Modified Wilkinson's Polynomial 2

`wilkinson.1.22`

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

$$\prod_{i=1}^{20}(x-i)(x-20)^2.$$

Polynomial obtained by modifying Wilkinson's polynomial of degree 20 by increasing to 3 the multiplicity of the root 20. Supplied by D. A. Bini (Oct. 1996).

1 Characteristics

- Integer coefficients
- Besides the ill conditioning of the roots, there is a multiple root.

2 Problem

Newton-isolate all the roots up to within the relative error 10^{-100} (99 correct digits) for the nonisolated ones.

Newton-isolate all the roots with automatic detection of multiplicities

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 isolating all the roots up to within the relative error 10^{-100}: 6.9 seconds; Time for isolating all the roots with automatic detection of multiplicities: 20 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.