

# MSc thesis defense presentation

## Χαρλάος Τζβας defends his MSc thesis

<b>Date:</b>	Δευτέρα, 06 Ιούνι 2016
<b>Thesis title:</b>	<a href="#">Approximating Minkowski Decomposition and 2D Subset Sum</a>
<b>Committee:</b>	<ul style="list-style-type: none"><li><a href="#">Ιωάννης Εμρης</a></li><li><a href="#">Δημήτρης Φωτικής</a></li><li><a href="#">Βασίλειος Ζησιμπίουλος</a></li></ul>

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### Thesis abstract

We consider the approximation of two NP-hard problems: Minkowski Decomposition (MinkDecomp) of lattice polygons in the plane and the closely related problem of Multidimensional Subset Sum (kD-SS) in arbitrary dimension. In kD-SS we are given an input set  $S$  of  $k$ -dimensional vectors, a target vector  $t$  and we ask if there exists a subset of  $S$  that sums to  $t$ . We prove, through a gap-preserving reduction, that, for general dimension  $k$ , kD-SS does not have a PTAS although the classic 1D-SS does. On the positive side, we present an  $O(n^3/\epsilon^2)$  approximation algorithm for 2D-SS, where  $n$  is the cardinality of the set and  $\epsilon$  bounds the difference of some measure of the input polygon and the sum of the output polygons. Applying this algorithm, and a transformation from MinkDecomp to 2D-SS, we can approximate MinkDecomp. For an input polygon  $Q$  and parameter  $\epsilon$ , we return two summands  $A$  and  $B$  such that  $A + B = Q'$  with  $Q'$  being bounded in relation to  $Q$  in terms of volume, perimeter, or number of internal lattice points and an additive error linear in  $\epsilon$  and up to quadratic in the diameter of  $Q$ . A similar function bounds the Hausdorff distance between  $Q$  and  $Q'$ . We offer experimental results based on our implementation which is openly provided via Github.

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