

Harmonic Analysis in Computer Science and Combinatorics

February 2 – March 3, 2006

Program for February 13 – February 17

All lectures are held in S5.

Mon, Feb 13

9 – 12 *N. Linial* Harmonic Analysis in Computer Science and Combinatorics
14 – 17 Exercises

Tue, Feb 14

9 – 12 *N. Linial* Harmonic Analysis in Computer Science and Combinatorics
14 – 17 Exercises

Wed, Feb 15

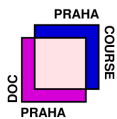
10:40 *A. Samorodnitsky*
Can One Do Better by Not Using Harmonic Analysis?

Thu, Feb 16

10:40 *A. Samorodnitsky*
Gowers Uniformity, Influence of Variables, and PCPs
14:00 *T. Szabó* Characters and the Projective Norm-graphs

Fri, Feb 17

10:40 *A. Samorodnitsky*
Edge-isoperimetric Inequalities and Influences



DocCourse Prague 2006

Harmonic Analysis in Computer Science and Combinatorics

Programme coordinators: Jiří Matoušek and Jaroslav Nešetřil

<http://kam.mff.cuni.cz/~matousek/doccourse06.html>

Abstracts of lectures

Alex Samorodnitsky: CAN ONE DO BETTER BY NOT USING HARMONIC ANALYSIS?

We will describe three situations in which harmonic analysis is useful but does not show the whole picture. In these situations one can do better by using other tools.

Alex Samorodnitsky: GOWERS UNIFORMITY, INFLUENCE OF VARIABLES, AND PCPS

We prove two structural results for functions on the boolean cube with high Gowers uniformity norms.

First - a boolean function with a large 3-rd uniformity norm is globally correlated with a quadratic polynomial.

Second, a function with a large uniformity norm of any order has a highly influential variable. This result is used to obtain conditional hardness of approximation results. For instance, assuming the Unique Games Conjecture is true, it is hard to approximate the cardinality of a maximal independent subset of a graph of degree d within a factor of $\text{polylog}(d)/d$.

The second result is joint work with Luca Trevisan.

Alex Samorodnitsky: EDGE-ISOPERIMETRIC INEQUALITIES AND INFLUENCES

We give a combinatorial proof of the result of Kahn, Kalai, and Linial which states that every boolean function has a variable with large influence. We describe additional applications of this proof, and state some conjectures.

This is a joint work with Dvir Falik.

Abstracts of lectures

Tibor Szabó: CHARACTERS AND THE PROJECTIVE NORM-GRAPHS

The projective norm-graphs are dense graphs, which do not contain complete bipartite graphs of certain parameters. In the lecture we describe these objects, calculate their spectrum using basic properties of characters, and show how all this provides explicit constructions to various Ramsey-type problems.