Improving the performance of the stochastic dual dynamic programming algorithm using Chebyshev centers. (English) Zbl 1492.90099

Summary: In hydro predominant systems, the long-term hydrothermal scheduling problem (LTHS) is formulated as a multistage stochastic programming model. A classical optimization technique to obtain an operational policy is the stochastic dual dynamic programming (SDDP), which employs a forward step, for generating trial state variables, and a backward step to construct Benders-like cuts. To assess the quality of the obtained policy (the cuts obtained over the iterations), a confidence interval is computed on the optimality gap. As the SDDP is a cutting-plane based method, it exhibits slow convergence in large-scale problems. To improve computational efficiency, we explore different regions in which the cuts are usually constructed by the classical algorithm. For that, the cuts in the forward step are translated using ideas related to the definition of Chebyshev centers of certain polyhedrons. Essentially, the cuts are lifted by a parameter that vanishes along with iterations without harming the convergence analysis. The proposed technique is assessed on an instance of the Brazilian LTHS problem with individualized monthly decisions per plant, indicating a higher policy quality in comparison with the classical approach, since it computes lower optimality gaps throughout the iterative process.

MSC:
90C15 Stochastic programming
90C39 Dynamic programming
90C90 Applications of mathematical programming

Keywords:
hydrothermal scheduling problem; multi-stage stochastic programming; stochastic dynamic dual programming; Chebyshev centers

Full Text: DOI

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