Nathaniel J. Born
Mathematics/Computer Science, IT, 2009
Mentor: Ezra Miller, Mathematics

Implementation of a Non-overlapping Unfolding Algorithm

In elementary school mathematics, many children experience the realization that a 3-dimensional object, such as a cube, can be “unfolded” so that it lies flat in a plane. Usually, they are taught only a couple of different unfoldings, with all the folds occurring along the edges of the cube. However, many unfoldings exist. One such nontrivial unfolding is the result of an algorithm developed by M Sharir and A Schorr, later generalized to work in n dimensions by Miller and Pak, as described in their article *Metric Combinatorics of Convex Polyhedra*. It may seem easy to visualize a way of unfolding the boundary of a 3-dimensional cube, but how would one unfold an icosahedron (20 sides)? Or to stretch the mind even more, what would the analog of an icosahedron in 4 dimensions look like if it were unfolded into 3 dimensions? The Miller-Pak algorithm was previously written only in pseudocode, which captures the main ideas of the algorithm enough to prove its correctness from a mathematical standpoint, but omits a few details on the specifics. Therefore, the goal of my project is to write a computer program which implements the structure of the Miller-Pak algorithm, computing the nonoverlapping unfolding of an arbitrary convex polyhedron. This project is still in progress, so my presentation will consist of an overview of how the algorithm works, along with an explanation of a few of the boundaries that we have encountered thus far.

Poster Number: Session: