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 $b_u(x,u) > b_0^2 > 0$ on $[0,1] \times \mathcal{R}^1$, 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 ε. Numerical results are presented in support of this result. Full details appear in [1].

Reference

[1] G. Sun and M. Stynes, *An almost fourth order uniformly convergent difference scheme for a semilinear singularly perturbed reaction-diffusion problem* (1994). (Preprint 1994-1, Mathematics Department, University College Cork.)

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FINITE VOLUME METHODS FOR CONVECTION-DIFFUSION PROBLEMS

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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

[1] M. Stynes, *Finite volume methods for convection-diffusion problems* (Invited plenary lecture at MODELLING 94 Conference, Prague, Czech Republic, 29.8-2.9.1994). (Preprint 1994-4, Mathematics Department, University College Cork.)

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