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

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**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