying FairUAM to a real-world network.

Biography: Dr. Weijun Xie is the Coca-Cola Foundation Early Career Professor and Assistant Professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Tech. Dr. Xie obtained his Ph.D. in Operations Research at the Georgia Institute of Technology in 2017. His research interests are theory and applications of stochastic, discrete, and convex optimization. His works have received multiple awards, including the 2022 New Investigator Award from the Virginia Space Grant Consortium (NASA), the 2021 NSF CAREER Award, and the Winner of the 2020 INFORMS Young Researchers Paper Prize. He currently serves as Associate Editor of Operations Research, Mathematical Programming, and the Journal of Global Optimization.