Strzeboński, Adam; Tsigaridas, Elias P.
Univariate real root isolation over a single logarithmic extension of real algebraic numbers. (English) Zbl 1393.11086


Summary: We present algorithmic, complexity, and implementation results for the problem of isolating the real roots of a univariate polynomial $B \in L[x]$, where $L = \mathbb{Q}[\lg(\alpha)]$ and $\alpha$ is a positive real algebraic number. The algorithm approximates the coefficients of $B$ up to a sufficient accuracy and then solves the approximate polynomial. For this we derive worst-case (aggregate) separation bounds. We also estimate the expected number of real roots when we draw the coefficients from a specific distribution and illustrate our results experimentally. A generalization to bivariate polynomial systems is also presented. We implemented the algorithm in C as part of the core library of MATHEMATICA for the case $B \in \mathbb{Z}[\lg(q)][x]$ where $q$ is positive rational number and we demonstrate its efficiency over various data sets.

For the entire collection see [Zbl 1379.13001].

MSC:
11Y16 Number-theoretic algorithms; complexity
11R04 Algebraic numbers; rings of algebraic integers
12D10 Polynomials in real and complex fields: location of zeros (algebraic theorems)
68W30 Symbolic computation and algebraic computation

Keywords:
real root isolation; logarithm; algebraic number; separation bound

Software:
Mathematica; ISOLATE

Full Text: DOI

References:


42. Yakoubsohn, J.-C.: Numerical analysis of a bisection-exclusion method to find zeros of univariate analytic functions. J.

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