1061-05-118 **Jesus A. De Loera*** (deloera@math.ucdavis.edu), Dept of Mathematics, University of California, Davis, CA 95616. *Algebraic-Geometric Methods in Algorithmic Graph Theory.*

Many hard combinatorial problems can be modeled by a system of polynomial equations. Noga Alon coined the term *polynomial method* to describe the use of nonlinear polynomials when solving combinatorial problems. We report on recent progress on the polynomial method and show how the algorithmic theory of polynomial ideals can be used to detect k-colorability, unique Hamiltonicity, and automorphism rigidity of graphs. In some particular cases offering polynomial complexity bounds.

Our techniques involve Nullstellensatz certificates,, Gröbner bases, toric geometry, and real algebraic geometry, but interestingly computations reduce to fast linear algebra over finite fields and convex programming which are known to perform well.

This reports on results joint work with various subsets of the following people. Chris Hillar (MSRI), Jon Lee (IBM), Peter Malkin (UC Davis), Susan Margulies (Rice), Pablo Parrilo (MIT) and Mohamed Omar (UC Davis). (Received April 10, 2010)