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On zero-error computation. (Chinese. English summary) Zbl 07494940

Summary: It is important both in theory and in practice to study how to obtain exact results via numeric computation, which we call zero-error computation. In this paper, we firstly indicate which kind of numbers are suitable for zero-error computation: One can compute the exact value from its approximate values for every element in a uniformly discrete set, in which there exists a nonzero separation bound between two distinct elements. Based on this observation, we give such a separation bound for algebraic numbers, which can be seen as a necessary condition on error control for zero-error computation of algebraic numbers. However, this condition may not be sufficient, depending on different algorithms. For the PSLQ (partial-sum-LQ-decomposition)-based algorithm, we give a sufficient condition on the precision that is quasi-linear in the degree of the algebraic number to be recovered, while the corresponding condition for the LLL (Lenstra-Lenstra-Lovasz)-based algorithm is quadratic. We also suggest several potential research areas in the future.

MSC:

11A05 Multiplicative structure; Euclidean algorithm; greatest common divisors
11Y16 Number-theoretic algorithms; complexity
68W40 Analysis of algorithms

Keywords:
zero-error computation; integer relation; error-controlling; LLL algorithm; PSLQ algorithm

Full Text: DOI