Gupta, Rupali; Kumar, Sushil
Numerical simulation of variable-order fractional differential equation of nonlinear Lane-Emden type appearing in astrophysics. (English) Zbl 07715011

Summary: This paper suggests the Chebyshev pseudo-spectral approach to solve the variable-order fractional Lane-Emden differential equations (VOFLEDE). The variable-order fractional derivative (VOFD) is defined in the Caputo sense. The proposed method transforms the problem into a set of algebraic equations that can be solved for unknowns. Few examples are discussed to exhibit the viability and effectiveness of the approach. The present study indicates the accuracy, efficiency, and powerfulness of the Chebyshev collocation method in solving the VOFD Lane-Emden equation. Error bound and convergence analysis of the method is also discussed. It is worth noticing that using lesser collocation nodes in computation is another advantage of the technique, which eventually reduces the computational cost.

MSC:
65-XX Numerical analysis
34-XX Ordinary differential equations

Keywords:
Chebyshev polynomials; collocation method; Lane-Emden equation; variable-order fractional derivative

Full Text: DOI

References:


