Advances in Intelligent Systems and Computing 1111

Hemen Dutta
Zakia Hammouch
Hasan Bulut
Haci Mehmet Baskonus *Editors*

4th International Conference on Computational Mathematics and Engineering Sciences (CMES-2019)

Springer

Contents

An Efficient Computational Technique for Nonlinear Emden-Fowler Equations Arising in Astrophysics and Space Science

Sumit Gupta[1], Devendra Kumar[2(✉)], Jagdev Singh[3], and Sushila[4]

[1] Department of Mathematics, Swami Keshvanand Institute of Technology, Management and Gramothan, Ramnagaria, Jaipur 302017, Rajasthan, India
guptasumit.edu@gmail.com
[2] Department of Mathematics, University of Rajasthan, Jaipur 302004, Rajasthan, India
devendra.maths@gmail.com
[3] Department of Mathematics, JECRC University, Jaipur 303905, Rajasthan, India
jagdevsinghrathore@gmail.com
[4] Department of Physics, Vivekananda Global University, Jaipur 303012, Rajasthan, India
sushila.jag@gmail.com

Abstract. In the present article, we suggest an efficient computational scheme to examine nonlinear Emden-Fowler equations arising in astrophysics and space science. The suggested scheme is based on a modified theory of the Adomian polynomials, and the two steps Adomian decomposition technique mixed with the padé approximant. Moreover, a maple software package ADMP is used to apply the suggested computational scheme, which is very simple to perform and well organized. The input of the system requires initial or boundary conditions and many desired parameters to find the analytic approximate solutions within a very short time. The following algorithm does not require linearization, perturbations, guessing the initial terms and any restrictive supposition, which may leads the solutions in closed form. Several examples are discussed to illustrate the reliability of the algorithm.

Keywords: Emden Fowler equations · Lane Emden type equations · Astrophysics · ADM · TSADM · Adomian polynomials

1 Introduction

Analytical techniques have made a comeback in research methodology after proceeds a backseat to the numerical schemes for the end of the preceding century. The superiority of analytical schemes are manifolds, the main being that they give a much effective intuition than the numbers crunched by a computer using a purely numerical algorithm. Many such physical phenomena are represented in the form of nonlinear differential equations. A wide class of analytic techniques and computational techniques have been applied to examine nonlinear mathematical models [1–10].

The ADM has been proven to be one of the most powerful techniques to solve nonlinear differential equations. Numerous researchers have concentrated on the ADM

H. Dutta et al. (Eds.): CMES 2019, AISC 1111, pp. 76–98, 2020.
https://doi.org/10.1007/978-3-030-39112-6_5