Western Science

Department of Applied Mathematics

APPLIED MATHEMATICS COLLOQUIUM

Date: Friday, October 16, 2015
Time: 2:00 – 3:00 p.m.
Location: Middlesex College Room 260

Exact Algorithms for Linear Matrix Inequalities

Simone Naldi

Institut National des Sciences Appliquées,
Toulouse, France
(Postdoctoral Visitor at the Fields Institute)

Abstract:

Semidefinite programming (SDP) is the natural extension of linear programming to the convex cone of positive semidefinite matrices. It consists in minimizing a linear function over the convex set, called spectrahedron, defined by a linear matrix inequality (i.e. over the set of real vectors x such that a linear matrix A(x) is positive semidefinite, A(x)>=0). While a floating point approximation of a solution of a semidefinite program can be computed efficiently by interior-point algorithms, neither efficient exact algorithms for SDP are available, nor a complete understanding of its theoretical complexity has been achieved. I will present an algorithm for deciding the feasibility of a linear matrix inequality A(x)>=0 in exact arithmetics. In particular, I will show how to reduce this particular semialgebraic optimization problem to a (finite) sequence of algebraic optimization problems preserving the determinantal structure. Remarkably, the algorithm does not assume the presence of an interior point in the spectrahedron, and it takes advantage of the existence of low-rank solutions of the linear matrix inequality. I will finally report on complexity bounds and on results of practical experiments.

This is joint work with Didier Henrion and Mohab Safey El Din.