

Eighth Mississippi State - UAB Conference on Differential Equations Computational Simulations, May 7–9, 2009, Department of Mathematics and Statistics, Mississippi State University, Mississippi State, MS, USA

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A HIGHER ORDER PARAMETER UNIFORM SCHEME FOR SOLVING SINGULARLY PERTURBED PARABOLIC PROBLEMS WITH SMALL PARAMETERS

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A numerical study is made for solving one-dimensional time dependent singularly perturbed parabolic problems with one and two small parameters. With one small parameter this class of problem exhibit a regular boundary layer on one side of the domain and with two small parameters these problems may exhibit the boundary layers at both the end of the domain, depending upon size of the parameters. The asymptotic bounds for the solution and its derivatives are given by splitting the solution into smooth and singular components for both types of problems. To discretize the temporal variable we use Crank-Nicolson method for one-parameter problem and Implicit-Euler method for two-parameter problem with uniform mesh. For the spatial discretization we construct a monotone difference operator consisting a upwind, midpoint upwind and central finite difference operator on a specially designed Shishkin mesh for both the problems. The proposed algorithms have been shown second and first order parameter uniform convergent in temporal variable for one and two parameter problem respectively and second order parameter uniform convergent in spatial variable for both the problems. Higher accuracy and convergence of the method is demonstrated by numerical examples and an estimate of the error is given.

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