

B-series and TSRK methods based on Gaussian quadratures

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July 14, 2008

Accurate solutions to initial value systems of ordinary differential equations may be approximated efficiently by Runge–Kutta pairs or linear multistep methods. Two-step Runge–Kutta methods are hybrid formulas designed to combine the advantages of both methods, and these have been stimulated by the initial work of Jackiewicz. A B-series approach is used to characterize the order conditions, previously derived using an algebraic approach by Butcher and Tracogna. These form the basis of a MAPLE code for verifying the order of particular methods, and obtaining norms of the local truncation error coefficients as a criteria for selection of good algorithms.

A restricted sub-family of methods based on weights from Lobatto and Radau quadrature rules simplifies the nature of starting methods required for implementation. Some simple examples of such methods will be presented.