

Stochastic Decision Optimization based on Deterministic Approximations of Processes described as Closed-form Arithmetic Simulation

Abstract

We consider processes with feasibility constraints and metrics of interest, including process cost, that are stochastic functions of process controls. We propose an efficient stochastic optimization algorithm for the problem of finding process controls that minimize the expectation of cost while satisfying multiple deterministic and stochastic feasibility constraints with a given high probability. The proposed algorithm is based on (1) a series of deterministic approximations to produce a candidate set of near-optimal control settings for the process, and (2) stochastic simulations on the candidate set using optimal simulation budget allocation methods. In an experimental study, we demonstrate the proposed algorithm on a use case of a real-world heat-sink service network that involves contract suppliers and manufacturers as well as unit manufacturing processes of shearing, milling, drilling, and machining. The experimental study shows that the proposed algorithm significantly outperforms four popular simulation-based stochastic optimization algorithms.