

# Parallel-iterated pseudo two-step Runge-Kutta-Nyström methods for nonstiff second-order IVPs

Cong N.H., Minh N.T.H.

Faculty of Mathematics Mechanics and Informatics, Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Hanoi, Viet Nam

**Abstract:** The aim of this paper is to consider parallel iteration schemes for a general class of pseudo two-step Runge-Kutta-Nyström (RKN) methods of arbitrary high order for solving nonstiff initial-value problems  $y''(t) = f(y(t))$ ,  $y(t_0) = y_0$ ,  $y'(t_0) = y_0'$  on parallel computers. Starting with an  $s$ -stage pseudo two-step RKN method of order  $p^*$  with  $w$  implicit stages, we apply the highly parallel PC iteration process in P(EC)<sup>m</sup>E mode. The resulting PIPTRKN method (parallel-iterated pseudo two-step RKN method) uses an optimal number of processors equal to  $w \leq p^*/2$ . By a number of numerical experiments, we show the superiority of the PIPTRKN methods proposed in this paper over both sequential and parallel methods available in the literature.

**Author Keywords:** Parallelism; PC methods; RKN methods

**Index Keywords:** Initial value problems; Iterative methods; Parallel processing systems; Problem solving; Parallel computers; Runge-Kutta-Nyström methods; Runge Kutta methods

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Correspondence Address: Cong, N.H.; Fac. of Math., Mechanics and Info., Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Hanoi, Viet Nam

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Authors with affiliations:

- Cong, N.H., Faculty of Mathematics Mechanics and Informatics, Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Hanoi, Viet Nam
- Minh, N.T.H., Faculty of Mathematics Mechanics and Informatics, Hanoi University of Science, 334 Nguyen Trai, Thanh Xuan, Hanoi, Viet Nam

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