A COMPARISON OF FIRST- AND SECOND-ORDER REZONED AND LAGRANGIAN GODUNOV SOLUTIONS. M. S. Hall, *Alexandria, Virginia, USA.*

In this paper we present solutions from a Godunov-type algorithm to a selection of hydrodynamics test problems. Included in this selection are implosions in planar, cylindrical, and spherical coordinates; piston problems with a variety of mesh configurations including the difficult Saltzman problem; interacting blast waves; and a spherical expansion on a rectangular mesh. These solutions have been obtained using CAVEAT, a three-dimensional arbitrary Lagrangian/Eulerian (ALE) hydrodynamics code that employs a Godunov method of solution with an approximate Riemann solver. First- and second-order solutions are presented for most of the problems, and rezoned and Lagrangian solutions to the implosion (Noh) problem are compared.

HAIRPIN REMOVAL IN VORTEX INTERACTIONS. Alexandre J. Chorin, *University of California, Berkeley, California, USA.*

An algorithm is presented for removing tightly folded hairpins in an evolving collection of vortex filaments. It is argued that this removal provides a model of the effect of the small scales of turbulence. It results in a dynamic smoothing of vortex interactions and in a great reduction in the amount of labor required to sum them. The self-consistency of the model is exhibited numerically.

A VECTORIZED PARTICLE TRACER FOR UNSTRUCTURED GRIDS. Rainald Löhner, *George Washington University, Washington, District of Columbia, USA*; John J. Ambrosiano, *Lawrence Livermore National Laboratory, Livermore, California, USA.*

A vectorized particle tracer for unstructured grids is described. The basic approach is to use elementary properties of the linear basis functions to search for particles on the grid using the element last occupied as an initial guess. To permit vectorization, a simple binary sort of the particles is performed every timestep such that all particles that have as yet not found their host element remain at the top of the list. In this way, vector-loops can be easily formed. Timings taken from a numerical example indicate that speed-ups of the order of 1:14 can be obtained on vector-machines when using this algorithm.

SPLINE ALGORITHMS FOR THE HARTREE–FOCK EQUATION FOR THE HELIUM GROUND STATE. Charlotte F. Fischer and W. Guo, *Vanderbilt University, Nashville, Tennessee, USA.*

Spline algorithms are evaluated for the non-linear, integro-differential equation describing the Hartree–Fock approximation for the He $1s^2\,{}^1S$ ground state. The error in the energy decreases as h^{2K-2}, where h is a grid parameter and K the order of the spline. It is shown that for higher order splines, the method is fast and accurate, and contrary to the conclusion reached by Altenberger-Siczek and Gilbert that spline methods are suitable for SCF atomic structure calculations. Accuracy and timing studies as well as comparisons with other accurate procedures are presented.

NOTES TO APPEAR

COMPUTING THE EIGENVALUES AND EIGENVECTORS OF SYMMETRIC ARROWHEAD MATRICES. D. P. O'Leary and G. W. Stewart, *University of Maryland, College Park, Maryland, USA.*

ELIMINATION OF SPURIOUS EIGENVALUES IN THE CHEBYSHEV TAU SPECTRAL METHOD. G. B. McFadden, B. T. Murray, and R. F. Boisvert, *National Institute of Standards and Technology, Gaithersburg, Maryland, USA.*