

Bratsos, A. G.

A numerical method for the one-dimensional sine-Gordon equation. (English) Zbl 1143.65068
Numer. Methods Partial Differ. Equations 24, No. 3, 833-844 (2008).

Summary: A numerical method based on a predictor-corrector (P-C) scheme arising from the use of rational approximants of order 3 to the matrix-exponential term in a three-time level recurrence relation is applied successfully to the one-dimensional sine-Gordon equation, already known from the bibliography. In this P-C scheme a modification in the corrector (MPC) is proposed according to which the already evaluated corrected values are considered.

The method, which uses as predictor an explicit finite-difference scheme arising from the second order rational approximant and as corrector an implicit one, is tested numerically on the single and the soliton doublets. Both the predictor and the corrector schemes are analyzed for local truncation error and stability. From the investigation of the numerical results and the comparison of them with other ones known from the bibliography it is derived that the proposed P-C/MPC schemes at least coincide in terms of accuracy with them.

MSC:

- 65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs Cited in 26 Documents
- 35Q53 KdV equations (Korteweg-de Vries equations)
- 35Q51 Soliton equations
- 65M12 Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs

Keywords:

finite-difference method; predictor-corrector method; sine-Gordon equation; soliton; numerical examples; error bounds

Full Text: [DOI](#)

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