



New exact solitary wave solutions of the strain wave equation in microstructured solids via the generalized exponential rational function method

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Abstract In this article, we utilize the generalized exponential rational function method and obtain exact solitary wave solutions in various forms of the strain wave equation. Abundant exact solitary solutions including multiple-solitons, bell-shaped solitons, traveling waves, trigonometric and rational solutions have been constructed. The dynamical structures of some solutions are illustrated graphically through 3D, 2D-shapes, and respective density plots, which gives an easy understanding of the physical explanation of the strain wave equation. Dispersive effects by the microstructures of materials combined with nonlinearities lead to exact solitary waves. Our obtained results are entirely different from earlier established findings and never published elsewhere. These results demonstrate that the generalized exponential rational function method is a straightforward, effective, and more capable mathematical tool for obtaining the exact solitary solutions to the nonlinear partial differential equations which arise in the field of mathematical physics, fluid mechanics, plasma physics, mathematical biology, fiber optics, chemistry, materials physics, engineering disciplines and many other natural sciences.

1 Introduction

The nonlinear partial differential equations (NLPDEs) appear in many applications of various research areas of applied mathematics and engineering. A vital tool is finding the exact solitary wave solutions of NLPDEs to understand its dynamics. The continuous development of natural phenomena in obtaining the analytic solutions of these NLPDEs is observed in the field of mathematical physics. The investigation of solitons and many other nonlinear evolution equations is one of the dynamic fields of research in plasma physics, materials physics, optical fibers, applied mathematics, mathematical physics, and physical sciences [1–5]. Therefore, various methods such as Lie symmetry analysis method, Hirota's method,

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