INVESTIGATION OF DIFFERNECE SCHEMES FOR SOLVING THE NONLINEAR SHRODINGER EQUATION

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This paper studies difference schemes for solving the nonlinear Schrodinger equation (NLSE). In addition to well – known methods such as: an implicit, an explicit method, Crank-Nicolson Implicit and Richardson schemes, and Split Step Fourier Method, new compact difference schemes are introduced. The analysis and the comparison of the methods are conducted in two different metrics. For computation, besides a standard soliton – solution, which is frequently used in such works, 16QAM-modulated signals are examined. What is more, exact potentials obtained by solving the inverse and direct Zakharov – Shabat problems for reflectionless potential were also constructed and used to compare the schemes.

Key words: difference schemes, the nonlinear Schrodinger equation, compact difference schemes, 16QAM-modulated signals, reflectionless potential, inverse and direct Zakharov – Shabat problems.

REFERENCES

1. Zaharov, V. E., Manakov, S. V., Novikov, S. P, & Pitaevskij, L. P. (1980). *Teoriya solitonov: metod obratnoj zadachi [Soliton Theory: Inverse Problem Method]*. Moscow: Nauka Publ. [in Russian].

2. Taha, T. R., & Ablowitz, M. I. (1984). Analytical and numerical aspects of certain nonlinear evolution equations. II. Numerical, nonlinear Schrodinger equation. Journal of Computational Physics, 55(2), 203–230.

3. Tingchun, W. (2012). Convergence of an Eighth-Order Compact Difference Scheme for the Nonlinear Schrodinger Equation. Advances in Numerical Analysis, 2012, 24 p.

4. Fedoruk, M. P., & Paasonen, V. I. (2011). Kompaktnaya dissipativnaya skhema dlya nelinejnogo uravneniya Shredingera. Vychislitel'nye tekhnologii [*Computational Technologies]*, 16(6), 68–73 [in Russian].

5. Chekhovskoy, I. S., Paasonen, V. I., Shtyrina, O. V., & Fedoruk, M. P. (2017). Numerical approaches to simulation of multi-core fibers. Journal of Computational Physics, 334, 31–44.

6. Satsuma, J., & Yajima, N. (1974). Initial Value Problems of One-Dimensional Self-Modulation of Nonlinear Waves in Dispersive Media. Supplement of the Progress of Theoretical Physics, 55.

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