# Abstracts of Papers to Appear in Future Issues

SHEPARD'S INTERPOLATION FOR SOLUTION-ADAPTIVE METHODS. Cherng-Yeu Shen and Helen L. Reed. *Mechanical and Aerospace Engineering Department, Arizona State University, Tempe, Arizona, U.S.A.*; Thomas A. Foley. *Computer Science and Engineering Department, Arizona State University, Tempe, Arizona, U.S.A.*

In numerical simulations of fluid-dynamics problems, solution-adaptive methods have proven to be very powerful. The implementation of the modified Shepard's interpolation to the structured grids used in CFD is suggested and described in this paper, which takes advantage of the logical grid structure. This technique, which is demonstrated to be robust, efficient, smoother, and a more accurate alternative to linear interpolation, is used in the remapping step during the solution-adaption procedure. Applications to the solutions of the incompressible Navier–Stokes equations (both 2D and 3D) are included.

A FINITE-VOLUME HIGH-ORDER ENO SCHEME FOR TWO-DIMENSIONAL HYPERBOLIC SYSTEMS. Jay Casper. *Vigyan, Inc., 30 Research Drive, Hampton, Virginia 23666, U.S.A.*; H. L. Atkins. *Theoretical Flow Physics Branch, NASA Langley Research Center, Hampton, Virginia 23665, U.S.A.*

We consider here the finite-volume approach in developing a two-dimensional, high-order accurate, essentially non-oscillatory shock-capturing scheme. Such a scheme achieves high-order spatial accuracy by a piecewise polynomial approximation of the solution from its cell averages. High-order Runge–Kutta methods are employed for time integration, thus making such schemes best-suited for unsteady problems. The focal point in our development is a high-order spatial operator which will retain high-order accuracy in smooth regions, yet avoid the oscillatory behavior that is associated with interpolation across steep gradients. Such an operator is first presented within the context of a scalar function on a rectangular mesh and then extended to hyperbolic systems of equations and curvilinear meshes. Spatial and temporal accuracy are validated through grid refinement studies, involving the solutions of scalar hyperbolic equations and the Euler equations of gas dynamics. Through a control-volume approach, we find that this two-dimensional scheme is readily applied to inviscid flow problems involving solid walls and non-trivial geometries. Results of a physically relevant, numerical experiment are presented for qualitative and quantitative examination.

HIGH-ORDER FINITE DIFFERENCE AND MULTIGRID METHODS FOR SPATIALLY EVOLVING INSTABILITY IN A PLANAR CHANNEL. C. Liu and Z. Liu. *Computational Mathematics Group, University of Colorado at Denver, Campus Box 170, P.O. Box 173364, Denver, Colorado 80217-3364, U.S.A.*

A computational study of the spatial instability of planar Poiseuille flow is presented. A fourth-order finite difference with a fully implicit time-marching scheme is developed on a staggered grid. A semi-coarsening multigrid method is applied to accelerate convergence for the implicit scheme at each time step and a line distributive relaxation is developed as a fast solver, which is very robust and efficient for anisotropic grids. A new treatment for outflow boundary conditions makes the buffer area as short as one wavelength. The computational results demonstrate high accuracy in terms of agreement with linear theory and excellent efficiency in the sense that cost is comparable to (and usually less than) explicit schemes.

STREAMLINE-COORDINATE FINITE-DIFFERENCE METHOD FOR HOT METAL DEFORMATIONS. S. G. Chung. *Department of Physics, Western Michigan University, Kalamazoo, Michigan 49008, U.S.A.*; K. Kuwahara. *The Institute of Space and Astronautical Science, 3-1-1 Yoshinodai, Sagamihara, Kanagawa 229, Japan*; O. Richmond. *Alcoa Laboratories, Aluminum Company of America, Alcoa Center, Pennsylvania 15069, U.S.A.*

The hot metal deformation in the rolling process is a typical example of near-steady, quasi two-dimensional non-Newtonian flows. An isotropic work-hardening model characterized by a dislocation energy-density is presented and analyzed by the streamline-coordinate finite-difference method.

USE OF A ROTATED RIEMANN SOLVER FOR THE TWO-DIMENSIONAL EULER EQUATIONS. David W. Levy, Kenneth G. Powell, and Bram van Leer. *Department of Aerospace Engineering, University of Michigan, Ann Arbor, Michigan 48109, U.S.A.*

A scheme for the two-dimensional Euler equations that uses flow parameters to determine the direction for upwind-differencing is described. This approach respects the multi-dimensional nature of the equations and reduces the grid-dependence of conventional schemes. Several angles are tested as the dominant upwinding direction, including the local flow and velocity-magnitude-gradient angles. Roe's approximate Riemann solver is used to calculate fluxes in the upwind direction, as well as for the flux components normal to the upwinding direction. The approach is first tested for two-dimensional scalar convection, where the scheme is shown to have accuracy comparable to a high-order MUSCL scheme. Solutions of the Euler equations are calculated for a variety of test cases. Substantial improvement in the resolution of shock and shear waves is realized. The approach is promising in that it uses flow solution features, rather than grid features, to determine the orientation for the solution method.

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