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Abstracts of Papers to Appear in Future Issues

Time-Stable Boundary Conditions for Finite-Difference Schemes Solving Hyperbolic Systems: Methodology and Application to High-Order Compact Schemes. Mark H. Carpenter. *Theoretical Flow Physics Branch, Fluid Mechanics Division, NASA Langley Research Center, Hampton, Virginia 23681-0001, U.S.A.*; David Gottlieb. *Division of Applied Mathematics, Brown University, Providence, Rhode Island 02912, U.S.A.*; Saul Abarbanel. *Department of Mathematical Sciences, Division of Applied Mathematics, Tel-Aviv University, Tel-Aviv, Israel.*

We present a systematic method for constructing boundary conditions (numerical and physical) of the required accuracy, for compact (Padé-like) high-order finite-difference schemes for hyperbolic systems. First a proper summation-by-parts formula is found for the approximate derivative. A "simultaneous approximation term" is then introduced to treat the boundary conditions. This procedure leads to time-stable schemes even in the system case. An explicit construction of the fourth-order compact case is given. Numerical studies are presented to verify the efficacy of the approach.

Numerical Simulation of AC Plasma Arc Thermodynamics. Han-ming Wu. *Department of Aerospace Engineering and Engineering Mechanics, The University of Texas at Austin, Texas 78712, U.S.A.*; G. F. Carey. *Computational Fluid Dynamics Laboratory, Department of Aerospace Engineering and Engineering Mechanics, The University of Texas at Austin, Texas 78712, U.S.A.*; M. E. Oakes. *Department of Physics, The University of Texas at Austin, Texas 78712, U.S.A.*

A mathematical model and approximate analysis for the energy distribution of an ac plasma arc with a moving boundary is developed. A simplified electrical conductivity function is assumed so that the dynamic behavior of the arc may be determined, independent of the gas type. The model leads to a reduced set of non-linear partial differential equations which governs the quasi-steady ac arc. This system is solved numerically and it is found that convection plays an important role, not only in the temperature distribution, but also in arc disruptions. Moreover, disruptions are found to be influenced by convection only for a limited frequency range. The results of the present studies are applicable to the frequency range of 10–10^2 Hz which includes most industry ac arc frequencies.

Extension of the Streamlined Darwin Model to Quasineutral Plasmas. Gregory DiPeso, Dennis W. Hewett, and Gregory F. Simonson. *Plasma Physics Research Institute and D Division, Lawrence Livermore National Laboratory, Livermore, California 94550, U.S.A.*

The finite electron mass streamlined Darwin field (SDF) model is derived for a quasineutral plasma and contrasted to the SDF model for a nonneutral plasma. Because the Darwin model is used, the Courant numerical stability condition $c\,\Delta t/\Delta x < 1$ is avoided. In a quasineutral plasma, the $\omega_{pe}\,\Delta t < 2$ stability condition and the $\Delta x/\lambda_{De} < 1$ accuracy condition are avoided by the use of a quasineutral Poisson equation. A fast coupled-elliptic solution technique, found to work extremely well with the nonneutral SDF model, also works well with the quasineutral SDF model. Because of the similarity of the field equations for a nonneutral and a quasineutral plasma, it may be possible to simulate a plasma with both nonneutral and quasineutral regions using a single SDF solver.

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 55415, 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 themselves 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 Equations: 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.

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