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Uniqueness and error estimates for solutions to higher-order boundary value problems[☆]

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Abstract

Little work has been done for the error estimates of the homotopy analysis method. For general $2n$ th-order linear and nonlinear differential equations with Lidstone boundary conditions, we obtain sharp upper bounds for the absolute error of the approximations given by the homotopy analysis method. To achieve this goal, the existence and uniqueness of solutions to these differential equations are considered. Numerical results confirm the theoretical predictions.

Keywords: Error estimate, uniqueness, boundary value problem, homotopy analysis method, Cauchy-Schwarz inequality, Green's function .

1. Introduction

Higher-order boundary value problems arise in various branches of science and engineering. For example, fourth-order boundary value problems arise in the mathematical modeling of viscoelastic and inelastic flows, deformation of beams and plate deflection theory. In astrophysics, the narrow convecting layers bounded by stable layers which are believed to surround A-type stars may be modeled by high-order boundary value problems; see [1, 2] and the references therein.

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