Proodsal for a Joint Special Session at the AMS-ASL
Meeting of 2009, January 5-8, 2009, Washington, D.C.

Approved by the ASL, still needs approval of the AMS.

# Model Theoretic Methods in Finite Combinatorics

**Organizers:**

- Martin Grohe
  Institut für Informatik, Humboldt-Universität zu Berlin Berlin, Germany
  homepage: www2.informatik.hu-berlin.de/∼grohe/
  e-mail: grohe@informatik.hu-berlin.de

- Johann A. Makowsky (corresponding organizer)
  Department of Computer Science,
  Technion - Israel Institute of Technology, Haifa, Israel
  homepage: www.cs.technion.ac.il/∼janos
  e-mail: janos@cs.technion.ac.il

## Purpose of the special session

We want to bring the various aspects of the interaction between **Model Theory** and **Finite Combinatorics** to a wider audience. Although the work on 0-1 laws is by now widely known, the other applications on counting functions, graph polynomials, extremal combinatorics, graph minors and regularity lemmas, have not yet received their deserved attention.

## Background

In the last twenty years several applications of Logic, in particular Model theory, to problems in Combinatorics emerged. Among them we have

- 0-1 laws and their variations.
  This is well summarized in the book by J. Spencer [Spe01].

- Modular linear recurrence relations for combinatorial counting functions (The Specker-Blatter Theorem)
  This theorem has remained widely unnoticed, and deserves wider attention and further study [Spe88, Fis03, FM03]

- Recent progress in undertanding the ultimate periodicity of finite spectra by Y. Gurevich and S. Shelah, and E. Fischer and J.A. Makowsky [FM04].

- Applications of meta-theorems which apply to whole families of combinatorial problems, instead of just specific problems.
  This was pioneered by B. Courcelle and S. Arnborg, J. Lagergren and

1

D.Seese, in applications of definability in Monadic Second Order Logic to graph algorithms, and summarized in J.A. Makowsky [Mak04] and M. Grohe [Gro07].

- The use of model theoretic methods in designing algorithms for the computation of forbidden minors, [AGK08].

- The use of definability criteria in the study of graph polynomials (Tutte polynomial and its relatives, matching polynomials, generalized chromatic polynomials) introduced by J.A. Makowsky [Mak05] and further developed together with B. Zilber [MZ06]. See also [Mak07, MF08].

- The realization that virtually all graph polynomials of the literature can be viewed as combinatorial counting functions which occur inside models of $\omega$-stable $\omega$-categorical theories, J. Makowsky and B. Zilber [MZ06].

- The use of model theory to unify results in extremal combinatorics, as in A. Razborov [Raz07].

- Recent work on the classification and characterization of partition functions by L. Lovasz and B. Szegedy and their collaborators, and their complexity, cf. [BG05]. [FLS07, Sze07].

- The use of ultraproducts in the proof of the Regularity Lemma by B. Szegedy and G. Elek [ES07]. [ES].

## Format of the special session

Expository lectures (40 minutes) and technical lectures (20 minutes) and a problem session.

## Tentative speakers

1. Albert Atserias (TBA),
   Departament de Llenguatges i Sistemes Informàtics Universitat Politècnica de Catalunya 08034 Barcelona, Spain.
   homepage: www.lsi.upc.edu/~atserias/home.html
   e-mail: atserias@lsi.upc.edu

2. Andreas Blass (TBA)
   Mathematics Department, University of Michigan Ann Arbor, MI 48109-1043 U.S.A.
   homepage: www.math.lsa.umich.edu/~ablass/
   email: ablass@umich.edu

3. Andrei Bulatov (Partition functions)
   Department of Computing Science, Simon Fraser University, Burnaby, B.C. Canada
   homepage: www.cs.sfu.ca/~abulatov/
   e-mail: andrei.bulatov@gmail.com

4. Bruno Courcelle (TBA)
   Laboratoire Bordelais de Recherche en Informatique, F-33405 Talence,
   France
   homepage: www.labri.fr/perso/courcell/
   e-mail: courcell@labri.fr

5. Eldar Fischer (The Specker Blatter Theorem)
   Department of Computer Science, Technion - Israel Institute of Technol-
   ogy, Haifa, Israel
   homepage: www.cs.technion.ac.il/∼eldar
   e-mail: eldar@cs.technion.ac.il

6. Stephan, Kreutzer (TBA)
   Oxford University Computing Laboratory, University of Oxford, Oxford,
   England
   homepage: web.comlab.ox.ac.uk/oucl/work/stephan.kreutzer/
   e-mail: stephan.kreutzer@comlab.ox.ac.uk

7. Johann Makowsky (Definability of graph polynomials)
   Department of Computer Science, Technion - Israel Institute of Technol-
   ogy, Haifa, Israel
   homepage: www.cs.technion.ac.il/∼janos
   e-mail: janos@cs.technion.ac.il

8. Jaroslav Nešetřil (Duality theorems and their applications)
   Department of Applied Mathematics, Faculty of Mathematics and Physics,
   Charles University, Prague, Czech Republic
   homepage: kam.mff.cuni.cz/∼nesetril/en/
   e-mail: nesetril@kam.mff.cuni.cz

9. Alexander Razborov (Flag algebras)
   Department of Mathematics, Institute of Advanced Studies, Princeton,
   N.Y., USA, and Mathematical Institute, Russian Academy of Sciences,
   Moscow, Russian Federation
   homepage: www.mi.ras.ru/∼razborov/
   email: razborov@ias.edu

10. Balazs Szegedy (Ultraproducts and Regularity Lemmas)
    Department of Mathematics, University of Toronto, Toronto, Canada
    homepage: http://www.math.toronto.edu/ szegedy/
    e-mail: szegedy@math.toronto.edu

11. Boris Zilber (Combinatorial counting functions and categoricity)
    Mathematical Institute, University of Oxford, Oxford, England
    homepage: www2.maths.ox.ac.uk/∼zilber/
    e-maill: zilber@maths.ox.ac.uk

## Publishing proceedings

There is a possibility to publish proceedings in the *Contemporary Mathematics Series* of the AMS.

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