

II Escuela y Workshop sobre Sistemas Polinomiales

Angra dos Reis, RJ, Brasil - Feb 28 a Mar 4, 2005

Description and scope

The theoretical study of the solution set of polynomial equations gave rise to classical areas in mathematics, such as Algebra or Algebraic Geometry. Polynomial systems arising from practical or industrial applications require a much finer study of the system structure than what is available from classical tools.

This conference is interdisciplinary due to the nature of its object. The analysis of equation structure involves, besides Algebraic Geometry, concepts of Convex Geometry, Symplectic Geometry, Complexity, Numerical Analysis, etc.. In addition, efficient algorithms to solve systems of polynomial equations combine tools and concepts of Computational Algebra, Computational Algebraic Geometry, Differential Geometry, Linear Programming, Structured Numerical Linear Algebra, Combinatorics, etc..

Applications of polynomial systems arise in many areas, such as mechanical engineering, chemistry and bio-chemistry, control theory, computer graphics, mathematical physics. Special attention here will be given to applications to statistics.

Target audience

The school is intended for a public ranging from first year graduate students in mathematics to research scientists. There will be a short course and five survey lectures during the morning.

The scientific program is intended for specialists in the subject, or researchers and students wishing to enter the subject.

Five lectures by Bernd Sturmfels

Algebraic Geometry of Statistical Models

The five lectures offer an introduction to algebraic methods in statistics. Many statistical models for discrete data, in particular those used in machine learning and computational biology, can be regarded as algebraic varieties inside a high-dimensional probability simplex. While some of these models correspond to classical geometric objects (e.g. Segre varieties and their secant varieties), others pose new and unexpected challenges for algebraic geometers. Conversely,

computational algebraic geometry has a lot to offer for statistical analysis since certain key problems, such as computing maximum likelihood estimates and checking identifiability, lead to systems of polynomial equations.

Tentative Outline:

Lecture 1 Graphical Models
Lecture 2 Maximum Likelihood Equations
Lecture 3 Mixture Models and Secant Varieties
Lecture 4 The Expectation Maximization Algorithm
Lecture 5 Tropicalization and Polytope Propagation

Survey lectures

Alicia Dickenstein: Toric Ideals and Applications

Gregorio Malajovich: Mixed volume and sparse homotopy

Laurent Busé: Elimination Theory, Commutative Algebra and Applications

Ioannis Emiris: Sparse Elimination and Geometric Applications

Jean-Pierre Dedieu: Newton iteration and applications.

There will also be invited (to be announced soon) and contributed talks.
The deadline for submissions is October 31, 2004.

Financial support for participants

Participants are supposed to cover their own expenses.

We are working on obtaining support for students and researchers from Brasil and from the Mercosul community.

Local information.

The meeting will be held at the Portogalo Suíte Hotel, Estrada Rio Santos km 71, Angra dos Reis, RJ, Brasil. (Distance to Rio de Janeiro: 130 km. Distance to Angra dos Reis: 15km).

Previous conference.

The first Latin American School and Workshop on Polynomial Systems was held in Buenos Aires, from 14 to 26 of July 2003, with approximately 70 registered participants.

Organizing Committee

Alicia Dickenstein (co-chair), Departamento de Matemática, FCEyN,
Universidad de Buenos Aires.

Alvaro Rittatore, Centro de Matemática, Universidad de la
República, Uruguay.

Gregorio Malajovich (co-chair), Departamento de Matemática Aplicada,
Universidade Federal do Rio de Janeiro.

Ioannis Emiris, Department of Informatics & Telecommunications,
National University of Athens.

Vilmar Trevisan, Instituto de Matemática, Universidade Federal
do Rio Grande do Sul.

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