JOURNAL OF COMPUTATIONAL PHYSICS 91, 495–497 (1990)

Abstracts of Papers to Appear in Future Issues

THE EFFECT OF FILTERING ON THE PSEUDOSPECTRAL SOLUTION OF EVOLUTIONARY PARTIAL DIFFERENTIAL EQUATIONS. L. S. Mulholland and D. M. Sloan, *University of Strathclyde, SCOTLAND.*

This paper examines the effect of filtering on the solution of time-dependent partial differential equations by the pseudospectral method. It is shown that if spatial discretisation is effected using the Fourier pseudospectral method the computed solution will be an approximation to the solution of a modified differential equation. The changes in dispersive and dissipative properties induced by the modification are examined, and numerical results are presented which illustrate these changes for both linear and nonlinear equations. Numerical results are also presented which show the effect of filtering on Chebyshev pseudospectral solutions of time-dependent equations.

VECTORIZATION OF A MONTE CARLO SIMULATION SCHEME FOR NONEQUILIBRIUM GAS DYNAMICS. Iain D. Boyd, *NASA Ames Research Center, California, USA.*

The numerical performance of a Monte Carlo scheme used in the analysis of nonequilibrium gas dynamics has been greatly improved. This improvement is attained by careful implementation of the algorithm in order to take advantage of the vector hardware of supercomputers. The performance of the modified implementation is demonstrated by application to three different flow problems. First, the one-dimensional standing shock wave is considered. Due to the relative simplicity of this example, it is shown that an adequate solution is obtained in a very small computational time. The second problem considered is the flow of an expanding gas through an axisymmetric nozzle. Lastly, the hypersonic flow of argon over a three-dimensional wedge is computed. This problem illustrates the increase in the number of molecules which may be employed in the simulation due to the improved performance of the algorithm. In fact, over 10 million particles are employed, which is the largest number reported in the literature for the simulation scheme considered.

THREE-DIMENSIONAL VORTEX SIMULATION OF ROLLUP AND ENTRAINMENT IN A SHEAR LAYER. Omar M. Knio and Ahmed F. Ghoniem, *Massachusetts Institute of Technology, Cambridge, Massachusetts, USA.*

The transport element method is extended to three dimensions to study the evolution of scalar fields in a flow with high vorticity concentration. The numerical scheme is based on following Lagrangian computational elements employed in the transport of vorticity and local scalar gradients. The formulation of the numerical scheme is first presented as a direct generalization of the three-dimensional vortex element method. The numerical algorithms required to implement this scheme are then developed. Problems associated with severe distortion of the flow map due to the growth of perturbations are shown to cause difficulties including loss of numerical accuracy and resolution. Means to overcome this problem are discussed and are shown to yield accurate solutions. Two grid-based and two grid-free methods for the computation of vorticity stretching are implemented. The accuracy of the methods is discussed in the light of numerical results which reveal the need for a careful treatment of the discrete form of the vorticity transport equation. The methods are applied to study the evolution of an initially two-dimensional shear layer, perturbed in the streamwise and spanwise directions. Attention is focused

0021-9991/90 $3.00