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

Xiaolong Zhang, Songxin Liang, Li Zou

PII: S0377-0427(17)30088-2
DOI: http://dx.doi.org/10.1016/j.cam.2017.02.023
Reference: CAM 11025

To appear in: *Journal of Computational and Applied Mathematics*

Received date: 27 May 2016
Revised date: 18 January 2017

Please cite this article as: X. Zhang, S. Liang, L. Zou, Uniqueness and error estimates for solutions to higher-order boundary value problems, *Journal of Computational and Applied Mathematics* (2017), http://dx.doi.org/10.1016/j.cam.2017.02.023

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

Xiaolong Zhang[a,*], Songxin Liang[a], Li Zou[b]

[a]School of Mathematical Sciences, Dalian University of Technology, Dalian, China, 116024
[b]School of Naval Architecture, State Key Laboratory of Structural Analysis for Industrial Equipment, Dalian University of Technology, Dalian, China, 116024

Abstract

Little work has been done for the error estimates of the homotopy analysis method. For general 2*n*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.

☆This work was partially supported by the National Natural Science Foundation of China (51379033, 51522902).

*Corresponding author
Email addresses: topmaths@mail.dlut.edu.cn (Xiaolong Zhang), sliang668@dlut.edu.cn (Songxin Liang), lizou@dlut.edu.cn (Li Zou)