FINITE ELEMENT ANALYSIS OF EXPONENTIALLY FITTED LUMPED SCHEMES FOR TIME-DEPENDENT CONVECTION-DIFFUSION PROBLEMS

Wen Guo & Martin Stynes

We consider a singularly perturbed linear parabolic initial-boundary value problem in one space variable. Two exponentially fitted schemes are derived for the problem using Petrov-Galerkin finite element methods with various choices of trial and test spaces. On rectangular meshes which are either arbitrary or slightly restricted, we derive global energy norm and L^2 norm and local L^∞ error bounds which are uniform in the diffusion parameter. Numerical results are also presented. Full details appear in [1].

FINITE ELEMENT ANALYSIS OF AN EXPONENTIALLY FITTED NON-LUMPED SCHEME FOR ADVECTION-DIFFUSION EQUATIONS

Wen Guo & Martin Stynes

We analyse a Petrov-Galerkin finite element method for numerically solving an advection-diffusion equation in one space variable. Under reasonable assumptions on the behaviour of the exact solution and a certain stability condition, the scheme is shown to be convergent, uniformly in the diffusion parameter, in global energy and L^2 norms and a local discrete L^∞ norm. Full details appear in [2].

POINTWISE ERROR ESTIMATES FOR A STREAMLINE DIFFUSION SCHEME ON A SHISHKIN MESH FOR A CONVECTION-DIFFUSION PROBLEM

Wen Guo & Martin Stynes

We analyse a streamline diffusion scheme on a special piecewise uniform mesh for a model time-dependent convection-diffusion problem. The method with piecewise linear elements is shown to be convergent, independently of the diffusion parameter, with a pointwise accuracy of almost order 5/4 outside the boundary layer and almost order 3/4 inside the boundary layer. Numerical results are also given. Full details appear in [3].

AN ANALYSIS OF A CELL VERTEX FINITE VOLUME METHOD FOR A PARABOLIC CONVECTION-DIFFUSION PROBLEM

Wen Guo & Martin Stynes

We examine a cell vertex finite volume method which is applied to a model parabolic convection-diffusion problem. By using techniques from finite element analysis, local errors away from all layers are obtained in a seminorm which is related to, but weaker than, the L^2 norm. Full details appear in [4].

References

[1] W. Guo and M. Stynes, *Finite element analysis of exponentially fitted lumped schemes for time-dependent convection-diffusion problems* (1992) (Preprint 1992-5, Mathematics Department, University College Cork).

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[3] W. Guo and M. Stynes, *Pointwise error estimates for a streamline diffusion scheme on a Shishkin mesh for a convection-diffusion problem* (1993) (Preprint 1993-2, Mathematics Department, University College Cork).

[4] W. Guo and M. Stynes, *An analysis of a cell vertex finite volume method for a parabolic convection-diffusion problem* (1993) (Preprint 1993-6, Mathematics Department, University College Cork).

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Book Review

Around Burnside

Translated from the Russian by James Wiegold

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Reviewed by Seán Tobin

This is in many ways an extraordinary book, and it is likely to become a collector's item even for those who are not primarily concerned with work on the Burnside problems. Commencing with a curious title, and ending with an eccentric index, it is full of stylistic quirks while also packed with information on the work by Kostrikin and his school which has led recently to the total solution by Efim Zelmanov, [5],[6], of the Restricted Burnside Problem. In his translator's preface Professor Wiegold remarks '... this book has been an interesting challenge to the translator. It is most unusual, in a text of this type, in that the style is racy with many literary allusions and witticisms: not the easiest to translate, but a source of inspiration to continue through material that could daunt by its computational complexity'.

In his preface to this English edition of his book, Professor Kostrikin says, 'Problems of Burnside type have become singularly popular in Moscow and Novosibirsk ... and it is of course advisable for [Russian algebraists] to share their knowledge with Western colleagues'. Our thanks are certainly due to both author and translator for their efforts to make this knowledge available to us, in particular through the medium of this book. Two other recent books worth mentioning in this context are Vaughan-Lee's [4] on the Restricted Problem and Zelmanov's [7] on problems of Burnside type.