Hybrid Algorithms for Unidimensional Cutting Stock Problems

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Abstract

In this dissertation we present an overview of cutting and packing problems, analyzing their main features and then we introduce the tipology proposed by Dickhoff. We briefly discuss the main strategies used in the resolution of these problems, mentioning some references for the reader interested in this topic.

We investigate the unidimensional cutting stock problem, modelled as an integer linear program, and propose an hybrid algorithm that is based in the column generation method and in an exact algorithm. The exact algorithm we use is appropriate to solve small instances of the unidimensional cutting stock problem when we know previously a lower bound for the value of the optimal integer solution. We show that the proposed hybrid algorithm finds an integer solution whose objective value differs from the optimal value by at most 1, under the assumption that the MIRUP (Modified Integer Round-Up Property) conjecture is true. Variations are proposed for the hybrid algorithm in order to speed up its runtime. We adapt the hybrid algorithm for a special case of the unidimensional cutting stock problem in which the amount of distinct itens in the patterns is limited by a constant.

The results obtained in the resolution of an expressive number of real world instances as well as randomly generated instances are analyzed, indicating that the hybrid algorithm and its variations have a very satisfactory performance.

Keywords: cutting and packing problems, unidimensional cutting stock problem, column generation.

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