

Parallel block PC methods with RKN-type correctors and adams-type predictors

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Abstract: This paper describes the construction of block predictor - corrector methods based on Runge-Kutta-Nystrom correctors. Our approach is to apply the predictor - corrector method not only at step point, but also at off-step points (block points), so that in each step, a whole block of approximations to the exact solution at off-step points is computed. In the next step, these approximations are used to obtain a high-accurate predictions using Adams-type formulas. By suitable choice of the abscissas of the off-step points, a much more accurately predicted value is obtained than by predictions using last step values. Since the block of approximations at the off-step points can be computed in parallel, the sequential costs of these block predictor - corrector methods are comparable with those of a conventional predictor - corrector method. Furthermore, by using Runge-Kutta-Nystrom corrector methods, the computation of the approximation at each off-step point is also highly parallel. Application of the resulting block predictor - corrector methods to a few widely-used test problems reveals that the sequential costs are very much reduced when compared with the best parallel and sequential methods from the literature.

Index Keywords: Approximation theory; Convergence of numerical methods; Error analysis; Initial value problems; Iterative methods; Ordinary differential equations; Problem solving; Runge Kutta methods; Adams type predictors; Block points; Parallel block method; Predictor corrector method; Runge-Kutta-Nystrom correctors; Computational methods

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