On probabilistic analysis of randomization in hybrid symbolic-numeric algorithms

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(joint work with Zhengfeng Yang, Lihong Zhi)

Algebraic randomization techniques can be applied to hybrid symbolic-numeric algorithms, that is, algebraic algorithms where the scalars in the inputs have numerical errors. We consider the problem of solving highly over- and underdetermined systems of linear equations by essentially optimal randomized algorithms (e.g., solving a linear system with n equations and $p = O((n \log(n))^{0.72})$ variables in $O(pn \log(n))$ field operations) and interpolating a sparse rational multivariate function from noisy values. We show that Zippel's original sparse polynomial interpolation technique applies to numerically perturbed data and we give an exact and hybrid algorithm for interpolating sparse rational functions. We discuss the expected condition numbers of the arising randomized linear systems, and observe that certain randomized projections can lead to ill-conditioned systems [1].

References

[1] Erich Kaltofen, Zhengfeng Yang, and Lihong Zhi. On probabilistic analysis of randomization in hybrid symbolic-numeric algorithms. In *Proc. Internat. Workshop on Symbolic-Numeric Comput. 2007* [2], 11–17.

[2] Jan Verschelde and Stephen Watt, editors. *Proc. Internat. Workshop on Symbolic-Numeric Comput. 2007*, New York, N. Y., 2007. ACM.