



LABORATOIRE D'ANALYSE ET DE MATHÉMATIQUES APPLIQUÉES
CNRS UMR 8050

Colloquium

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Bounds on Zeros of Polynomials and their Applications.

Smale's analysis of Newton's iteration function induces a lower bound on the gap between two distinct zeros of a given complex polynomial. We make use of a fundamental family of iteration functions, called Basic Family, indexed by $m=2,3,\dots$, to obtain a family of bounds referred as m -th order bounds. However, even for $m = 2$, where the corresponding iteration function coincides with Newton's, our lower bound is more than twice as good as Smale's bound or its improved version given by Blum, Cucker, Shub, and Smale. We show how to use these bounds to compute lower bounds on the distance between an arbitrary point and the nearest root of the polynomial. In particular, using the latter result, for each m we compute upper and lower bounds on the modulus of the roots of the given polynomial. We discuss the utility of these bounds in algorithms such as Weyl's quad-tree, also with respect to some questions on polynomial zeros.

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