Polynomial having large coefficients 3

`large3.1.n`

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Ring: $\mathbb{C}[x], \mathbb{R}[x]$
Equations:

$a10^{-200}x^n + 10^{100}x^{n-1} + 10^{200}, \quad (n = 20, a = 1, i)$

Polynomial supplied by D. A. Bini (Oct. 1996).

1 Characteristics

- The polynomial cannot be normalized in the standard IEEE arithmetic without generating an overflow condition.
- The polynomial, even if its coefficients are representable as double, has a root which cannot be represented as a double without generating an overflow condition. Failure is likely for programs that do not use extended arithmetic.

2 Problem

Newton-isolate all the roots.

2.1 Solution

Algorithm based on simultaneous iterations (Aberth's method) with cluster analysis (see [**?**]).

Program in Fortran 90 based on the multiprecision package MPFUN, by D. Bailey.

Machine used: IBM Risc 6000.

Time for Newton-isolating all the roots: for $n = 20$, $a = 1$, 2.3 seconds; for $n = 200$, $a = 1$, 15 seconds; for $n = 500$, $a = 1$, 18 seconds.

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References

[1] D. Bini. Numerical computation of polynomial zeros by means of aberth's method. *Numerical Algorithms*, 1997. (to appear).

[2] D. Bini and B. Mourrain. Polynomials test suite. 1996.