Research Announcement

AN ALMOST FOURTH ORDER
UNIFORMLY CONVERGENT DIFFERENCE SCHEME
FOR A SEMILINEAR SINGULARLY PERTURBED
REACTION-DIFFUSION PROBLEM

Guangfu Sun and Martin Stynes

We analyse a high-order convergent discretization for the semilinear reaction–diffusion problem: $-\varepsilon^2 u'' + b(x, u) = 0$, for $x \in (0, 1)$, subject to $u(0) = u(1) = 0$, where $\varepsilon \in (0, 1]$. We assume that $b_u(x, u) > k_0^2 > 0$ on $[0, 1] \times \mathbb{R}^1$, which guarantees uniqueness of a solution to the problem. Asymptotic properties of this solution are discussed. We consider a polynomial-based three-point difference scheme on a simple piecewise equidistant mesh of Shishkin type. Existence and local uniqueness of a solution to the scheme are analysed. The scheme is shown to be almost fourth order accurate in the discrete maximum norm, uniformly in the perturbation parameter $\varepsilon$. Numerical results are presented in support of this result. Full details appear in [1].

Reference


Guangfu Sun and Martin Stynes,
Department of Mathematics,
University College,
Cork.

Research Announcement

FINITE VOLUME METHODS
FOR CONVECTION-DIFFUSION PROBLEMS

Martin Stynes

An overview is given of the nature of convection-diffusion problems, and of the use of finite volume methods in their solution. Full details appear in [1].

Reference

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Martin Stynes,
Department of Mathematics,
University College,
Cork.

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