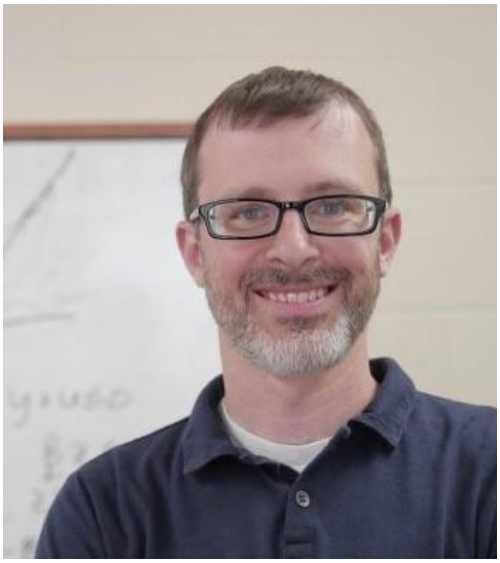
EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

New Approximate Solution Approaches for Multi-Stage Stochastic Optimization

ABSTRACT – Multi-stage stochastic optimization can be used to model dynamic decision-making environments in which a sequence of decisions are to be made in response to a sequence of random events. Such problems arise in many applications, such as unit commitment and economic dispatch in power systems and inventory and production management. Many approaches for solving multi-stage stochastic optimization problems rely on a given scenario-tree approximation of the underlying stochastic process. Unfortunately, the size of the scenario tree required to adequately represent the evolution of a stochastic process in general grows exponentially with the number of decision stages, making this approach limited in practice to problems with few stages. In this talk we discuss two approximate solution approaches for particular classes of such problems in settings where the number of stages is large, so that the scenario-tree approach is intractable. In addition to providing a decision policy, both approaches also yield bounds on the objective value of an optimal policy. First, we consider multi-stage stochastic linear programs, and propose a two-stage adaptation of the linear decision rule (LDR) approximation approach. The proposed approach differs from previous LDR approaches by imposing the LDR restriction on the state variables only, thereby yielding a two-stage approximation of the multi-stage problem. Second, we consider a multi-stage stochastic unit commitment problem, a problem that is especially challenging due to the presence of integer decision variables. We demonstrate how the "dual approximate dynamic programming", recently proposed by Barty, Carpentier and Girardeu (2010), can be applied to obtain bounds on the optimal value together with an approximate policy.



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SPEAKER BIO – Dr. Jim Luedtke is an Associate Professor in the department of Industrial and Systems Engineering at the University of Wisconsin-Madison. Luedtke earned his Ph.D. at Georgia Tech and did postdoctoral work at the IBM T.J. Watson Research Center. Luedtke's research is focused on methods for solving stochastic and mixed-integer optimization problems, as well as applications of such models. Luedtke is a recipient of an NSF CAREER award, was a finalist in the INFORMS JFIG Best Paper competition, and was awarded the INFORMS Optimization Society Prize for Young Researchers. Luedtke serves on the editorial boards of the journals SIAM Journal on Optimization, INFORMS Journal on Computing, and Mathematical Programming Comoputation. Luedtke is the current secretary of the SIAM Activity Group in Optimization, serves on the Committee on Stochastic Programming, and is a former secretary/treasurer of the INFORMS Optimization Society.

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3:30PM – 4:50PM
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