

DISCRETE APPROXIMATIONS FOR SINGULARLY PERTURBED BOUNDARY VALUE PROBLEMS WITH PARABOLIC LAYERS, II

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摘要

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DISCRETE APPROXIMATIONS FOR SINGULARLY PERTURBED BOUNDARY VALUE PROBLEMS WITH PARABOLIC LAYERS, II

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Abstract

In his series of three papers we study singularly perturbed (SP) boundary value problems for equations of elliptic and parabolic type. For small values of the perturbation parameter parabolic boundary and interior layers appear in these problems. If classical discretisation methods are used, the solution of the finite difference scheme and the approximation of the diffusive flux do not converge uniformly with respect to this parameter. Using the method of special, adapted grids, we can construct difference schemes that allow approximation of the solution and the normalised diffusive flux uniformly with respect to the small parameter.

We also consider singularly perturbed boundary value problems for convection-diffusion equations. Also for these problems we construct special finite difference schemes, the solution of which converges ϵ -uniformly. We study what problems appear, when classical schemes are used for the approximation of the spatial derivatives. We compare the results with those obtained by the adapted approach. Results of numerical experiments are discussed.

In the three papers we first give an introduction on the general problem, and then we consider respectively

(i) Problems for SP parabolic equations, for which the solution and the normalised diffusive fluxes are required;

(ii) Problems for SP elliptic equations

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with boundary conditions of Dirichlet, Neumann and Robin type;
(iii) Problems for SP parabolic equation
with discontinuous boundary conditions.

Key words

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