THREE-DIMENSIONAL BIN PACKING PROBLEM WITH A STABILITY REJECTION CRITERION

Teemu Linkosaari[1, 2], Tero Urponen[2], Henrik Juvonen[2], Marko Makela[1*], Yury Nikulin[1]

[1]Department of Mathematics and Statistics
20014, University of Turku
Turku, Finland
fteemu.linkosaari, marko.makela, yury.nikuling@utu.fi

[2]Kine Robot Solutions
Vallihaudankatu 10, Turku,
Finland
tero.urponen, henrik.juvoneng@kine.fi

ABSTRACT

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Packing problems play an important role in transportation and supply chain management. This study aims to solve a practical three-dimensional bin packing problem, where highly heterogeneous sized boxes are to be packed on a pallet. Without supporting walls it is critical to ensure that the boxes are supported and stay stable. Thus, there are two goals: solution
compactness and stability. This problem is a part of the task of minimizing the number of pallets needed. First, we use an existing bin packing algorithm [1] based on packing indices, which converts an arbitrary list of boxes to a packing solution. The method is extended to be able to pack boxes from four corners instead of one corner. Moreover, a special method to check the stability of placed boxes is devised. To make the search space a bit smaller, grouping of boxes with same dimensions is used. Secondly, a genetic algorithm [1] is used to find a good permutation to the packing procedure. To further improve the solution quality, we utilize an existing global search framework with the concept of evolutionary gradient.
The efficiency of proposed method is tested and verified in an industrial setting. Two orientations are allowed: boxes are rotated around the vertical axis only. Volume utilization is
maximized under the rejection stability criterion, i.e. we discard solutions if any packed box happens to be unstable. Solutions obtained are more stable and packable than in the previous
studies.

References

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