Abstract

Decompositions of Centrally Symmetric Polygons

Júlia Frittmann
Thesis Advisor: Zsolt Lángi
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Tiling the plane or a given region has been of interest to mathematicians and artists as well, throughout the history of mankind. In a large number of problems, the region to tile is often a polygon in the Euclidean plane $\mathbb{R}^2$.

In 1997, G. Horváth introduced the notion of *irreducible* decompositions of a centrally symmetric polygon into centrally symmetric convex polygons. He gave an example showing that for a centrally symmetric hexagon, there are infinitely many combinatorial types of such decompositions. On the other hand, he proved that, up to combinatorial equivalence, there are exactly six irreducible, *edge-to-edge* decompositions of this region.

G. Horváth's results were the motivation for a paper that we have published recently, where we investigate the irreducible, edge-to edge decompositions of a centrally symmetric octagon into centrally symmetric convex polygons. Moreover, we give a lower and upper bound for the number of decompositions in the general case. Later we realized that there are a lot of interesting connections with pseudolines, so we started to look for results that can be applied for polygon decompositions. These and our results give the basis of this thesis.

We start by introducing the important notions and results of pseudoline collections and their different representations. Then, we will bring an example for the definitions of the first part, with the emphasis being on displaying the representations. Later on we will review the results of our paper: how many irreducible, edge-to-edge decompositions does an octagon have, and what can we say about the number of decompositions for a $2k$-gon. And last but not least, we will use the results of the first part for giving better estimates compared to those in the second part of this thesis.