

Numerical Solution of Singularly Perturbed Problems via both Galerkin and Subdomain Galerkin methods

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Abstract

In this paper, numerical solutions of singularly perturbed boundary value problems are given by using variants of finite element method. Both Galerkin and subdomain Galerkin method based on quadratic B-spline functions are applied over the geometrically graded. Results of some test problems are compared with analytical solutions of the singularly perturbed problem.

Keywords: Subdomain Galerkin, graded mesh, spline, singularly perturbed.

1 Introduction

This paper contains numerical solutions of one dimensional singularly perturbation problems

$$-\varepsilon u'' + p(x)u' + q(x)u = f(x), \quad x \in [0, 1] \quad (1)$$

with boundary conditions

$$u(0) = \lambda \text{ and } u(1) = \beta, \quad \lambda, \beta \in \mathbb{R} \quad (2)$$

where ε is a small positive parameter, $p(x)$, $q(x)$, $f(x)$ are sufficiently smooth functions with $p(x) \geq p^* > 0$, $q(x) \geq q^* > 0$. These problems depend on ε in such a way that the solution varies rapidly in some parts and varies slowly

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