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Seminar AGCO

Speaker: Waldo Gálvez, TU Munich, Alemania

Title: A Tight (3/2+ε)-Approximation for Skewed Strip Packing.

Abstract: In the Strip Packing problem, we are given a vertical half-strip $[0,W] \times [0,+\infty)$ and a collection of open rectangles of width at most W. Our goal is to find an axis-aligned (non-overlapping) packing of such rectangles into the strip such that the maximum height OPT spanned by the packing is as small as possible. Strip Packing generalizes classical well-studied problems such as Makespan Minimization on identical machines (when rectangle widths are identical) and Bin Packing (when rectangle heights are identical). It has applications in manufacturing, scheduling and energy consumption in smart grids among others. It is NP-hard to approximate this problem within a factor $(3/2-\varepsilon)$ for any constant $\varepsilon > 0$ by a simple reduction from the Partition problem. The current best approximation factor for Strip Packing is $(5/3+\varepsilon)$ by Harren et al. [Computational Geometry '14], and it is achieved with a fairly complex algorithm and analysis.

It seems plausible that Strip Packing admits a $(3/2+\varepsilon)$-approximation. We make progress in that direction by achieving such tight approximation guarantees for a special family of instances, which we call skewed instances. As standard in the area, for a given constant parameter $\delta>0$, we call large the rectangles with width at least δW and height at least δOPT, and skewed the remaining rectangles. If all the rectangles in the input are large, then one can easily compute the optimal packing in polynomial time (since the input can contain only a constant number of rectangles). We consider the complementary case where all the rectangles are skewed. This second case retains a large part of the complexity of the original problem even for small values of δ; in particular, it is NP-hard to approximate within a factor $(3/2-\varepsilon)$ and we provide an (almost) tight $(3/2+\varepsilon)$-approximation algorithm for this case.

Joint work with Fabrizio Grandoni, Afrouz Jabal Ameli, Klaus Jansen, Arindam Khan and Malin Rau.

https://zoom.us/j/92434629142?pwd=d01ZSlNUQmpoM1hEYmRXMi93NU8zZz09
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