

A solution to the Lane–Emden equation in the theory of stellar structure utilizing the Tau method

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In this talk, we propose a Tau method for solving the singular Lane–Emden equation — a nonlinear ordinary differential equation on a semi-infinite interval. We applied collocation, Galerkin, and Tau methods for solving this problem, and according to the results, the solution of Tau method is the most accurate. The operational derivative and product matrices of the modified generalized Laguerre functions are presented. These matrices, in conjunction with the Tau method, are then utilized to reduce the solution of the Lane–Emden equation to that of a system of algebraic equations. We also present a comparison of this work with some well-known results and show that the present solution is highly accurate. A brief discussion follows on spectral collocation of nonlinear sets of PDEs.