Stochastic Algorithm for Solving the Wigner-Boltzmann Correction Equation

M. Nedjalkov, S. Selberherr, I. Dimov

For the solution of convection-diffusion problems we present a multilevel self-adaptive mesh-refinement algorithm to resolve locally strong varying behavior, like boundary and interior layers. The method is based on discontinuous Galerkin (Baumann-Oden DG) discretization. The recursive mesh-adaptation is interwoven with the multigrid solver. The solver is based on multigrid V-cycles with damped block-Jacobi relaxation as a smoother. Grid transfer operators are chosen in agreement with the Galerkin structure of the discretization, and local grid-refinement is taken care of by the transfer of local truncation errors between overlapping parts of the grid.
We propose an error indicator based on the comparison of the discrete solution on the finest grid and its restriction to the next coarser grid. It refines in regions, where this difference is too large. Several results of numerical experiments are presented which illustrate the performance of the method.
The approach shows the advantages of combining adaptive meshing, multilevel techniques and discontinuous Galerkin discretization.

Quadrature Formulae Based on Interpolation by Parabolic Splines

G. P. Nikolov, P. B. Nikolov

The standard way for construction of quadrature formulae is based on polynomial interpolation. A good reason for such an approach is the Weierstrass theorem about density of algebraic polynomials in the space $C[a,b]$, with $[a,b]$ being the integration interval (supposed to be finite and closed). However, there are lot of suggestions in the literature that in many situations spline functions provide better tool for approximation than polynomials, especially when the approximated functions are of low smoothness.
In the early nineties of the last century the first named author initiated study of quadrature formulae based on spline interpolation. In 1993 he formulated a conjecture about the asymptotical optimality of the Gauss-type quadratures associated with the spaces of polynomial splines with equidistant knots in the Sobolov classes of functions. This conjecture was proved (in a joint paper with P. Köhler) in 1995, and since then several papers devoted to Gaussian quadratures associated with spaces of low degree splines appeared.
A basic difficulty in the construction of Gaussian quadrature formulae associated with a given linear space of spline functions is to determine the mutual location of the quadrature nodes and the spline knots. Moreover, the highest "spline degree of precision" is achieved at the expense of irregular nodes distribution, and hence lack of possibility for building sequences of quadratures with nested nodes.