A DEFECT CORRECTION METHOD FOR PARABOLIC SINGULAR PERTURBATION PROBLEMS WITH CONVECTIVE TERMS

P.W.Hemker, G.I.Shishkin, L.P.Shishkina (Amsterdam, The Netherlands; Ekaterinburg). The Dirichlet problem for a singularly perturbed parabolic PDE with convective terms is considered on an interval. The perturbation parameter ϵ takes any values from the half-interval (0,1]; the reduced equation is a hyperbolic first-order one. As ϵ tends to zero, a boundary layer appears in the neighbourhood of that end of the interval onto which the convective flow is directed. For such a problem ϵ-uniformly convergent schemes, i.e., schemes the accuracy of which is independent of the parameter, are well known. In particular, it is the scheme on piecewise uniform meshes condensing in the boundary layer. The accuracy of this base scheme is $\mathcal{O}\{N^{-1}\ln^2 N + N_0^{-1}\}$, where $N+1$ and N_0+1 is the number of the space and time mesh nodes, respectively. The development of schemes with a higher order of the convergence rate is the actual problem. Here ϵ-uniformly convergent schemes with high-order time-accuracy are considered. For the numerical solution of the boundary value problem we use the base scheme and the system of additional corrected schemes. The improvement in time-accuracy of the solution by the base scheme is achieved by correction of the right-hand side. In this correction procedure we use the pre-obtained solution of the base scheme. The order of consistency for the new scheme (after correction) is higher than that for the base scheme. Then we can repeat such a defect correction by a similar way. This method with a sequential correction of the local truncation error allows us to construct ϵ-uniformly convergent schemes with high-order time-accuracy. The efficiency of these theoretical results is illustrated by the results of numerical experiments. This work was supported in part by the Dutch Research Organization NWO under Grant 047.003.017 and by the RFBR under Grant 98–01–000362.

SOLVING SCIENTIFIC PROBLEMS USING MAPLE

J.Hřebíček (Brno, Czech Republic). Today, computational simulation means much more that number crunching. Automating algebraic computation began about thirty years ago, with the programs Macsyma and Reduce; newer entries to the field include Derive, MathCAD, Maple and Mathematica. These Symbolic Computation Systems (SCS) directly address academic and research issues in an engineering education. Using SCS, we can get the answers to most of the questions on a traditional freshman mathematical examinations. They can differentiate, integrate, solve systems of equations (e.g. linear, nonlinear, difference, differential and integral) and find various approximations. We can also use SCS to treat questions of combinatorics, knot theory, molecular chemistry, population biology or general relativity. They produce quite nice $2D$ and $3D$ graphics, while they spare us the tedium of algebraic manipulation, and let us focus on the real questions rather than on the numerical evaluations. SCS such as Maple V by Waterloo Maple Inc., differ from