UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

SOLVING LANE-EMDEN EQUATION USING PADÉ APPROXIMATION METHOD

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

Lane-Emden equations are singular initial value problems relating to second-order ordinary differential equations (ODEs) and the equations have been used to model several phenomena in mathematical physics and astrophysics. The Lane-Emden equation is also of fundamental importance in mathematical physics, celestial mechanics, and computer science. There are various types of approximations that have been used to solve various types of Lane-Emden equation. For example, Legendre Wavelets Approximations, Hybrid Adomian Decomposition Method-Successive Linearization Method (ADM-SLM), q-homotopy analysis Laplace transform method (q-HATM) and others. However, some methods are not accurate in solving Lane-Emden equation. In this research, we compare the solution between Padé approximation with Taylor's Series method by using relative error. Padé Approximation method is used to solve Lane-Emden equation numerically and the results is compared with Taylor's Series method. The relative error is used to determine the accuracy and efficiency of both methods. We solved few examples from previous research to solve Lane-Emden equations by using the proposed method. These findings revealed that different Lane Emden equation influence the results. As some of the examples has less error on Taylor's Series and some has less error on Padé Approximation. As a recommendation, further research can find several other ways to find the most efficient method to solve the Lane-Emden equation, for example like Bernstein Operational Matrix of Integration or Orthogonal Boubaker Polynomials. The researchers also can determine the accuracy and efficiency of these methods to Lane-Emden equation by utilizing the relative error.