

MA855

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Time
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ADVANCED NUMERICAL ANALYSIS FOR SINGULARLY PERTURBED DIFFERENTIAL EQUATIONS

Simple examples of singular perturbation problems. Uniform numerical methods for problems with initial and boundary layers: Initial value problems- some uniformly convergent difference schemes, constant fitting factors, optimal error estimates.

Boundary value problems- constant fitting factors for a self adjoint problem, non self adjoint problem, self adjoint problem in conservation form, non self adjoint problem in conservation form, problems with mixed boundary conditions, fitted versus standard method, experimental determination of order or uniform convergence.

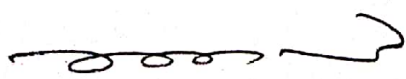
Fitted operator method- fitted mesh method, Cubic spline method, Finite element method, variable mesh method, shooting method, collocation method, Booster method, Boundary value technique, initial value technique, Schwarz method and Convergence of the above methods - Reaction-diffusion, convection-diffusion, reaction-convection-diffusion type problem in one dimension.

Simple fitted mesh methods in one dimension, convergence of fitted mesh finite difference methods for linear convection-diffusion problems in one dimension, linear convection-diffusion problems in two dimensions and their numerical solutions, fitted numerical methods for problems with initial and parabolic boundary layers.

Finite Element method and finite volume method for singularly perturbed ODE and singularly perturbed PDE of linear problems.

Reference books

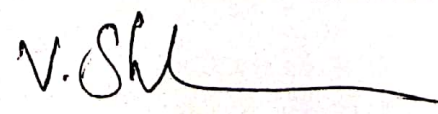
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3. J. J. H. Miller, E.O'Riordan, G.I.Shishikin, Fitted numerical methods for singular perturbation problems, Error estimates in the maximum norm for linear problems in one and two dimension, world scientific. Singapore. (1996)
4. C.M. Bender, S.A. Orszag, Advanced Mathematical Methods for Scientists and Engineers, Springer, New York, 1999.
5. Lawrence C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Vol. 19, American Mathematical Society, Providence, 1998
6. Robert C. Mc Owen, Partial Differential Equations - Methods and Applications, Pearson Education Inc., Indian Reprint 2004.
7. Stynes M., H.G. Roos and L. Tobiska (1996) Numerical Methods for singularly perturbed differential equations: convection diffusion and flow problems.



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93



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