Algorithms for Certain Classes of Cutting and Packing Problems

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Thesis Summary

Cutting and packing problems pose a significant challenge in the area of production and distribution in particular and management science in general. Generally speaking, cutting and packing problems, in its standard form, involve cutting (assigning) a list of regular shaped items, not necessarily all distinct, from (to) regular shaped identical large objects using as few of the large objects as possible. This thesis deals with certain classes of one-dimensional and two dimensional rectangular cutting and packing problems.

To get optimal solutions for one-dimensional bin packing (ODBPP) and cutting stock problems (ODCSP), a scheme named ODPACES, One Dimensional Packing And Cutting: Exact Solutions, has been proposed. The scheme involves some problem reduction procedures followed by a depth-first branch-and-bound algorithm. ODPACES outperforms currently known best methods for solving ODBPP and ODCSP when applied on benchmark set of problems.

The thesis demonstrates that two-stage two-dimensional (TDCSP) exact heterogeneous cutting problems using non-isotropic material can be solved optimally by solving a sequence of related one-dimensional problems. So this class of TDCSP can directly be handled by ODPACES. The thesis also shows that it is possible to formulate the two stage two dimensional homogeneous cutting problems on isotropic material as an ODCSP which differs from the standard ODCSP in the constraints to be satisfied. Accordingly, a variation of ODPACES, called TDHC, has been proposed that optimally solves this class of TDCSP. However, TDHC is slow when the problems are large. To tackle homogeneous TDCSP of large size, a meta-heuristics scheme using Tabu-Search has been designed that gives quick yet reasonably good quality solution for large problems

Related Publications

Sengupta S. and Bhattacharya S. *Tabu Search Techniques For Some 2-D Stock Problems*, proceedings of IASTED conference on Artificial Intelligence and Soft Computing, 1999; 39-44