Abstracts of Papers to Appear in Future Issues

NONCONSERVATIVE HYBRID SHOCK CAPTURING SCHEMES. Eduard Harabetian. *Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109, USA*; Robert Pego. *Department of Mathematics, University of Maryland, College Park, Maryland 20742, USA.*

We examine some efficient numerical approximations for hyperbolic systems of conservation laws. The approximations are constructed by hybridizing simple, accurate centered difference schemes (for use in smooth regions), with sophisticated shock capturing schemes (for use only in narrow zones near shocks and other singularities). The switching strategies we consider are very flexible in allowing one to choose schemes independently for different regions of the flow. The resulting hybrid schemes need not be conservative. But numerical examples in one dimension demonstrate that if the switching strategy is cautious (e.g., if switching is prohibited too close to shocks), then high accuracy can be achieved for both shock speeds and smooth regions. For one switching strategy in particular it is easy to prove convergence to the entropy solution.

HECTOR: A CODE FOR THE STUDY OF CHARGED PARTICLES IN AXISYMMETRIC TOKAMAK PLASMAS. M. A. Kovanen and W. G. F. Core. *JET Joint Undertaking, Abingdon, Oxfordshire OX14 3EA, United Kingdom.*

A new charged particle orbit following code HECTOR is described. The code simulates the behaviour of thermal particles and high energy particles, such as those resulting from the ICRF wave field interactions or from thermonuclear reactions within the confining magnetic fields of non-circular axisymmetric tokamak plasmas. The particle trajectories are traced using a new, fast, and efficient hybrid orbit following a scheme base upon the drift equations in the guiding centre approximation and the constants of motion. The Monte Carlo technique is used to describe the Coulomb scattering processes of dynamical friction, pitch angle scattering, energy diffusion, and the ICRF interaction processes. The code is specifically designed to operate within the experimental environment.

COMPUTING THE FLOW AROUND A SUBMERGED BODY USING COMPOSITE GRIDS. N. Anders Petersson and Johan F. Malmliden. *Center for Computational Mathematics and Mechanics, Royal Institute of Technology, S-100 44 Stockholm, Sweden.*

The subject of this paper is an accurate numerical method for solving the linear two-dimensional steady potential flow around a body which moves in a liquid of finite constant depth at constant speed and distance below the free surface. The differential equation is discretized by a second-order accurate finite difference scheme on a composite grid. The composite grid consists of two overlapping component grids: one curvilinear grid close to the body and one Cartesian grid which covers the surrounding liquid. To solve the problem numerically, the infinite domain is truncated to finite length. The inflow and outflow boundary conditions are formed by making an eigenfunction expansion of the solution ahead of and behind the body. Each eigenfunction is required to be bounded and satisfy the upstream condition at infinity. This is imposed by functional relations between the solution and its normal derivative at the inflow and outflow boundaries. The method is carefully validated and the computed solutions are found to be in very good agreement with existing results.

VORTICITY–VELOCITY FORMULATION FOR THREE-DIMENSIONAL STEADY COMPRESSIBLE FLOWS. A. Ern and M. D. Smooke. *Department of Mechanical Engineering, Yale University, New Haven, Connecticut 06520-2159, USA.*

The vorticity–velocity formulation of the Navier–Stokes equations is extended to the solution of three-dimensional compressible fluid flow and heat transfer problems. The basic governing equations are expressed in terms of three Poisson-like equations for the velocity components together with a vorticity transport equation and an energy equation. The resulting seven coupled partial differential equations are solved by a finite difference method on a single grid and a discrete solution is obtained by combining a steady-state and a time-dependent Newton's method. Once a converged solution is obtained, one of the velocity equations can be removed from the system and replaced by the continuity equation and a "conservative" solution is obtained by using the previous solution as a starting estimate for Newton's method with only a few additional iterations. The numerical procedure is evaluated by applying it to natural and mixed convection problems. The formulation is found to be stable at high Rayleigh numbers and it may be applied to a wide variety of flow and heat transfer problems.

DISPERSION AND GROUP VELOCITY IN NUMERICAL SCHEMES FOR THREE-DIMENSIONAL HYDRODYNAMIC EQUATIONS. Yuhe Song and Tao Tang. *Department of Mathematics and Statistics, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6.*

We investigate dispersion and group velocity relations of numerical schemes for the three-dimensional hydrodynamic equations by using the transform function method. The numerical methods are developed for two of Arakawa's spatial grid types, namely B-grid and C-grid, using a spectral method in the vertical direction. One of our results is that if the horizontal scale length is greater than the Rossby radius of deformation then the B-grid is more appropriate than the commonly used C-grid.

NOTE TO APPEAR

A NUMERICAL EVIDENCE OF FEIGENBAUM'S NUMBER δ IN NON-LINEAR OSCILLATIONS. R. Van Dooren and M. De Groote. *Department of Applied Sciences, Vrije Universiteit Brussel, Brussels, Belgium*; H. Janssen. *Department of Mathematics, Royal Military Academy, Brussels, Belgium.*

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