APPLIED MATHEMATICS COLLOQUIUM

Random matrices: The distribution of the smallest singular values (Universality at the Hard Edge)

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ABSTRACT:
Let x be a real-valued random variable of mean zero and variance one. Let M(n) denote the random matrix of size n whose entries are iid copies of x and s(n) denote the least singular value of $M_n(x)$. (One can also view $s(n)^2$ as the least eigenvalue of the Wishart matrix M(n) M(n)*.)

The problem of understanding the distribution of the least singular value of a random matrix was first raised by von Neumann and Goldstine in the 1940s, in their studies on numerical linear algebra. Since then, it has become an important problem in the theory of random matrices, numerical analysis and smooth analysis of linear programming. Results for special case where x is gaussian or gaussian divisible were obtained by Edelman, Forrester, Ben Arous-Peche, Ramirez-Rider and others.

We show that (under a finite moment assumption) the probability distribution of $n^{1/2}$ s(n) is UNIVERSAL in the sense that it does NOT depend on the distribution of x.

Our approach is guided by the general idea of ``property testing'' from combinatorics and theoretical computer science. This introduces a new approach to the study of spectra of random matrices.

TUESDAY MAY 19TH 2009

4:30 PM

Building 4, Room 231

Refreshments at 4:00 PM in Building 2, Room 349
(Applied Math Common Room)

Applied Math Colloquium: http://www-math.mit.edu/amc/spring09
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