Approximation Algorithms for Multiple Strip Packing

TUE/AE01
16:30–16:50

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We study the Multiple Strip Packing (MSP) problem, a generalization of the well-known Strip Packing problem. For a given set of rectangles, $r_1,\ldots,r_n$, with heights and widths ≤ 1, the goal is to find a non-overlapping orthogonal packing without rotations into $k \in \mathbb{N}$ strips $[0,1]\times[0,\infty)$, minimizing the maximum of the heights. Approximation algorithms for MSP can be used to find a schedule of parallel independent jobs on k clusters each with m processors with the objetive to minimize the maximum completion time among all jobs. We present an approximation algorithm with absolute ratio 2, which is the best possible, unless $\mathscr{P} = \mathscr{NP}$, and running-time polynomial in n. This improves the previous best result with ratio $2+\varepsilon$ and running-time polynomial in n, but doubly exponential in $\frac{1}{\varepsilon}$. Furthermore we present simple shelf-based algorithms with short running-time and an AFPTAS for MSP. Since MSP is strongly $\mathscr{NP}$-hard, an FPTAS is ruled out and an AFPTAS is also the best possible result in the sense of approximation theory.

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[2] D. YE, X. HAN AND G. ZHANG: On-line mulitple-strip packing. To appear in: *The 3rd Annual International Conference on Combinatorial Optimization and Applications (COCOA 2009)*, 2009.

[3] S.N. ZHUK: Approximate algorithms to pack rectangles into several strips. *Discrete Mathematics and Applications*, 16(1):73-85, 2006.