DISCRETE GEOMETRY DAY

Wednesday, February 1, 2012

Room: 3433, E6-1

Program

10.00 - 10.50 Michael Dobbins

Universality for families of non-crossing convex sets

11.00 - 11.50 Arseniy Akopyan

Kadets type theorems for partitions of a convex body

LUNCH

15.00 - 15.50 Roman Karasev

An analogue of Gromov's waist theorem for coloring the cube

16.00 - 16.50 Edward Donghuhn Kim

Lattice paths and Lagrangian matroids

17.00 - 17.50 Alfredo Hubard

Space Crossing Numbers

DINNER

ABSTRACTS

Universality for families of non-crossing convex sets

Michael Dobbins
KAIST

Mnëv's Universality theorem gives a construction showing that for any primary semi-algebraic set, there is a family of points in the plane of fixed combinatorial type given by an oriented matroid such that the realization space of the family is homotopic to the semialgebraic set. Analogous universality results have also been shown for polytopes. Recently, we have found that the realization spaces off amilies of non-crossing convex sets in the plane with fixed combinatorial type are contractible, but that universality holds for families of non-crossing convex polygons with a bounded number of vertices.

Kadets type theorems for partitions of a convex body

Arseniy Akopyan
Institute for Information Transmission Problems

For convex partitions of a convex body B we try to put a homothetic copy of B into each set of the partition so that the sum of homothety coefficients is ≥ 1. In the plane this can be done for arbitrary partition, while in higher dimensions we need certain restrictions on the partition.

An analogue of Gromov's waist theorem for coloring the cube

Roman Karasev
Moscow Institute of Physics and Technology

It is proved that if we partition a d-dimensional cube into n^d small cubes and color the small cubes into $m+1$ colors then there exists a monochromatic connected component consisting of at least $f(d,m)n^{d-m}$ small cubes. The constant $f(d,m)$ in our present approach looks quite ugly.

In particular cases $m = d-1$ the question (and the answer) goes back to Lebesgue, the case $m = 1$ was examined by Matoušek and Přívětivý. They also conjectured the general case with other m. The same question was posed in informal discussions in Moscow by Alexey Kanel-Belov.

The proof will be based on (widely understood) Gromov's method of contraction in the space of cycles. A different independent proof of a stronger fact was found by Marsel Matdinov, see arXiv:1111.3911.

Certain unsolved problems remain in this area. For example, Gromov's question about extending the sphere waist theorem for maps into polyhedra which are not manifolds with bound depending only on the dimension.

Lattice paths and Lagrangian matroids

Edward Donghuhn Kim
POSTECH

We investigate lattice path Lagrangian matroids, a family of Lagrangian matroids introduced by Joe Bonin and Anna de Mier. One definition for Lagrangian matroids involves a construction of ordinary matroids. We discuss the corresponding relationship holds between lattice path Lagrangian matroids and lattice path matroids, proving one direction of a conjecture by de Mier relating lattice path Lagrangian matroids and lattice path matroids.

Space Crossing Numbers

Alfredo Hubard
HIT

We define a higher dimensional geometric analogue of the the crossing number of graph theory. The basic idea comes from the theory ofl ine transversals and the Tverberg-Vrecica conjecture. Namely, we think of a crossing as a transversal 0-flat to a pair of edges or faces, and define space crossing as a transversal k-flat to a number of edges or faces. We obtain an almost tight space crossing number inequality that implies the classical crossing number inequality (up to a logaritmic factor). Joint work with Boris Bukh.