

Multi-stage adjustable robust mixed-integer optimization via iterative splitting of the uncertainty set

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Abstract

In this paper we propose a methodology for constructing decision rules for integer and continuous decision variables in multi-period robust linear optimization problems. This type of problems finds application in, for example, inventory management, lot sizing, and manpower management. We show that by iteratively splitting the uncertainty set into subsets one can differentiate the later-period decisions based on the revealed uncertain parameters. At the same time, the problem's computational complexity stays at the same level as for the static robust problem. This holds also in the non-fixed recourse situation. In the fixed recourse situation our approach can be combined with linear decision rules for the continuous decision variables. We provide theoretical results how to split the uncertainty set by identifying sets of uncertain parameter scenarios to be divided for an improvement in the worst-case objective value. Based on this theory, we propose several splitting heuristics. Numerical examples entailing a capital budgeting and a lot sizing problem illustrate the advantages of the proposed approach.

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