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Abstracts of Papers to Appear in Future Issues

AN APPROXIMATE RIEMANN SOLVER FOR IDEAL MAGNETOHYDRODYNAMICS. Wenlong Dai and Paul R. Woodward. *School of Physics and Astronomy, Supercomputer Institute, Army High Performance Computing Research Center, University of Minnesota, Minneapolis/St. Paul, Minnesota 55455, U.S.A.*

To construct numerical schemes of the Godunov type for solving magnetohydrodynamical (MHD) problems, an approximate method of solving the MHD Riemann problem is required in order to calculate the time-averaged fluxes at the interfaces of numerical zones. Such an MHD Riemann solver is presented here which treats all waves emanating from the initial discontinuity as discontinuous. Thus shock jump conditions are used for rarefactions, which limits the applicability of this work to weak rarefactions, the case most important for computation. The solutions from our approximate MHD Riemann solver consist of two fast waves (either shock or rarefaction), two rotational discontinuities, two rarefaction waves (either shock or rarefaction), and one contact discontinuity for a general MHD Riemann problem. In order to display rotational discontinuities, a three component model is necessary. Only under very limited circumstances is there no rotational discontinuity involved and thus the two component approximation may be used in the MHD Riemann problem. The solutions of the MHD Riemann problem in the shock tube problem which generates the compound wave in the earlier work contain two fast rarefaction waves, two slow shocks, one contact discontinuity, and one rotational discontinuity in our formalism.

FAST NUMERICAL SOLUTION OF KKR-CPA EQUATION: TESTING NEW ALGORITHMS. E. Bruno, G. M. Florio, B. Ginatempo, and E. S. Giuliano. *Dipartimento di Fisica, Università di Messina, Messina, Italy.*

Some numerical methods for the solution of KKR-CPA equations are discussed and tested. New, efficient, computational algorithms are proposed, allowing a remarkable reduction of computing time and a good reliability in evaluating spectral quantities.

MULTI-COMPONENT FLOW CALCULATIONS BY A CONSISTENT PRIMITIVE ALGORITHM. Smadar Karni. *Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109, U.S.A.*

The dynamics of inviscid multicomponent fluids may be modelled by the Euler equations, augmented by one (or more) additional species equation(s). Attempting to compute solutions for extended Euler models in conservation form, show strong oscillations and other computational inaccuracies near material interfaces. This is due to erroneous pressure fluctuations generated by the conservative wave model. This problem does not occur in single component computations and arises only in the presence of several species. A nonconservative (primitive) Euler formulation is proposed, which results in complete elimination of the oscillations. The numerical algorithm uses small viscous perturbations to remove leading order conservation errors and is conservative to the order of numerical approximation. Numerical experiments show clean monotonic solution profiles, with acceptedly small conservation error for shocks of weak to moderate strengths.

NUMERICAL EVALUATION OF SPHERICAL BESSEL FUNCTIONS OF THE FIRST KIND. Aleksander Jablonski. *Institute of Physical Chemistry, Polish Academy of Sciences, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland.*

Calculations of cross sections for elastic scattering of electrons require frequent evaluations of the spherical Bessel functions, $j_l(x)$ and $n_l(x)$, in wide range of the argument x and the order l. It turns out that the usual algorithms providing the values of the spherical Bessel function of the first kind, $j_l(x)$, have a rather limited range of stability. It is shown that there is no algorithm implementing a single method which can be used in calculations associated with the theory of elastic scattering of electrons. An attempt is made to select different areas of stability from different algorithms in order to create a relatively fast and universal algorithm.

THE NUMERICAL COMPUTATION OF CONNECTING ORBITS IN DYNAMICAL SYSTEMS: A RATIONAL SPECTRAL APPROACH. Yingjie Liu. *Department of Mathematics, The University of Chicago, Chicago, Illinois 60637, U.S.A.*; Lixin Liu and Tao Tang. *Department of Mathematics and Statistics, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6.*

Structural changes in dynamical systems are often related to the appearance or disappearance of orbits connecting two stationary points (either heteroclinic or homoclinic). To compute the connecting orbits, the boundary value problem which is posed on the real line is frequently replaced by one on a finite interval. Then the problem is solved on the finite interval using appropriate numerical methods. In this work, we use a rational spectral approach to compute the connecting orbits. This method avoids truncating the problem to a finite interval and produces very accurate numerical solutions with a fairly small number of computational points. Numerical examples indicate that the method compares favorably with the existing ones.

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