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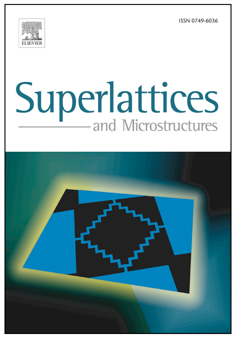

Modulation stability and optical soliton solutions of nonlinear Schrödinger equation with higher order dispersion and nonlinear terms and its applications

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Modulation stability and optical soliton solutions of nonlinear Schrödinger equation with higher order dispersion and nonlinear terms and its applications

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Abstract: In optical fibers, the higher order non-linear Schrödinger equation (NLSE) with cubic quintic nonlinearity describes the propagation of extremely short pulses. We constructed bright and dark solitons, solitary wave and periodic solitary wave solutions of generalized higher order NLSE in cubic quintic non Kerr medium by applying proposed modified extended mapping method. These obtained solutions have key applications in physics and mathematics. Moreover, we have also presented the formation conditions on solitary wave parameters in which dark and bright solitons can exist for this media. We also gave graphically the movement of constructed solitary wave and soliton solutions, that helps to realize the physical phenomena's of this model. The stability of the model in normal dispersion and anomalous regime is discussed by using the modulation instability analysis, which confirms that all constructed 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.
Keywords: Modified extended mapping method, generalized higher order nonlinear schrödinger equation, Solitons, Solitary wave solutions, periodic solutions, exact solutions.

1 Introduction

The nonlinear Schrödinger equations (NLSEs) are important physical models, illustrate the dynamics of optical soliton promulgation in nonlinear optical fibers [1–10]. In non-linear optical fibers, the optical soliton propagation is a topic of huge present curiosity since of the broad applications of ultrafast signal routing systems and short light pulses to telecommunication [5, 8, 9, 11]. The optical solitons in a dielectric fibers were experimentally and theoretically exposed by authors of [8,9]. Solitons in homogeneous and Hamiltonian systems are localized solitary waves containing special properties such as enormously robust to perturbations, without changing structure during propagate at constant speed, stable with respect to collision with other solitons. The usual NLSE is a essential form which depicts pulse promulgation in the presence of the group velocity dispersion of second order and the effect of optical Kerr (third-order). If the present nonlinearity is positive and dispersion is also anomalous, the chirps frequency established via self-phase modulation and dispersion owing to oppose of Kerr nonlinearity. A chirp free pulse is resulted if the length of dispersion is the same to nonlinear length [12].

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 [13]. Thus far, the ultra short pulses are produced as to increase the intensity of the incident pulse power, the non-Kerr nonlinearity effects and higher order dispersion turn into an important. The dynamics of the pulses must be illustrated via the generalized NLSE and based on the sign of group velocity dispersion. The NLSEs have different types of solitary wave solutions such as dark, bright, periodic solitary wave solutions etc [14–16]. Both dark soliton and bright soliton have distinctive characteristics during propagation in systems of optical communication and have much application in the context of optical switch, pulse compression and pulse amplification [17–19]. After description of experimentally and theoretically that it can promulgate in the anomalous dispersion system, in fiber