A new branch and bound algorithm for the bilevel linear programming problem

Nadezhda V. Dresvyanskaya

Melentiev Energy Systems Institute SB RAS,
Lermontov st. 130, 664033 Irkutsk, Russia
nadyadresvyanskaya@gmail.com

Abstract. The bilevel linear programming problem is considered. A new branch and bound algorithm in combination with optimization technique based on the support functions is proposed. Computational results for randomly generated test problems are given and analyzed.

Keywords: bilevel optimization, support functions, branch and bound algorithm

The statement of the bilevel linear programming problem (BLPP) in which the feasible region of the upper-level problem is determined implicitly by the solution set of the lower-level problem is investigated. The objective function and the constraints of the upper-level and lower-level problems of BLPP are all linear and affine. However, even for this simplest two-level linear case the problem is strongly NP-hard.

For this class of problems, the branch and bound algorithm is the most successful algorithm to deal with the complementary constraints arising from Karush-Kuhn-Tucker conditions.

In this paper we propose a novel implementation of the branch and bound algorithm based on the support functions. It is assumed that in each point of the convex set containing the feasible region, the functions that define the feasible set have distinct support functions. The method is used to expedite the solution finding process.

The feasibility and effectiveness of the proposed approach are demonstrated and the test results are compared with those of other methods reported in the literature.

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