Linß, Torsten; **Madden, Niall**

An improved error estimate for a numerical method for a system of coupled singularly perturbed reaction-diffusion equations. (English) Zbl 1040.65066

Comput. Methods Appl. Math. 3, No. 3, 417-423 (2003).

This paper deals with the following system of two coupled singularly perturbed equations

$$-\varepsilon^2 u_1'' + a_{11}(x)u_1 + a_{12}(x)u_2 = f(x),$$

$$-\mu^2 u_2'' + a_{21}(x)u_1 + a_{22}(x)u_2 = f_1(x),$$

for $x \in (0,1)$, ε, μ-small constants, subject to homogeneous Dirichlet boundary conditions. The aim of the present study is to improve the theoretical error bound to almost second order for the case $0 < \varepsilon = \mu \ll 1$. A finite difference scheme on the Shiskin mesh is presented. The results of two numerical examples are given.

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MSC:

65L10	Numerical solution of boundary value problems involving ordinary differential equations	Cited in **11** Documents
65L12	Finite difference and finite volume methods for ordinary differential equations	
65L70	Error bounds for numerical methods for ordinary differential equations	
34B05	Linear boundary value problems for ordinary differential equations	
34E15	Singular perturbations, general theory for ordinary differential equations	
65L50	Mesh generation, refinement, and adaptive methods for ordinary differential equations	

Keywords:

reaction diffusion equations; systems; singular perturbation; Shishkin mesh; error bound; finite difference scheme; numerical examples

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