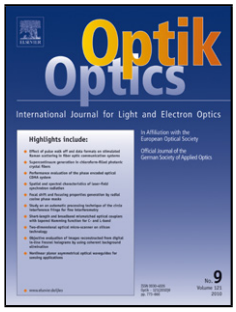

Title: Soliton solutions of the nonlinear Schrödinger equation with the dual power law nonlinearity and resonant nonlinear Schrödinger equation and their modulation instability analysis

Author: Asghar Ali Aly R. Seadawy Dianchen Lu

PII: S0030-4026(17)30833-1
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2017.07.016
Reference: IJLEO 59412

To appear in:

Received date: 18-5-2017
Accepted date: 6-7-2017

Please cite this article as: Asghar Ali, Aly R. Seadawy, Dianchen Lu, Soliton solutions of the nonlinear Schr*ddoto*dinger equation with the dual power law nonlinearity and resonant nonlinear Schr*ddoto*dinger equation and their modulation instability analysis, *<![CDATA[Optik - International Journal for Light and Electron Optics]]>* (2017), http://dx.doi.org/10.1016/j.ijleo.2017.07.016

Soliton solutions of the nonlinear Schrödinger equation with the dual power law nonlinearity and resonant nonlinear Schrödinger equation and their modulation instability analysis

Asghar Ali [1,2], Aly R. Seadawy[1,3] and Dianchen Lu[1]

[1]Faculty of Science, Jiangsu University, Zhenjiang, Jiangsu 212013, P. R. China
[2]Department of Mathematics, University of Education, Multan Campus, Pakistan
[3]Mathematics Department, Faculty of Science, Taibah University, Al-Ula, Saudi Arabia
Mathematics Department, Faculty of Science, Beni-Suef University, Egypt

Corresponding Authors:(Aly Seadway):E-mail:Aly742001@yahoo.com

Abstract: In optical fibers, the higher order nonlinear Schrödinger equations describes propagation of ultra-short pluse. The proposed modified simple equation method is employed to the nonlinear higher order Schrödinger equations for soliton solutions. The balance numbers in these Schrödinger equations are positive non integers. The obtain solitary solutions are also presented by graphically. The modulation instability analysis shows the stability and movement of the waves, which confirms that all obtained solutions are analytical and stable. This is a new and standardized method which is applicable to solve different kind of problems in mathematics and physics.
Keywords: Nonlinear higher order schrödinger equations, positive non integers balance numbers, modified simple equation method, solitons, Solitary wave solutions.

1 Introduction

In various branches of mathematical physical sciences such as chemistry, biology, physics and engineering, the partial differential equations play as a basic tool for solving different kind of problems arises in these areas. In partial differential equations, the higher order nonlinear Schrödinger equations are essential module for nonlinear optics which explained the propagation especially short pulses in optical fibers and have a wide applications in ultrafast signal-routing, telecommunication system etc. The parameters involving in higher order Schrödinger equations are utilized to explain the pulse propagation in optical fibers. Optical solitons occur due the balance of group velocity dispersion and nonlinear effect.

The phenomena of soliton was first described by author in [1] and the solution of solitons are acquired by means of the inverse scattering transform in [2]. In different aspect, solutions of nonlinear Schrödinger equations have been studied different authors in [3–11]. Many influential methods have been developed for the solitary waves solution of nonlinear partial equation such as the homogeneous balance method [12,13], modified simple equation method [14–17], modified extended direct algebraic method [18], the tanh-sech method and the extended tanhcoth method [19–21], the soliton ansatz method [22–30], the Kudryashov method [31], the first integral method [32], the symmetry method [33], the (G'/G)-expansion method [35] and many more.

In the current work, we have employed proposed modified simple equation method on nonlinear higher order schrödinger equations with non integer balance number [34, 38] to obtain new solitary wave solutions. To the best of our knowledge, no work has been done in previous study by employing the current proposed method for solving such type of higher order nonlinear Schrödinger equations. The obtained solutions are useful in exploring nonlinear wave phenomena in mathematical physical sciences.

The article structured as follows: The main steps of the proposed method are given in Section 2. In Section 3, we apply the present method to higher order nonlinear Schrödinger equations for constructing solitary wave solution. In section 4, we discuss the stability of higher order NLSEs. Lastly, the summary of the work is given in Section 5.