



# Almost Tight Approximation Algorithms for 2D Demand Strip Covering

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## Abstract

Packing problems are classical Discrete Optimization problems that involve selecting or allocating items while satisfying capacity constraints. Many of them have been generalized to the two-dimensional geometric setting (e.g. Knapsack, Bin Packing, Makespan Minimization) [1], where now items are rectangles to be packed into a region in the plane, achieving interesting recent advances. On the other hand, classical Covering problems (e.g. Knapsack Cover, Bin Covering, Machine Covering) do not allow for good approximation algorithms in multidimensional geometric contexts.

Recently, motivated by Energy Management scenarios (e.g., [2]), two-dimensional packing problems with “partial” geometric constraints have been considered. In 2D Demand Packing [3, 4], instead of requiring the rectangles to be embedded in the plane so that they do not intersect, we place them along a horizontal line and account for the accumulated load at each point. In this work, we initiate the study of Covering problems in the 2D Demand Setting, considering a generalization of Machine Covering called 2D Demand Strip Covering, where we seek to allocate all the items so as to maximize the minimum load along the horizontal line. As opposed to the direct 2D geometric generalization of Machine Covering, which cannot be approximated within any factor, we prove that there exists a  $(2+\varepsilon)$ -approximation for 2D Demand Covering, and also provide an almost matching lower bound. The result is achieved through computing *sheathing-based allocations*, which might be useful in other contexts.

## References

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