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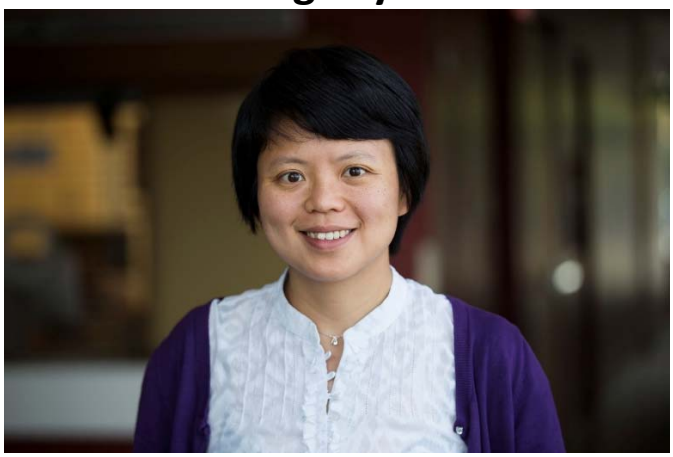
Engineering Management, Information, and Systems

Seminar Series

Research Seminar

Multistage Distributionally Robust Mixed-Integer Programming with Decision-Dependent Moment-Based Ambiguity Sets



Dr. Siqian Shen
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Friday, November 6, 2020
11:00 a.m. – 12:15 p.m.
Zoom link: https://smu.zoom.us/j/95273954561

Abstract: We study multistage distributionally robust mixed-integer programs under endogenous uncertainty, where the probability distribution of stage-wise uncertainty depends on the decisions made in previous stages. We first consider two ambiguity sets defined by decision-dependent bounds on the first and second moments of uncertain parameters and by mean and covariance matrix that exactly match decision-dependent empirical ones,

respectively. For both sets, we show that the subproblem in each stage can be recast as a mixed-integer linear program (MILP). Moreover, we extend the general moment-based ambiguity set in (Delage and Ye, 2010) to the multistage decision-dependent setting, and derive mixed-integer semidefinite programming (MISDP) reformulations of stage-wise subproblems. We develop methods solving a series of MILPs for approximating lower and upper bounds of the optimal objective value of the multistage MISDPs. We deploy the Stochastic Dual Dynamic integer Programming (SDDiP) method for solving the problem under risk-neutral or risk-averse objectives, and conduct numerical studies on multistage facility-location instances having diverse sizes under different parameter and uncertainty settings.

Biography: Siqian Shen is an Associate Professor of Industrial and Operations Engineering at the University of Michigan and also serves as an Associate Director in the Michigan Institute for Computational Discovery & Engineering (MICDE). She obtained a B.S. degree from Tsinghua University in 2007 and Ph.D. from the University of Florida in 2011. Her theoretical research interests are in integer programming, stochastic/robust optimization, and network optimization. Applications include optimization and risk analysis of energy, healthcare, cloud computing, and transportation systems. She is a recipient of the IIE Pritsker Doctoral Dissertation Award (1st Place), IBM Smarter Planet Innovation Faculty Award, and Department of Energy (DoE) Early Career Award, and several best paper prizes from INFORMS. Her research has been supported by the National Science Foundation, Department of Defense, Department of Energy, Department of Transportation, and industry funds.