Convex Algebraic Geometry and Semidefinite Optimization

ISSAC 2013 Tutorial

This tutorial will focus on basic and recent developments in convex algebraic geometry, and the associated computational methods based on semidefinite programming for optimization problems involving polynomial equations and inequalities. There has been much recent progress in this area, combining theoretical results in real algebraic geometry with semidefinite programming to develop effective computational approaches to these problems. We will make particular emphasis on sum of squares decompositions, general duality properties, infeasibility certificates, approximation/inapproximability results, as well as survey many exciting developments that have occurred in the last few years.

Time and place: ISSAC 2013, Boston, Massachusetts, June 26th, 2013.

Speaker: Pablo A. Parrilo (MIT)
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Reading: The content of the minicourse is mostly based on the first two chapters of the book:

G. Blekherman, P. A. Parrilo, and R. Thomas, editors. *Semidefinite optimization and convex algebraic geometry*, volume 13 of *MOS-SIAM Series on Optimization*. SIAM, 2012.

A full online copy of the book can be found (courtesy of SIAM) at

`http://www.mit.edu/~parrilo/SDOCAG`

Software: The following software packages can be used to explore the techniques described in the tutorial:

- SOSTOOLS: A sum of squares toolbox for MATLAB.

  `http://www.mit.edu/~parrilo/sostools`

- YALMIP: MATLAB parser/solver by Johan Löfberg (Linköping U.).

  `http://users.isy.liu.se/johanl/yalmip/`

- SOS/M2: a sum of squares package for Macaulay2, by Helfried Peyrl.

  `http://www.mit.edu/~parrilo/SOSM2`