Modeling On-Demand Public Transit: A Markovian Continuous Approximation Approach

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Talk will take place from 11:15AM - 12:05PM in Freeman Auditorium (and also through Zoom).

Abstract: With recent advances in mobile technology, public transit agencies around the world have been actively experimenting with new transportation modes, many of which can be characterized as on-demand public transit. Design and efficient operation of such systems can be particularly challenging because they often need to carefully balance demand volume with resource availability. The talk will discuss a family of models for on-demand public transit that combine a continuous approximation methodology with a Markov process. Our goal is to develop a tractable method to evaluate and predict system performance, specifically focusing on obtaining the probability distribution of performance metrics. This information can then be used in capital planning, such as fleet sizing, contracting, and driver scheduling, among other tasks. We will discuss the analytical solution for a stylized single-vehicle model of first-mile operation, and then describe several extensions to the base model. We will also review some computational experiments and a case study, based on a real-world pilot on-demand public transit project in a major U.S. metropolitan area. We will then outline connections between the developed modeling approach and more general methodologies, such as semi-Markov models, and how continuous approximation idea can improve applicability of such techniques in future research.

Bio: Daniel F. Silva is an Assistant Professor in the Industrial and Systems Engineering Department at Auburn University's Samuel Ginn College of Engineering. He holds a Ph.D. in Operations Research from Georgia Tech. Silva's research interests involve developing and applying novel techniques, including data-driven approaches, to model and solve optimization problems under uncertainty in diverse applications, including manufacturing, supply chains, and service systems. Silva is currently involved

in research initiatives that include: applying machine learning algorithms for pore and surface roughness characterization in additive manufacturing; developing the optimal operational parameters for on-demand public transportation systems; and optimally dispatching orders in a same-day-delivery setting employing a combination of trucks and drones. Silva is also working on collaborative projects with industry, including partnerships with Honda Manufacturing of Alabama and Transdev North America. In addition to his research, Silva teaches graduate and undergraduate courses on manufacturing systems, dynamic optimization, and production and inventory control. He also develops software applications related to stochastic optimization. He is a major contributor to the jMarkov Project, a Java framework for Markov chain modeling. Silva also has over four years of industry experience working with two Fortune 500 corporations creating and implementing operations research solutions for a variety of manufacturing, logistics, and warehousing problems.