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Multi-soliton solutions for a (2+1)-dimensional variable-coefficient nonlinear Schrödinger equation

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Abstract

In this paper, a (2+1)-dimensional variable-coefficient nonlinear Schrödinger equation is investigated, which can describe an inhomogeneous Heisenberg ferromagnetic spin chain with the octuple-dipole interaction or alpha helical protein with higher-order excitations and interactions under the continuum approximation. Bilinear forms, one- and two-soliton solutions are derived by virtue of the Hirota method with an auxiliary function. Propagation and interaction properties of the solitons are discussed: Parabolic, cubic and periodic solitons are presented. Solitonic amplitudes are only related to the wave numbers, while solitonic velocities are related to both the wave numbers and variable coefficients. Interactions between the two parallel solitons are discussed.

Keywords: Heisenberg ferromagnetic spin chain; Alpha helical protein; (2+1)-dimensional variable-coefficient nonlinear Schrödinger equation; Solitons

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