VNS for the Strip Packing Problem *

David Beltrán Cano, Ignacio García del Amo, Rayco Jorge Cabrera,
José A. Moreno Pérez, J. Marcos Morneo Vega

[1]Departamento de E.I.O. y Computación. Escuela Técnica Superior de Ingeniería Informática
Universidad de La Laguna. Tenerife, SPAIN
personal@davidbeltran.info, igdelamo@ull.es, raycojorge@canarias.org,
jamoreno@ull.es, jmmoreno@ull.es

1 Introduction

Metaheuristic searches are general solution procedures for solving problems. They are characterized by their wide applicability and by their good performance in many cases. Thus, ideally, they provide high quality solutions consuming moderate resource (time). Two relevant Metaheuristics are *Variable Neighborhood Search* (VNS) (see [2] and [3]) and *Greedy Randomized Adaptive Search Procedure* (GRASP) (see [1] and [4]).

In this work we describe a GRASP+VNS hybrid for the Strip Packing Problem. Consider a strip of fixed width w and infinite height, and a finite set of rectangles, with at least one of their sides smaller than w. The *Strip Packing Problem* (SPP) consists of packing the rectangles in the strip minimizing the height of the packing or, equivalently, cutting the rectangular pieces from the strip minimizing the height of strip used. In this problem the rectangles can be rotated 90 degrees and the cuttings can be non guillotine. A cutting is guillotine if there exists a straight line that goes from a lateral side of the object to the front side. In some problems, the rectangular pieces have to be obtained from the strip by a series of guillotine cuts on the resulting objects. In a non-guillotine cut problem this can not be true.

Our hybrid uses a nested VNS to improve the solutions obtained by the GRASP. An important

*This research has been partially supported by the projects TIC2002-04242-C03-01 (70% of which are FEDER funds) and PI042004/088

characteristic of our proposal is that the VNS operates on a part of the solution given by the GRASP. Specifically, the VNS attempts to improve the packing of the last rectangles introduced into the solution. This is done by extracting the upper rectangles and searching for a new arrangement of them that decreases the total height reached. The VNS extracts the rectangles depending on which neighbourhood is considering in each iteration, and, as it is nested, each time the number of iterations increases, a higher number of rectangles is extracted (and thus rearranged). This eventualy produces a local search that explores a high number of rectangles with the possibility of reducing the height with a configuration that maybe the GRASP would have never been able to find.

After explaining the model, we show the computational experience, where we have run a series of tests with standard data sets widely used in the literature. We also present some comparative tables with the performance of our approach and some reference implementations by other authors.

References

[1] T.A. Feo and M.G.C. Resende. Greedy randomized adaptive search procedures. *Journal of Global Optimization*, 6:109–133, 1995.

[2] P. Hansen and N. Mladenović. Variable neighborhood search. *Computers & Operations Research*, 24(11):1097–1100, 1997.

[3] P. Hansen and N. Mladenović. Variable neighborhood search. In F. Glover and G. Kochenberger, editors, *Handbook of Metaheuristics*, 2003.

[4] M. Resende and C. Ribeiro. Greedy randomized adaptive search procedures. In F. Glover and G. Kochenberger, editors, *Handbook of Metaheuristics*, 2003.