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Analytic study on triple-s, triple-triangle structure interactions for solitons in inhomogeneous multi-mode fiber. (English) Zbl 1428.81079

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Summary: The analytic multi-soliton solutions for nonlinear Schrödinger (NLS) equations are complex to obtain. Based on those solutions, interactions among multiple solitons show more abundant characteristics than two soliton interactions. With the Hirota method, bilinear forms and analytic soliton solutions of the coupled NLS equation are derived, and the influences of the dispersion parameter $\beta(x)$ and constant parameters p_1, p_2 and p_3 on soliton interactions are discussed in detail. The novel triple-S structures are presented via choosing suitable values. The phase, intensity and incidence angles of dark solitons are controlled with appropriate constant parameters. Besides, bound states of dark solitons are observed with different periods. In addition, the peculiar triple-triangle structures are presented when one sets $\beta(x)$ as the hyperbolic tangent function. Results in this paper are useful for the generation and interaction of optical solitons in nonlinear optics and ultrafast optics.

MSC:

81Q05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics

35Q53 KdV equations (Korteweg-de Vries equations)

Keywords:

solitons; soliton interactions; analytic solution; coupled nonlinear Schrödinger equation

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