

Approximate and Analytical Solutions of Generalized Lane-Emden-Fowler Equations

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ABSTRACT

The work deals with a family of nonlinear differential equations of Lane-Emden-Fowler type. The original Lane-Emden equation was used to model the thermal behavior of a spherical cloud of gas within the framework of the classical thermodynamics. Slightly modified, this equation describes phase transitions in a critical thermodynamic system of spherical geometry. The aim of the current work is to obtain approximate analytical solutions of the regarded class of equations. The problem is re-formulated in terms of non-homogeneous nonlinear Volterra integral equations of the second kind. The approximate solutions are sought by He's homotopy perturbation method, Adomian's decomposition technique and Picard's method of successive approximations. The obtained solutions of the considered equations are compared with the results obtained numerically.

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