JOURNAL OF COMPUTATIONAL PHYSICS **125,** 526–527 (1996)
ARTICLE NO. 0113

Abstracts of Papers to Appear in Future Issues

AN ALTERNATING DIRECTION IMPLICIT SCHEME FOR PARABOLIC EQUATIONS WITH MIXED DERIVATIVE AND CONVECTIVE TERMS. S. McKee, D. P. Wall, and S. K. Wilson. *Department of Mathematics, University of Strathclyde, Livingstone Tower, 26, Richmond Street, Glasgow, GI 1XH, United Kingdom.*

An alternating direction implicit (ADI) scheme is introduced which is capable of solving a general parabolic equation in two space dimensions with mixed derivative and convective terms. In the case of constant coefficients the scheme is shown to be unconditionally stable. The study was motivated by the investigation of flow in a dye laser cell (a device used for the amplification of a laser beam), a simple model for which involves laminar flow in a two-dimensional symmetric channel subject to impulsive heating. Numerical results are presented for this problem, and the qualitative behaviour of the temperature distribution within the channel for different Peclet numbers is discussed.

SHOCK-CAPTURING APPROACH AND NONEVOLUTIONARY SOLUTIONS IN MAGNETOHYDRODYNAMICS. A. A. Barmin. *Institute of Mechanics, Moscow University, 1 Michurin Ave., 117192 Moscow, Russia*; A. G. Kulikovskiy. *Steklov Institute of Mathematics, Russian Academy of Sciences, 42 Vavilov St., 117942 Moscow, Russia*; N. V. Pogorelov. *Institute for Problems in Mechanics, Russian Academy of Sciences, 101 Vernsdskii Ave., 117526 Moscow, Russia.*

Shock-capturing methods have become an effective tool for the solution of hyperbolic partial differential equations. Both upwind and symmetric TVD schemes in the framework of the shock-capturing approach are thoroughly investigated and applied with great success to a number of complicated multidimensional gasdynamic problems. The extension of these schemes to magnetohydrodynamic (MHD) equations is not a simple task. First, the exact solution of the MHD Riemann problem is too multivariant to be used in regular calculations. On the other hand, the extensions of Roe's approximate Riemann problem solvers for MHD equations in general case are nonunique and need further investigation. That is why some simplified approaches should be constructed. In this work, the second order of accuracy in time and space high-resolution Lax–Friedrichs type scheme is suggested that gives a drastic simplification of the numerical algorithm comparing to the precise characteristic splitting of Jacobian matrices. The necessity is shown to solve the full set of MHD equations for modeling of multishocked flows, even when the problem is axisymmetric, to obtain evolutionary solutions. For the numerical example, the MHD Riemann problem is used with the initial data consisting of two constant states lying to the right and to the left from the centerline of the computational domain. If the problem is solved as purely coplanar, a slow compound wave appears in the self-similar solution obtained by any shock-capturing scheme. If the full set of MHD equations is used and a small uniform tangential disturbance is added to the magnetic field vector, a rotational jump splits from the compound wave, and it degrades into a slow shock. The reconstruction process of the nonevolutionary compound wave into evolutionary shocks is investigated. Presented results should be taken into account in the development of shock-capturing methods for MHD flows.

PARAMETRIC REPRESENTATION OF ANATOMICAL STRUCTURES OF THE HUMAN BODY BY MEANS OF TRIGONOMETRIC INTERPOLATING SUMS. J. C. Jimenez, R. Biscay, and E. Aubert. *Centro de Neurociencias de Cuba, Apartado 6880, La Habana, Cuba.*

An approach for the parametric representation of anatomical structures of the human body by means of trigonometric interpolating sums (TIS) is introduced. This representation is constructed on the basis of the geometric information provided by medical digital images and an arbitrarily chosen system of curvilinear coordinates. The parameterization defined by these coordinates is approximated through TIS by using a multidimensional extension of the Lancozos's method for accelerating the convergence of trigonometric approximations for smooth, nonperiodic functions. This allows us to obtain accurate representations for a wide class of anatomical structures, including nonclosed ones. An upper bound of the approximation error is derived in the sense of the supremum norm. The reconstructions of a human face and the surface of a brain cortex are shown as illustrative examples of parameterization by means of TIS.

EXPLICIT GENERATION OF ORTHOGONAL GRIDS FOR OCEAN MODELS. Ross J. Murray. *School of Earth Sciences, University of Melbourne, Parkville, 3052, Victoria, Australia.*

Several explicit methods are proposed for generating global orthogonal curvilinear grids for ocean modelling. The methods are based on the conformal properties of stereographic and Mercator map projections and have been developed with the specific object of removing the North Pole from the ocean domain. Some of the configurations, in addition to overcoming the pole problem, have very attractive resolution properties in the polar regions. Two of the constructions are geometrical in nature, while a third is based on the superposition of potential fields generated by discrete coordinate poles. The methods described here differ from those commonly employed in engineering problems in that grid line control is exercised by the placement of a finite number of singularities, and no specific condition is placed upon the fitting of coordinate lines to physical boundaries. The grids produced are accordingly of global construction and have smooth variations in grid size. Being of analytical or semi-analytical formulation, the grids may be generated quickly and without the need for advanced software.

A NEW NUMERICAL ALGORITHM FOR THE ANALYTIC CONTINUATION OF GREEN'S FUNCTIONS. Vincent D. Natoli,* Morrel H. Cohen,* and Bengt Fornberg.† **Exxon Research and Engineering Company, Annandale, New Jersey 08801 and †University of Colorado, Program in Applied Mathematics, Boulder, Colorado 80309-0526.*

The need to calculate the spectral properties of a Hermitian operator H frequently arises in the technical sciences. A common approach to its solution involves the construction of the Green's function operator $G(z) = [z - H]^{-1}$ in the complex z plane. For example, the energy

0021-9991/96 $18.00
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spectrum and other physical properties of condensed matter systems can often be elegantly and naturally expressed in terms of the Kohn–Sham Green's functions. However, the nonanalyticity of resolvents on the real axis makes them difficult to compute and manipulate. The Herglotz property of a Green's function allows one to calculate it along an arc with a small but finite imaginary part, i.e., $G(x + iy)$, and then to continue it to the real axis to determine quantities of physical interest. In the past, finite-difference techniques have been used for this continuation. We present here a fundamentally new fast Fourier transform based on an algorithm which is both simpler and more effective.