

A fourth order numerical scheme for the sine-Gordon equation

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Abstract

A numerical scheme arising from the use of a fourth order rational approximants to the matrix-exponential term in a three-time level recurrence relation is proposed for the numerical solution of the one-dimensional sine-Gordon (SG) equation already known from the bibliography. The method for its implementation uses a predictor-corrector scheme in which the corrector is accelerated by using the already evaluated corrected values (MPC). For the implementation of the corrector in order to avoid extended matrix evaluations an auxiliary vector was successfully introduced. Both the predictor and the corrector schemes are analysed for stability. The P-C/MPC schemes are tested on the single and the doublet solitons as well as on the collision of breathers and comparison of the numerical results with the relevant ones in the bibliography is made. Finally, conclusions for the behaviour of the introduced MPC over the standard P-C scheme are derived.

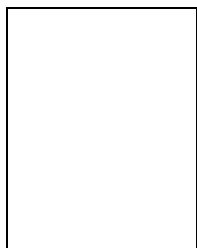
Keywords

Soliton; Sine-Gordon; Finite-difference method; Predictor-corrector.
AMS — 35Q51, 35Q53, 65M06, 78M20, 65Y10.

The method and the numerical results are given in [1].

REFERENCES

- [1] A. G. Bratsos, A fourth order numerical scheme for the one-dimensional sine-Gordon equation, to be appeared in Intern. J. Computer Math.



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Professor Bratsos research interests are in the numerical solution of linear/non-linear partial differential equations with applications to applied sciences (URL: <http://math.teiath.gr/bratsos>).