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Abstracts of Papers to Appear in Future Issues

NUMERICAL CALCULATION OF THE EQUATION OF FLOW IN POROUS MEDIA: THE LATTICE–GAS APPROACH. Paul Papatzacos. *Høgskolesenteret i Rogaland, Norway.*

Lattice gasses are models of gasses where the particles move in discretized space and time. A lattice–gas model is defined by a lattice and a set of rules defining particle movements. The hydrodynamical equations of the gas are then found as successive terms in a perturbation expansion of the lattice Boltzmann equations. A lattice–gas has been introduced in a previous publication, where it was shown that the lowest order term in the above-named expansion is the equation of one-phase flow in a homogeneous porous medium with two independent permeability components. The model assumes that the lattice–gas density, as characterized by a density scale, is small. This paper presents a generalization to inhomogeneous media with three independent permeability components. The main contribution of the paper is, however, a calculation of the flow equation of the lattice–gas to the next order in the perturbation expansion of the Boltzmann equations, showing that correction terms proportional to the gas density appear in the permeability coefficients. A numerical example is given, in a case where the exact solution is known. The numerical results contain errors due to statistical fluctuations, and deviations due to the correction terms mentioned above. For the particular example, the relative deviations are shown to be in the neighborhood of 5% for a 600×600 lattice and a density scale of about 0.1.

SIMULTANEOUS POTENTIAL AND CIRCUIT SOLUTION FOR 1D BOUNDED PLASMA PARTICLE SIMULATION CODES. J. P. Verboncoeur. *University of California, Berkeley, California, USA*; M. V. Alves. *Institute for Space Research (INPE), S. J. dos Campos, SP, 12201, Brazil*; V. Vahedi and C. K. Birdsall. *University of California, Berkeley, California, USA.*

A general second-order accurate method for solving the combined potential and circuit equations in a one-dimensional electrostatic bounded plasma PIC simulation is presented. The boundary conditions include surface charge on the electrodes, which are connected to a series RLC circuit with driving terms $V(t)$ or $I(t)$. The solution is obtained for planar, cylindrical, and spherical electrodes. The result is a tridiagonal matrix which is readily solved using well-known methods. The method is implemented in the codes PDP1 (plasma device planar 1D), PDC1 (cylindrical), and PDS1 (spherical).

CHARACTERISTIC MULTIGRID METHOD APPLICATION TO SOLVE THE EULER EQUATIONS WITH UNSTRUCTURED AND UNNESTED GRIDS. M. P. Leclercq and B. Stoufflet. *Avions Marcel Dassault-Bréguet Aviation, 78 quai Marcel Dassault 92214, Saint-Cloud, France.*

A new multigrid method for the solution of hyperbolic systems of conservation laws (such as the Euler equations of compressible inviscid flows) combined with high-order upwind approximation, is constructed. The novelty of the method lies in the introduction of an upwind transfer operator between two successive grids. First of all, the efficiency of the method is investigated for a scalar linear advection equation in one dimension of space using Fourier analysis. An extension to an unstructured multigrid method is then proposed. Numerical results for two-dimensional flow computations including hypersonic flow simulation are presented.

PERFORMANCE OF THE CAPACITANCE MATRIX METHOD FOR SOLVING HELMHOLTZ TYPE EQUATIONS IN OCEAN MODELLING. E. Blayo and C. Le Provost. *Institut de Mécanique de Grenoble, BP 53X, 38041 Grenoble Cedex, France.*

A capacitance matrix method has been implemented in a quasi geostrophic eddy resolving general circulation model, for applications to real oceanic basins. This method allows the use of very fast direct solvers to treat problems on irregular regions. The aim of the present study is to test the performance of this method in terms of CPU requirements and accuracy.

AN ADAPTIVE LAGRANGIAN METHOD FOR COMPUTING 1D REACTING AND NON-REACTING FLOWS. Tasso Lappas, Anthony Leonard, and Paul E. Dimotakis. *Graduate Aeronautical Laboratories, California Institute of Technology, Pasadena, California, USA.*

A method for computing one-dimensional unsteady compressible flows, with and without chemical reactions, is presented. This work has focused on the accurate computation of the discontinuous waves that arise in such flows. The main feature of the method is the use of an adaptive Lagrangian grid. This allows the computation of discontinuous waves and their interactions with the accuracy of front-tracking algorithms. This is done without the use of additional grid points representing shocks, in contrast to conventional front-tracking schemes. The Lagrangian character of the present scheme also allows contact discontinuities to be captured easily. The algorithm avoids interpolation across discontinuities in a natural and efficient way. The method has been used on a variety of reacting and non-reacting flows in order to test its ability to compute accurately and in a robust way for complicated wave interactions.

A TREATMENT OF DISCONTINUITIES FOR FINITE DIFFERENCE METHODS IN THE TWO-DIMENSIONAL CASE. De-kang Mao. *University of California, Los Angeles, California, USA, and Shanghai University of Science and Technology, Shanghai, People's Republic of China.*

This paper extends the treatment of discontinuities that have been introduced for the two-dimensional case. The main idea relies on the fact that on each side of a discontinuity the computations draw information from the same side. A numerical method for ordinary differential equations modeling the movement of the discontinuity curve is incorporated into the algorithm to compute discontinuity positions. The conservation feature of the treatment is studied for the case of an isolated discontinuity. Finally, we study two-dimensional scalar and systems of conservation laws and display some numerical results when our treatment is applied.

A DIRECT NEWTON SOLVER FOR THE TWO-DIMENSIONAL TOKAMAK EDGE PLASMA FLUID EQUATIONS. D. A. Knoll and A. K. Prinja. *University of New Mexico, Albuquerque, New Mexico, USA*; R. B. Campbell. *Sandia National Laboratories, Division 6428, Albuquerque, New Mexico, USA.*

Newton's method, finite volume discretization and a staggered grid are used to compute the steady state profiles of the two-dimensional two-fluid

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