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Monotonicity conditions for multirate and partitioned explicit Runge-Kutta schemes. (English) Zbl 1263.65089

Ansorge, Rainer (ed.) et al., Recent developments in the numerics of nonlinear hyperbolic conservation laws. Lectures presented at a workshop at the Mathematical Research Institute Oberwolfach, Germany, January 15–21, 2012. Berlin: Springer (ISBN 978-3-642-33220-3/hbk; 978-3-642-33221-0/ebook). Notes on Numerical Fluid Mechanics and Multidisciplinary Design (NNFM) 120, 177-195 (2013).

Summary: Multirate schemes for conservation laws or convection-dominated problems seem to come in two flavors: schemes that are locally inconsistent, and schemes that lack mass-conservation. In this paper these two defects are discussed for one-dimensional conservation laws. Particular attention is given to monotonicity properties of the multirate schemes, such as maximum principles and the total variation diminishing property. The study of these properties is done within the framework of partitioned Runge-Kutta methods. It is also seen that the incompatibility of consistency and mass-conservation holds for 'genuine' multirate schemes, but not for general partitioned methods.

For the entire collection see [Zbl 1254.65002].

MSC:

65M20	Method of lines for initial value and initial-boundary value problems involving PDEs	Cited in **11** Documents
65L06	Multistep, Runge-Kutta and extrapolation methods for ordinary differential equations	
35L65	Hyperbolic conservation laws	
65M06	Finite difference methods for initial value and initial-boundary value problems involving PDEs	
65M12	Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs	

Keywords:

semidiscretization; stability; multirate schemes; conservation laws; maximum principles; total variation diminishing property; partitioned Runge-Kutta method; consistency

Full Text: DOI Link