The conjugate gradient algorithm in finite-precision arithmetic and the condition number of random matrices

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In an effort to understand the average-case behavior of classical algorithms from numerical analysis some striking observations have been made. After a number of steps of Gaussian elimination, Trefethen and Schreiber (1990) noticed that the entries of a random matrix are universally close to Gaussian, i.e., this is independent of the initial law on the matrix entries. Pfrang, Deift and Menon (2014) observed universal fluctuations in the number of iterations it takes to compute the eigenvalues of a random matrix. Recently, we expanded this probabilistic study to many other iterative algorithms — still observing universality. In this talk, I will focus on the statistics of the conjugate gradient algorithm in finite-precision arithmetic and its relation to a new limit theorem for the condition number of a random matrix ensemble. This is joint work with P. Deift, G. Menon and S. Olver.