

# Department of Industrial Engineering

## Spring 2021 Seminar Series

Friday, Apr. 16<sup>th</sup> 1:25-2:15pm EST via Zoom

Open to the public

Please contact Dr. Emily Tucker (etucke3@clemson.edu) for log-in information

**Speaker:** Dr. Güzin Bayraksan

**Affiliation:** Ohio State University, Integrated Systems Engineering

**Title:** Residuals-Based Stochastic Optimization Approaches with Covariate Information

**Abstract:** We consider data-driven approaches that integrate a machine learning prediction model within stochastic optimization, given joint observations of uncertain parameters and covariates. Given a new covariate observation, the goal is to choose a decision that minimizes the expected cost conditioned on this observation. We first examine a Sample Average Approximation (SAA) approach for approximating this problem. We derive conditions on the data generation process, the prediction model, and the stochastic program under which solutions of these data-driven SAAs are consistent and asymptotically optimal. We also derive convergence rates and finite sample guarantees. Then, in the limited-data regime, we consider Distributionally Robust Optimization (DRO) variants of these models. Our framework is flexible in the sense that it can accommodate a variety of learning setups and DRO ambiguity sets. We investigate the asymptotic and finite sample properties of solutions obtained using Wasserstein, sample robust optimization, and phi-divergence-based ambiguity sets and explore cross-validation approaches for sizing these ambiguity sets. Computational experiments validate our theoretical results, demonstrate the potential advantages of our data-driven formulations (even when the prediction model is misspecified), and illustrate the benefits of our new data-driven formulations in the limited data regime.



**Bio:** Güzin Bayraksan is an associate professor in the Integrated Systems Engineering Department and an affiliated faculty member of the Sustainability Institute and the Translational Data Analytics Institute at the Ohio State University. Prior to joining OSU, she was a faculty member in the Systems and Industrial Engineering Department at the University of Arizona, where she was also a member of the Graduate Interdisciplinary Program in Applied Mathematics. She received her Ph.D. in Operations Research and Industrial Engineering from the University of Texas at Austin and B.S. in Industrial Engineering from Bosphorus (Bogazici) University in Istanbul, Turkey. Her research interests are in optimization under uncertainty, particularly stochastic programming, Monte Carlo sampling-based and data-driven distributionally robust methods with applications in water resources management. She is the recipient of 2016 INFORMS ENRE Best Publication Award in Environment and Sustainability, 2016 Lumley Research Award (OSU), 2012 NSF CAREER award, 2012 Five Star Faculty Award (UA), and the 2008 INFORMS best case study award. She is currently the Chair of Stochastic Programming Society. In the past, she served as the Vice Chair of Optimization under Uncertainty of INFORMS Optimization Society and President of the INFORMS Forum on Women in Operations Research and Management Science (WORMS). She is a founding area editor of Optimization under Uncertainty in the newly established Open Journal of Mathematical Optimization and also serves on the editorial boards of IIEE Transactions and Computational Optimization and Applications.