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Abstracts of Papers to Appear in Future Issues

A BLOCK-MATRIX ITERATIVE NUMERICAL METHOD FOR COUPLED SOLVING 2D NAVIER–STOKES EQUATIONS. Oleg P. Iliev, *Institute of Mathematics, Bulgarian Academy of Sciences, Acad. G. Bontchev Strasse, bl.8, 1113 Sofia, Bulgaria*; Mikhail M. Makarov, *Department of Computational Mathematics and Cybernetics, Moscow State University, 119 899 Moscow, Russia.*

An algorithm for coupled solving 2D Navier–Stokes equations in the stream function ψ-vorticity ω variables is presented. Lid driven cavity flow is computed as a test example. Implicit difference schemes on uniform grids are used for discretizing the unsteady Navier–Stokes equations. An iterative method, similar to the BLOCK-ORTHOMIN(K) method, is used for solving a block-matrix set of linear algebraic equations at each time step. The non-symmetric block is reversed on each block-iteration by using approximate factorization—ORTHOMIN(1) iterative method. The difference Laplace operator is reversed by means of a direct method. The comparison of the results provided by coupled solving Navier–Stokes equations with those provided by decoupled (consecutive) solving equations for ω and ψ demonstrates the advantages of the suggested computing technique.

AN ADAPTIVE DISCRETE VELOCITY MODEL FOR THE SHALLOW WATER EQUATIONS. B. T. Nadiga, *Theoretical Division and CNLS, Los Alamos National Laboratories, Los Alamos, New Mexico 87545, U.S.A.*

A new approach to solving the shallow water equations is presented. This involves using discrete velocities of an adaptive nature in a finite volume context. The origin of the discrete-velocity space and the magnitudes of the discrete-velocities are both spatially and temporally variable. The near-equilibrium flow method of Nadiga and Pullin is used to arrive at a robust second-order (in both space and time) scheme—the adaptive discrete velocity (ADV) scheme—which captures hydraulic jumps with no oscillations. The flow over a two-dimensional ridge, over a wide range of undisturbed upstream Froude numbers prove the robustness and accuracy of the scheme. A comparison of the interaction of two circular vortex patches in the presence of bottom topography as obtained by the ADV scheme and a semi-Lagrangian scheme more than validates the new scheme in two dimensions.

THE METHOD OF AUXILIARY MAPPING FOR THE FINITE ELEMENT SOLUTIONS OF ELASTICITY PROBLEMS CONTAINING SINGULARITIES. Hae-Soo Oh, *Department of Mathematics, University of North Carolina at Charlotte, Charlotte, North Carolina 28223, U.S.A.*; Ivo Babuška, *Institute for Physical Science and Technology, University of Maryland, College Park, Maryland 20742, U.S.A.*

We have introduced a new approach called the method of auxiliary mapping to deal with elliptic boundary value problems with singularities. In this paper this method is extended so that it can handle the plane elasticity problems containing singularities. In order to show the effectiveness, this method is compared with the conventional approach in the framework of the p-version of the finite element method. Moreover, it is demonstrated that this method yields a better solution for those elasticity problems containing strong singularities than does the h-p version of the finite element method.

SEMI-IMPLICIT EXTENSION OF A GODUNOV-TYPE SCHEME BASED ON LOW MACH NUMBER ASYMPTOTICS I: ONE-DIMENSIONAL FLOW. R. Klein, *Institut für Technische Mechanik, RWTH, Templergraben 64, 52056 Aachen, Germany.*

A single time scale, multiple space scale asymptotic analysis provides detailed insight into the low Mach number limit behavior of solutions of the compressible Euler equations. We use the asymptotics as a guideline for developing a low Mach number extension of an explicit higher order shock-capturing scheme. This semi-implicit scheme involves multiple pressure variables, large scale differencing and averaging procedures that are discretized versions of standard operations in multiple scales asymptotic analysis. Advection and acoustic wave propagation are discretized explicitly and upwind and only one scalar elliptic equation is to be solved implicitly at each time step. This equation is a pressure correction equation for incompressible flows when the Mach number is *zero*. In the low Mach number limit, the time step is restricted by a Courant number based essentially on the maximum flow velocity. For moderate and large Mach numbers the scheme reduces to the underlying explicit higher order shock capturing algorithm.

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