

Dynamics of soliton solutions of the fifth-order nonlinear Schrödinger equation via the Riemann-Hilbert approach

Jin-Jie Yang¹, Shou-Fu Tian¹, Tian-Tian Zhang¹, and Xiao-Li Wang²

¹China University of Mining and Technology

²Qilu University of Technology

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Abstract

The theory of inverse scattering is developed to investigate the initial-value problem for the fifth-order nonlinear Schrödinger (foNLS) equation under the zero boundary conditions at infinity. The spectral analysis is performed in the direct scattering process, including the establishment of the analytical, asymptotic and symmetric properties of the scattering matrix and the Jost functions. In the inverse scattering process, a suitable Riemann-Hilbert (RH) problem is successfully established by using the modified eigenfunctions and scattering data, and the relationship between the potential function and the solution of the RH problem is successfully established. In order to further analyze the propagation behavior of the solutions of the foNLS equation, we present some new phenomena of studying the one-, two-, and three- soliton solutions corresponding to simple zeros in scattered data. Finally, we also analyze the one- and two-soliton solutions corresponding to double zeros.

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