

## Forward Stable Computation of Roots of Real Polynomials with Only Real Distinct Roots

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**Abstract :** Any polynomial can be expressed as a characteristic polynomial of a complex symmetric arrowhead matrix. This expression is not unique. If the polynomial is real with only real distinct roots, the matrix can be chosen as real. By using accurate forward stable algorithm for computing eigen values of real symmetric arrowhead matrices we derive a forward stable algorithm for computation of roots of such polynomials in  $O(n^2)$  operations. The algorithm computes each root to almost full accuracy. In some cases, the algorithm invokes extended precision routines, but only in the non-iterative part. Our examples include numerically difficult problems, like the well-known Wilkinson's polynomials. Our algorithm compares favorably to other method for polynomial root-finding, like MPSolve or Newton's method.

**Keywords :** roots of polynomials, eigenvalue decomposition, arrowhead matrix, high relative accuracy

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