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Numerical Solution of Singularly Perturbed Boundary Value Problems by Improved Least Squares Method

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Abstract

This paper introduces a numerical method based on least squares method for solving singularly perturbed differential equations with two-point boundary conditions. Moreover, an intelligent algorithm is proposed to improve of the method. This algorithm is essential as it finds the unknown location of the layer (boundary layer and interior layer). As part of evaluation, the convergence analysis of the method is presented. Numerical examples demonstrate the superconvergence of the intelligent algorithm and confirm the accuracy of the theory.

Keywords: Singular Perturbed Differential Equations, Boundary Value Problems, Least Squares Method, B-Splines.

2010 MSC: 65L11, 65L10

1. Introduction

Singularly perturbed differential equations arise in mathematical modeling of process in various fields of science and engineering such as neurobiology, quantum mechanics, fluid dynamic elasticity, reactor diffusion process, oceanography, the modeling of convective heat transport problems with large Peclet num-

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