### Research Announcement

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

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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  $\varepsilon$ . 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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