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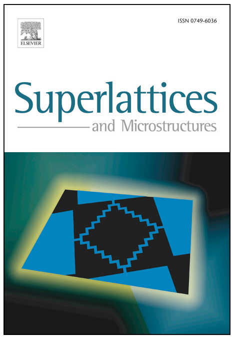

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Modulation stability and dispersive Optical Soliton solutions of higher order nonlinear Schrödinger equation and its applications in mono-mode optical fibers

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Abstract: In mono-mode optical fibers, the higher order non-linear Schrödinger equation (NLSE) describes the propagation of enormously short light pulses. We constructed optical solitons and, solitary wave solutions of higher order NLSE mono-mode optical fibers via employing modified extended mapping method which has important applications in Mathematics and physics. Furthermore, the formation conditions are also given on parameters in which optical bright and dark solitons can exist for this media. The moment of the obtained solutions are also given graphically, that helps to realize the physical phenomena's of this model. The modulation instability analysis is utilized to discuss the model stability, which verifies that all obtained solutions are exact and stable. Many other such types of models arising in applied sciences can also be solved by this reliable, powerful and effective method. The method can also be functional to other sorts of higher order nonlinear problems in contemporary areas of research.
Keywords: Modified extended mapping method, Higher order nonlinear schrödinger equation, Solitons, Solitary wave solutions.

1 Introduction

The nonlinear Schrödinger equations (NLSEs) are important physical models, illustrate the dynamics of optical soliton promulgation in mono-mode optical fibers [1–8]. The nonlinear transformation of dielectric of the fiber termed as the Kerr effect is applied to neutralize the dispersion effect, in this state the optical pulse might lean to form a steady nonlinear pulse known as an optical soliton. The bit rate of transmission is restricted by the dispersion of the fiber material. The fiber loss is the only factor that contributes to the drop in the pulse quality by expansion in the pulse width, for details (see references [9–13]).

In the mono-mode optical fibers, the soliton propagation is a topic of huge current curiosity since of the broad applications of ultrafast signal routing systems and short light pulses to telecommunication [8, 14]. The authors in [15] investigated the optical solitons in dielectric fibers experimentally and theoretically. Solitons inhomogeneous and Hamiltonian systems are localized solitary waves containing special properties such as enormously robust to perturbations, without changing structure during propagating at a constant speed, stable with respect to collision with other solitons. A chirp-free pulse is resulted if the length of dispersion is the same to nonlinear length [13]. In the Pico-second system, the NLSE which is the central governing pulse envelope equation in which the self-phase modulation and the group velocity dispersion effects are just taken into description [32].

In last some decades, both physicist and mathematician and have made many efforts in finding the analytic solutions to a number of nonlinear wave systems. Many systematic and powerful methods have been formulated for the obtaining exact explicit solutions in numerous form such as the trial equation technique, variational method, semi-inverse variational principle, Bäcklund transformations, Darboux transformation, inverse scattering method, Hirotas bilinear method, the extended tanh method, expansion methods, auxiliary equation method, simple equation method, direct algebraic method, mapping method, modified simple equation method, the rational expansion method