Improved parallel-iterated pseudo two-step RK methods for nonstiff IVPs

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Abstract: The aim of this paper is to consider a parallel predictor-corrector (PC) iteration scheme for a general class of pseudo two-step Runge-Kutta methods (PTRK methods) of arbitrary high-order for solving first-order nonstiff initial-value problems (IVPs) on parallel computers. Starting with an s-stage pseudo two-step RK method of order p^* with w implicit stages, we apply a highly parallel PC iteration process in PE $(CE)^m$ E mode. The resulting parallel PC method can be viewed as a parallel-iterated pseudo two-step Runge-Kutta method (PIPTRK method) with an improved (new) predictor formula and therefore will be called the improved PIPTRK method (IPIPTRK method). The IPIPTRK method uses an optimal number of processors equal to $w \leq p^* / 2$. Numerical experiments show that the IPIPTRK methods proposed in this paper are superior to the efficient sequential DOPRI5 and DOP853 codes and parallel PIRK methods available in the literature. © 2006 IMACS.

Author Keywords: Parallelism; PC methods; RK methods

Index Keywords: Initial value problems; Iterative methods; Parallel algorithms; Problem solving; Parallelism; PC methods; RK methods; Runge Kutta methods

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