An Efficient Numerical Method for a system of Singularly Perturbed Semilinear Reaction-Diffusion equations

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In this work we consider a system of singularly perturbed semilinear reaction-diffusion equations. To solve this problem numerically, we construct a finite difference scheme of Hermite type, and combine this with standard central difference scheme in a special way on a piecewise-uniform Shishkin mesh. The error analysis is given and parameter-uniform error bounds are established; this shows that the present method gives better approximations than the standard central difference scheme. Moreover, it is shown that the method is third order ε-uniformly convergent, when $\sqrt{\varepsilon} \leq N^{-1}$. Numerical experiments are conducted to demonstrate the efficiency of the present method.