# MSc thesis defense presentation

## Tzovas Harilaos defends his MSc thesis

| | |
|---|---|
| **Date:** | Monday, 06 Jun 2016 |
| **Thesis title:** | Approximating Minkowski Decomposition and 2D Subset Sum |
| **Committee:** | • Ioannis Emiris<br>• Dimitris Fotakis<br>• Vassilis Zissimopoulos |

---

## Thesis abstract

We consider the approximation of two NP-hard problems: Minkowski Decom- position (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 $O(n3/\varepsilon2)$ approximation al- gorithm for 2D-SS, where n is the cardinality of the set and $\varepsilon$ bounds the difference of some measure of the input polygon and the sum of the output polygons. Ap- plying this algorithm, and a transformation from MinkDecomp to 2D-SS, we can approximate MinkDecomp. For an input polygon Q and parameter $\varepsilon$, 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 ad- ditive error linear in $\varepsilon$ 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.