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Submitter :
Language : Fortran

Library: MATHLIB
Submitted: 15.01.1988
Revised: 01.12.1994

Roots of a Quartic Equation

Subroutine subprograms RRTEQ4 and DRTEQ4 compute the four roots of

$$x^4 + ax^3 + bx^2 + cx + d = 0 \qquad (*)$$

for real coefficients a, b, c, d.

On computers other than CDC or Cray, only the double-precision version DRTEQ4 is available. On CDC and Cray computers, only the single-precision version RRTEQ4 is available.

Structure:

SUBROUTINE subprograms
User Entry Names: RRTEQ4, DRTEQ4
Obsolete User Entry Names: RTEQ4 ≡ RRTEQ4
External References: RRTEQ3 (C207), DRTEQ3 (C207)

Usage:

For t = R (type REAL), t = D (type DOUBLE PRECISION),

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CALL tRTEQ4(A,B,C,D,Z,DC,MT)
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A,B,C,D	(type according to t) Coefficients a, b, c, d in $(*)$.
Z	(COMPLEX for t = R, COMPLEX*16 for t = D) One-dimensional array of length ≥ 4. On exit, Z contains the roots of $(*)$.
DC	(type according to t) On exit, DC is set to the value of the discriminant of the cubic resolvent of $(*)$.
MT	(INTEGER) On exit, MT specifies the type of the roots: = 1 : Four real roots in Z(1), . . . , Z(4); = 2 : Two pairs of complex conjugate roots, one pair in Z(1),Z(2), the other in Z(3),Z(4); = 3 : Two real roots in Z(1),Z(2), and one pair of complex conjugate roots in Z(3),Z(4).

Method:

The equation is solved by the classical procedure, i.e., by solving its cubic resolvent and by combining the square roots of these solutions appropriately.

Accuracy:

Depends on the coefficients a, b, c, d. The values of Z(1), . . . , Z(4) and of DC may be inaccurate if |DC| is very small. MT may be uncertain in such cases.

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