

B-series and TSRK pairs based on Gaussian quadratures

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Abstract.

Solutions to non-stiff or mildly-stiff initial value systems of ordinary differential equations may be approximated **efficiently** by explicit Runge–Kutta pairs or linear multistep methods. Hybrid explicit two-step Runge–Kutta pairs have been designed in an attempt to improve on efficiency/accuracy benefits of such treatments. Here, a B-series approach is used to characterize the order conditions for TSRK methods, previously derived using an algebraic approach by Butcher and Tracogna. This leads to the construction of a MAPLE code which may be used to verify the order of particular methods, and compute norms of the local truncation error coefficients. The latter may be used as a criteria for searching for and selecting good algorithms.

Recent work establishes an alternative formulation for representing the order conditions using a recursion based on Butcher’s theory. This leads to a restricted sub-family of pairs based on weights from Lobatto and Radau quadrature rules which simplifies trequired starting methods and allows for easy change of step-size. Results using order six pairs will be presented.