A High Order Convergent Adaptive Numerical Method for Singularly Perturbed Non-linear Systems

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ABSTRACT

In this work, we develop a high-order convergent adaptive numerical method for a system of first-order singularly perturbed non-linear differential equations with distinct perturbation parameters. The problem is discretized by a hybrid finite difference scheme for which a posteriori error estimate in the maximum norm is derived. The layer-adapted meshes are generated using the equidistribution of the monitor function chosen based on the derived a posteriori error estimate. Numerical results are presented that validate the theory and show the effectiveness of the present numerical method.

Keywords: Singularly perturbed; Non-linear system; A posteriori analysis; Adaptive meshes.

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