Algebra and Number Theory Seminar

Title: Exact certification in global polynomial optimization via sums-of-squares of rational functions with rational coeffs.

Speaker: Erich Kaltofen (North Carolina State University)

Date: Mon 31st May 2010 at 4:00PM

Location: Mathematical Sciences Seminar Room

Abstract: Any positive semidefinite polynomial f with real (rational) coefficients, i.e., a polynomial that does not evaluate to a negative value, can be written as a finite sum

f($x_1, ..., x_n$) = $(g_1(x_1, ..., x_n)2 + ... + g_k(x_1, ..., x_n)2)/g_0(x_1, ..., x_n)2$

where $g_i arepolynomialswithreal(rational)coefficients.Ifthereexistg_iwithg_0 = 1, fissaidtobeSOS$ $hisequivalenttof-hbeingpositivesemidefinite; hinglobaloptimizationistherealinfimum(oraratio$ $h = 1/g_02(g_12+...+g_k2)constituteaproof(exactcertificate)fortheinequality/optimum.Optimizatic$ $calledPositivstellensaetze.$

Two recent developments have made it possible to compute such certificates. The first are the numerical optimization algorithms for semidefinite programming. The second is a symbolic technique for converting an imprecise SOS with floating point coefficients to an exact identity over the rational numbers. Among our recent successes are a proof

of the Monotone Column Permanent Conjecture for n = 4, which was completed shortly before the general conjecture could be established, proofs for sharp factor coefficient bounds of degree¡= 17 ("Rump's model problem"), new SOS proofs for many known inequalities, and a deformation analysis approach to Seidenberg's problem.

In my talk I will explain how our certificates have been found and what difficulties remain. This is joint work with Sharon Hutton, Bin Li, Zhengfeng Yang, and Lihong Zhi.

http://www4.ncsu.edu/ kaltofen/