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A NEW BRANCH-AND-CUT ALGORITHM FOR THE ORTHOGONAL STRIP PACKING PROBLEM

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Abstract. We consider the *2D strip packing problem* (SPP-2). Given a set of rectangular items, SPP-2 is to find a packing of all items occupying the minimal height of the given semi-infinite strip. SPP-2 is considered without items rotation.

Keywords: linear programming; branch-and-cut; facet-defining inequalities.

We develop an integer linear programming model. The model is based on the representation of two 1D contiguous solutions [1] (CBP-1) in a *time-indexed* formulation. In comparison to [1], the non-overlapping condition for the feasibility of 2D solutions is realized through the linear inequalities which are applied for every pair of possible coordinates in each 1D solution.

We determine different valid inequalities. For some of them we show that they are strong, i. e. *facet-defining* [2] for the convex hull of the integer solutions of the formulation. The number of such inequalities (also called cuts) is exponential.

Based on the proposed formulation we develop a new branch-and-cut algorithm which is branch-and-bound in which cutting planes are generated throughout the branch-and-bound tree [3]. The idea of the method is to do much work as is necessary to get a tight dual bound at the node of the branching tree.

The main procedures of the branch-and-cut algorithms are *branching, pruning, and cut generation*. The first two are usual ones. The last one has the following meaning. At the beginning of the algorithm we start with the relaxation of the basic formulation. At the next step, in order to deal with the exponential number of the cuts, we solve so-called *separation problem* which returns all the cuts or the one which is most affected. Then we add this cut into the formulation and resolve the relaxation. We reiterate until no cut is affected. This procedure is called *cut generation*. After all cuts are added we perform to pruning and branching.

Theoretical investigations as well as numerical results are discussed at the talk. The latter demonstrate the strength of the found inequalities.

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