Courant Institute of Mathematical Sciences  
Mathematics Colloquium  
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Title: Numerical Algebraic Intersection with Applications

Abstract:

In numerical algebraic geometry, algebraic sets are represented by witness sets, which can be computed with numerical homotopy methods (a.k.a. continuation). After discussing this basic construct, we will describe an algorithm, based on the regeneration technique, that solves the following problem: given a witness set for a pure-dimensional algebraic set, say Z, along with a system of polynomial equations defined on Z, compute a numerical irreducible decomposition of the zero set of the polynomials on Z. Also treated is the case where Z is the cross product of two or more pure-dimensional sets, each given in terms of a witness set. Two existing algorithms, diagonal intersection and the homotopy membership test, can be seen as special cases of the new algorithm. In addition to this unification, the method also extends the range of problems that can be solved using numerical algebraic geometry. We will discuss application of these techniques to robot kinematics and sphere packing problems.

Brief Bio:
Charles has degrees in Mechanical Engineering from MIT (B.S. ’79) and Stanford University (M.S. ’80, Ph.D. ’85). He has been employed at General Motors R&D since 1985, currently a Technical Fellow in the Chemical and Materials Systems Lab. He has co-authored two books on the topic of numerical algebraic geometry, has published over 80 scholarly articles, and is an inventor on 25 U.S. patents.