Abstract

In this dissertation, we study one, two and three-dimensional nonlinear elastic wave equations using quadratically nonlinear Murnaghan potential. We employ two effective methods for obtaining approximate series solutions: the Adomian decomposition and the variational iteration method. These methods have the advantage of not requiring any physical parametric assumptions in the problem. Finally, these methods can generate expansion solutions for linear and nonlinear partial differential equations without perturbation, linearization, or discretization. The results obtained using the adopted methods along various initial and boundary conditions are in excellent agreement with the numerical results on MATLAB, which show the reliability of our methods to these problems. We came to the conclusion that our methods are accurate and simple to use.

The theory of nonlinear elastic wave propagation is important in multiple scientific and engineering fields. We present a comprehensive examination of nonlinear elastic wave profiles through a contemporary approach of successive approximation. This research is related to nonlinear elastic wave models with different types of nonlinearities. Murnaghan potential is used due to the assumption of the hyper-elastic materials. We explore the complication of the governing equations and go through the behaviors of nonlinear waves in one dimension. The comparative aspect of our study is a distinctive feature, as we evaluate and contrast the results obtained using successive approximation along different nonlinearities. Additionally, we present graphical representations of our findings, enhancing the visual comprehension of the wave profiles and their evolution. This study contributes to the nonlinear elastic wave analysis and comparison.