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Higher order global solution and normalized flux for singularly perturbed reaction-diffusion problems  
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*Keywords:* singularly perturbed reaction–diffusion equation; normalized flux; finite difference scheme; higher order compact finite difference scheme; piecewise cubic interpolants

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*Review text:*

The authors consider a one dimensional singularly perturbed reaction–diffusion equation. A modified Shishkin mesh is introduced and a higher order compact finite difference solution on this mesh is presented. Piecewise cubic interpolants for both the exact solution and discrete solution are formulated. Thanks to the modified Shishkin mesh, the authors proved that the convergence is uniform in the sense that the convergence accuracy is the same for any value of the diffusion parameter  $\varepsilon$ . More precise, the convergence order analysis contains two principle results. The first result states that the method is, almost, of fourth convergence order. The second result states that the normalized flux of the piecewise cubic interpolant of the discrete solution approximates the normalized flux of the piecewise cubic interpolant of the exact solution by order three, almost everywhere, and by order four at mid–points of the mesh. The theoretical results are confirmed by numerical examples.

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