Polynomial Optimization
Math 582D, MW, 2:30-3:45, Winter 2014
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Polynomial optimization is the problem of optimizing a polynomial function over a set defined by polynomial equations and inequalities. These problems appear all over science and engineering and have traditionally been tackled using methods from non-linear programming. However, recently newer algebraic methods have come to bear on these problems via the theory of sums of squares of polynomials and semidefinite programming. This course will develop the basics of this new approach to polynomial optimization along with the various mathematical pieces that enter the subject. The main topics will be:

(1) Applications of polynomial optimization
(2) Sum of squares polynomials and Hilbert’s 17th problem
(3) Sums of squares relaxations of polynomial optimization
(4) Semidefinite programming and sums of squares
(5) Lasserre hierarchy and theta bodies (specific relaxation techniques)
(6) Exploiting symmetry and sparsity
(7) Further applications and numerical issues

This class will require some basic abstract algebra and real analysis. The emphasis will be on optimization. Math 514 and 516 are encouraged.

References:
