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Non-Linear Schrodinger Equation Solitary Wave Solutions Using Phase Amplitude Method With Higher Order Dispersion In terms of mathematics

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ABSTRACT

We show that certain bifurcation is frequently used to characterize the complexity of nonlinear systems. We are able to create the streamlined approximation technique for solitary wave solution formulation. The underlying mechanisms were not fully known in the past because the bifurcation and solitary waves were typically examined independently. Only a small number of the exact or analytic solutions to nonlinear partial differential equations (PDEs) could be directly derived by integration, although predictions for their solitary waves may have existed. In my paper, I present the analytical solution of the solitary wave solution of the nonlinear Schrodinger equation with higher order dispersion. In addition, the bifurcation analysis makes the producing mechanisms and full outcomes of the existence/coexistence of kinks, anti-kinks, and solitary wave solutions more evident. Using the Phase Amplitude approach, we investigate the Bright Solitary Wave solution of NLSE and observe the nature of solutions by varying parameters. Solitons, or solitary waves, are crucial to theory and applications of the nonlinear Schrödinger (NLS) equation.

Keywords: Non Linear Schrodinger Equation, Solitary Waves.

INTRODUCTION

In order to evaluate solitary wave solutions, numerous simplified equations for nonlinear Schrodinger effects can be found. A few of these models have significant application values and admit exact solutions that are essential to the theory of the associated equations. One crucial parameter in the propagation of nonlinear waves in dynamical systems with solitary wave solutions is one of the fundamental objects of nature and the subject of growing interest among researchers.

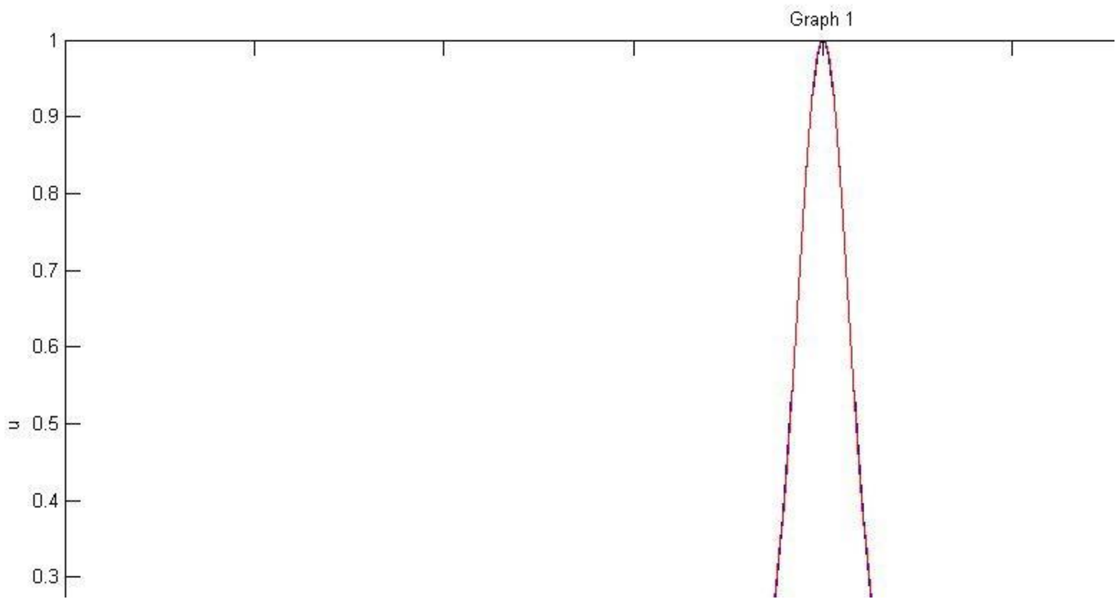
Additionally, nonlinear Schrodinger is crucial to the development of solitary wave solutions in many scientific and engineering domains. A Fractional Order Coupled Burger Traveling Wave Solution? (G'G)-Expansion Method Equations Additionally, Johnson, R.S. (1970) found A Non-Linear Equation Incorporating Damping and Dispersion[1], and He, J.H. (1999) conducted research on Some Applications of Nonlinear Fractional Differential Equations[4]. A wide class of nonlinear evolution equations can have single solitons solutions determined with the help of the solitary wave ansatz method [13] [14], which is a relatively heuristic approach that takes into account important properties. The solitary wave ansatz approach has been used to obtain the solitary wave and shock wave soliton.

Many studies on nonlinear effects are documented in the literature in an effort to examine and mitigate the impacts of nonlinearity. Numerous techniques, including the reverse-scattering method, Backlund transformation, the wadati trace method, Hirota bilinear forms, the sine-cosine method, and the first integral method, have been developed in recent years to investigate the precise solitary wave solutions of mathematical-physical equations. Numerous important theoretical and numerical contributions have been made to the development of soliton theory since Kruskal and Zabusky's discovery of the soliton [1] [2, 3, 4, 5]. NLSEs have a number of problems that require attention. These consist of wave interactions, conservation laws, the integrability component, and many others.

Numerous solutions for NLSEs can be obtained by including different parts of computation for conserved quantities, wave-wave interaction, and quasi-stationary solutions. Therefore, the first steps determine the problem's primary importance before calculating its answer.

3. OUTCOMES AND CONVERSATIONS

Graph 1: The findings indicate that peak value propagation occurs at various parameters, where To=100, 50, 10, and more can be combined to create even more distinct parameters. Here, To=100, 50, 10 yields the best findings for our study



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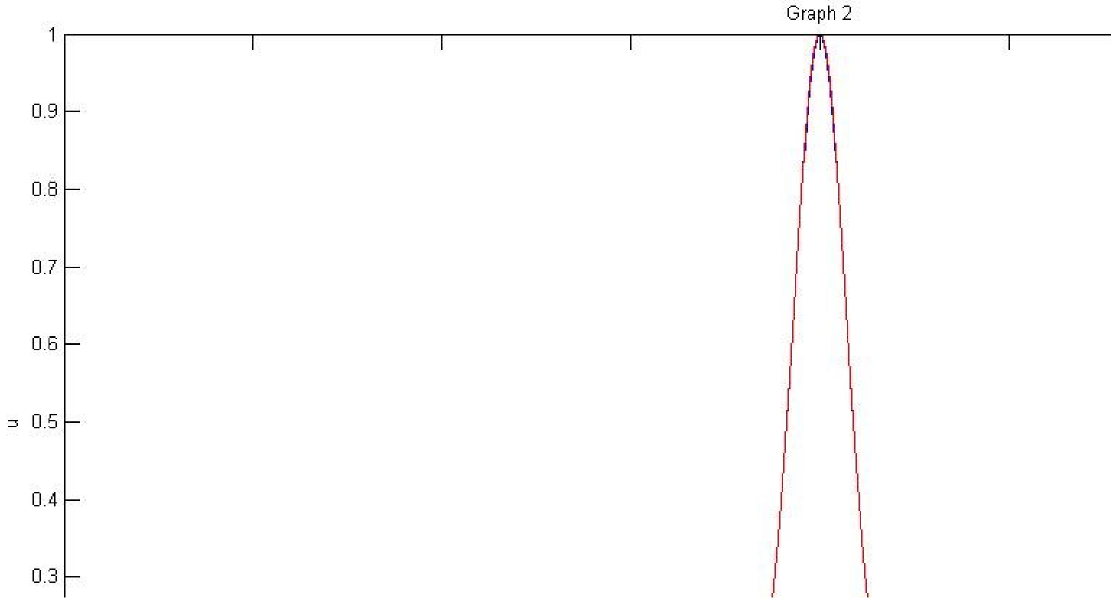
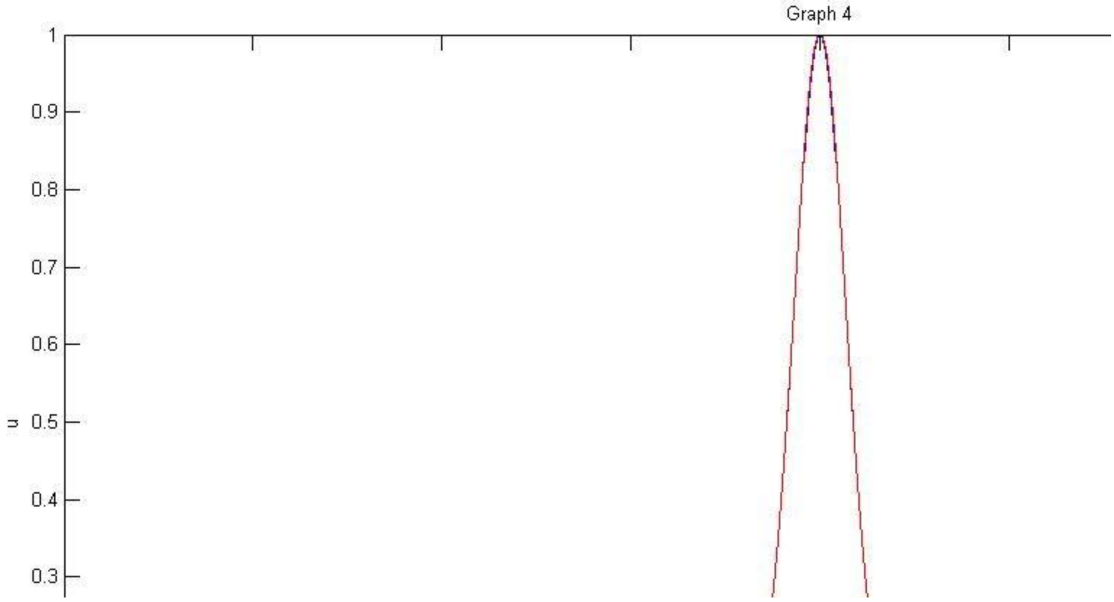
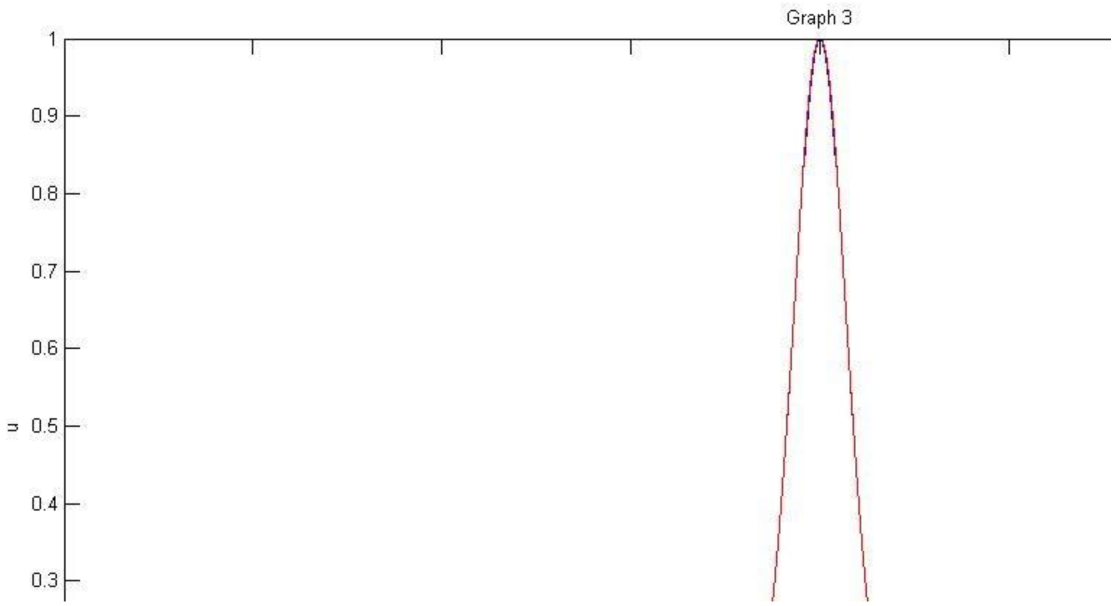
Graph 2: We have established a better performance analysis and modified the parameter to To=1 for our second result.



Graph 3:



Graph 4: The steeping effect and higher order dispersion at To=100, a defined parameter that has been set up using the ansatz approach for significantly better performance than earlier results, are demonstrated in this study.



4. CONCLUSION

The propagation of ultra-short fem to second pulses has been described in this paper using the higher order nonlinear Schrodinger equation with cubic-quintic factors, the self-steeping effect, and higher order dispersion effects.

We used the phase amplitude ansatz method to theoretically determine the bright solitary wave solution after seeing various modulations for various parameters.

REFERENCE

[1] Johnson, R.S. (1970) A Non-Linear Equation Incorporating Damping and Dispersion. Journal of Fluid Mechanics, 42, 49-60. http://dx.doi.org/10.1017/S0022112070001064

[2] Younis, M. and Zafar, A. (2014) Exact Solution to Nonlinear Differential Equations of Fractional Order via (G'/G)-Expansion Method. Applied Mathematics, 5, 1-6. http://dx.doi.org/10.4236/am.2014.51001

[3] Younis, M. (2013) The First Integral Method for Time-Space Fractional Differential Equations. Journal of Advanced Physics, 2, 220-223. http://dx.doi.org/10.1166/jap.2013.1074

[4] He, J.H. (1999) Some Applications of Nonlinear Fractional Differential Equations and Their Applications. Bulletin of Science and Technology, 15, 86-90.

[5] Younis, M., Zafar, A., Ul-Haq, K. and Rahman, M. (2013) Travelling Wave Solutions of Fractional Order Coupled Burgers? Equations by (G'G) - Expansion Method. American Journal of Computational and Applied Mathematics, 3, 81-85.

[6] Seadawy AR. Stability analysis for two-dimensional ion-acoustic waves in quantum plasmas. Phys Plasmas 2014; 21:052107.

[7] Islam MH, Khan K, Akbar MA, Salam MA. Exact traveling wave solutions of modified dV-

Zakharov-Kuznetsov equation and viscous Burgers equation. Springer Plus 2014; 3(105):1–9.
[8] Seadawy AR, Lu Dianchen. Ion acoustic solitary wave solutions of three dimensional nonlinear extended Zakharov-Kuznetsov dynamical equation in a magnetized two-ion-temperature dusty plasma. Result Phys 2016; 6:560–93.
[9] Liu, J. and Hou, G. (2011) Numerical Solutions of the Space- and Time-Fractional Coupled Burgers Equations by Generalized Differential Transform Method. Applied Mathematics and Computation, 217, 7001-7008. http://dx.doi.org/10.1016/j.amc.2011.01.111
[10] Younis, M. and Zafar, A. (2014) Exact Solution to Nonlinear Differential Equations of Fractional Order via (G'/G)-Expansion Method. Applied Mathematics, 5, 1-6. http://dx.doi.org/10.4236/am.2014.51001
[11] Fan E., Multiple travelling wave solutions of nonlinear evolution equations using a unified algebraic method, J. Phys. A: Math. Gen., 2002, V.35, 6853–6872.
[12] Younis, M. and Zafar, A. (2013) The Modified Simple Equation Method for Solving Nonlinear Phi-Four Equation. International Journal of Innovation and Applied Studies, 2, 661-664.
[13] Triki, H. and Wazwaz, A.-M. (2011) Dark Solitons for a Combined Potential KdV and Schwarzian KdV Equations with t-Dependent Coefficients and Forcing Term. Applied Mathematics and Computation, 217, 8846-8851.http://dx.doi.org/10.1016/j.amc.2011.03.050
[14] Bekir, A., Aksoy, E. and Guner, O. (2012) Bright and Dark Soliton Solitons for Variable Cefficient Diffusion Reaction and Modified KdV Equations. Physica Scripta, 85, 35009-35014. http://dx.doi.org/10.1088/0031-8949/85/03/035009
[15] Bekir, A., Aksoy, E. and Guner, O. (2012) Bright and Dark Soliton Solitons for Variable Cefficient Diffusion Reaction and Modified KdV Equations. Physica Scripta, 85, 35009-35014. http://dx.doi.org/10.1088/0031-8949/85/03/035009