New approximability results for 2-dimensional packing problems

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Abstract

In the strip packing problem it is desired to pack a set of rectangles, each of width and length at most 1, into a strip of unit width and minimum length. In this paper we present asymptotic polynomial time approximation schemes (APTAS) for this problem without and with 90^o rotations. The additive constant in the approximation ratios of both algorithms is 1, thus improving on the additive term in the approximation ratios of the algorithm by Kenyon and Rémila (for the problem without rotations) and Jansen and van Stee (for the problem with rotations), both of which have a much larger additive constant $O(1/\varepsilon 2)$, $\varepsilon > 0$.

The algorithms were derived from the study of the following rectangle packing problem: Given a set R of rectangles with positive profits, the goal is to pack a subset of R into a unit size square bin $[0,1] \times [0,1]$ so that the total profit of the rectangles that are packed is maximized. We present algorithms that for any value $\epsilon > 0$ find a subset $R' \subseteq R$ of rectangles of total profit at least $(1-\epsilon)OPT$, where OPT is the profit of an optimum solution, and pack them (either without rotations or with 90^o rotations) into the augmented bin $[0,1] \times [0, 1+\epsilon]$."

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