

APPLIED MATHEMATICS COLLOQUIUM

TOWARDS ACCURATE POLYNOMIAL EVALUATION OR WHEN CAN NUMERICAL LINEAR ALGEBRA BE DONE ACCURATELY?

IOANA DUMITRIU
University of California, Berkeley

ABSTRACT:

Given a multivariate (real or complex) polynomial p and a (real or complex) domain \mathcal{D} , we would like to decide if there is an algorithm that can evaluate p accurately (with relative error smaller than 1) for all $x \in \mathcal{D}$, using rounded (real or complex) “traditional model” arithmetic. We consider this problem both in a classical setting (where the operations are $+, -, \times$) and in a black-box setting (where other polynomial operations, like $x-yz$, are allowed).

This work has a two-fold motivation, the first of which is that in computational geometry and mesh generation one formulates the point inclusion problem in terms of the sign of a multivariate polynomial (which needs accurate computation in order to be obtained correctly). The second motivation lies in the recent work of Demmel and Koev, who identified large classes of structured matrices on which accurate Numerical Linear Algebra can be performed; we tried (and partially succeeded) to find an algebraic structure shared by these matrices which explains this phenomenon.

We obtain necessary and, in some cases, sufficient conditions on $p(x)$ for it to be accurately evaluable when $\mathcal{D} = R^n$ or C^n , and for some smaller domains. If time allows, I will also describe progress towards a complete decision procedure.

This is joint work with Jim Demmel and Olga Holtz, both of U.C. Berkeley.

MONDAY, MARCH 7, 2005
4:15 PM
Building 4, Room 231

Refreshments at 3:30 PM in Building 2, Room 349.

Applied Math Colloquium: <http://www-math.mit.edu/amc/spring05>
Math Department: <http://www-math.mit.edu>



Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139