

Numerically Optimal Runge–Kutta Pairs with Interpolants*

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Abstract Explicit Runge–Kutta pairs are known to provide efficient solutions to initial value differential equations with inexpensive derivative evaluations. Two criteria for selection are proposed with a view to deriving pairs of all orders 6(5) to 9(8) which minimize computation while achieving a user-specified accuracy. Coefficients of improved pairs, their stability regions and coefficients of appended optimal interpolatory Runge–Kutta formulas are provided on the author’s website (www.math.sfu.ca/~jverner). This note reports results of tests on these pairs to illustrate their effectiveness in solving nonstiff initial value problems. These pairs and interpolants may be used for implementation, or else to provide comparison targets for other new types of methods such as explicit general linear methods.

Keywords explicit Runge–Kutta pairs · order conditions · local error estimation · continuous Runge–Kutta methods

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