A hybrid finite difference method for singularly perturbed delay partial differential equations with discontinuous coefficient and source.

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Abstract

The article presents a hybrid finite difference scheme to solve a singularly perturbed parabolic functional differential equation with discontinuous coefficient and source. The simultaneous presence of deviating argument with a discontinuous source and coefficient makes the problem stiff. The solution of the problem exhibits turning point behaviour across discontinuity as ε tends to zero. The hybrid scheme presented is a composition of a central difference scheme and a midpoint upwind scheme on a specially generated mesh. At the same time, an implicit finite difference method is used to discretize the time variable. Consistency, stability, and convergence of the presented numerical approach have been investigated. The presented method converges uniformly independent of the perturbation parameter. Numerical results have been presented for two test examples that verify the effectiveness of the scheme.

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