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Abstracts of Papers to Appear in Future Issues

A METHOD FOR SOLVING THREE-DIMENSIONAL VISCOUS INCOMPRESSIBLE FLOWS OVER SLENDER BODIES. Moshe Rosenfeld, *NASA Ames Research Center, Moffett Field, California, USA*; Moshe Israeli and Micha Wolfshtein, *Technion, Haifa, ISRAEL.*

A marching iterative method for solving the three-dimensional incompressible and steady reduced Navier–Stokes equations in general orthogonal coordinate systems is described with the velocity and the pressure as dependent variables. The coupled set of the linearized finite-difference continuity and momentum equations are solved iteratively without any splitting or factorization errors. Each iteration consists of spatial marching from the upstream boundary to the downstream boundary. The discrete continuity and the two linearized crossflow momentum equations are satisfied at each marching step, even when the mainstream momentum equation is not converged. This solution procedure is equivalent to the solution of a single Poisson-like equation by the *successive plane over relaxation* method, while other available solution methods employ a Jacobi-type iterative scheme and therefore are less efficient. Several properties of the numerical method have been assessed through a series of tests performed on the laminar incompressible flow over prolate spheroids at intermediate incidence.

A PSEUDOSPECTRAL METHOD FOR TWO-POINT BOUNDARY VALUE PROBLEMS. S. J. Jacobs, *University of Michigan, Ann Arbor, Michigan, USA.*

Pseudospectral collocation is employed for the numerical solution of nonlinear two-point boundary value problems with separated end conditions. Second-order finite difference schemes are used as preconditioners for the spectral calculation, and a solution of the discretized equations is obtained using versions of the defect correction principle. The method and a variant based on an adaptive grid technique are tested on a variety of sample problems and are shown to provide high accuracy with low storage requirements.

FULL-WAVE CALCULATIONS IN FLUX COORDINATES FOR TOROIDAL GEOMETRY. B. A. Carreras, V. E. Lynch, E. F. Jaeger, D. B. Batchelor, and J. S. Tolliver, *Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.*

A two-dimensional (2D) full-wave code, HYPERION, employing a poloidal and toroidal mode expansion and including the toroidal terms arising in the wave equation, has been developed. It is based on the existing modules developed for the MHD stability codes. The plasma response is described by the collisionally broadened cold-plasma conductivity tensor. The code retains the $E_{\parallel}$ component of the electric field, which allows the study of the low-density region of the plasma. A detailed benchmarking of the HYPERION code has been done with the existing finite-difference full-wave code ORION.

SOLUTIONS OF REYNOLDS-AVERAGED NAVIER–STOKES EQUATIONS FOR THREE-DIMENSIONAL INCOMPRESSIBLE FLOWS. H. C. Chen, V. C. Patel, and S. Ju, *University of Iowa, Iowa City, Iowa, USA.*

A general numerical method for the solution of complete Reynolds-averaged Navier–Stokes equations for three-dimensional flows is described. The method uses nonorthogonal body-fitted coordinates,

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generated either analytically or numerically, while retaining the velocity components in a triply-orthogonal curvilinear coordinate system. The convective transport equations for mean velocities and turbulence parameters (k, ε) are solved by the finite-analytic method in the transformed domain. The pressure field is updated using a modified version of the SIMPLER algorithm to satisfy the equation of continuity. The capability of the method and its overall performance are demonstrated by calculations of the flow over a typical ship hull.

A MIXED FINITE ELEMENT FORMULATION FOR MAXWELL'S EQUATIONS IN THE TIME DOMAIN. Robert L. Lee and Niel K. Madsen, *Lawrence Livermore National Laboratory, Livermore, California, USA.*

A Galerkin finite element solution technique for the Maxwell's equations is discussed. This new formulation can be viewed as a generalization of certain staggered-grid finite difference schemes to arbitrary meshes. It is shown that this technique is simple to implement and is more accurate as well as more cost effective than the standard equal-order finite element approach. Numerical examples are presented to evaluate the performance of this new element relative to the standard element.

AN ANALYSIS AND OPTIMIZATION OF THE PSEUDO-CURRENT METHOD. Dale E. Nielsen, Jr., *Lawrence Livermore Laboratory, Livermore, California, USA*; Adam T. Drobot, *Science Applications International Corporation, McLean, Virginia, USA.*

The pseudo-current method proposed by B. Marder for eliminating charge conservation errors in electromagnetic particle-in-cell codes has been analyzed and extended. The new method has been shown to be effective and efficient in removing high frequency, short wavelength errors caused by the choice of charge deposition algorithms. To maintain the physical properties of the electromagnetic field the choice of the free parameter in the originally proposed method has been restricted. It is found that the parameter should be homogeneous spatially and that an error minimization technique can be used to determine its value. A comparison is made between this adaptive pseudo-current method and the effects of spatial smoothing on the transverse and longitudinal components of the electromagnetic field.

SYSTEMATIC METHODS FOR CALCULATION OF THE DIELECTRIC PROPERTIES OF ARBITRARY PLASMAS. P. A. Robinson, *University of Colorado, Boulder, Colorado, USA.*

A new approach to the calculation of the dispersion integrals involved in determining the dielectric properties of arbitrary plasmas is developed. Rather than relying on ad hoc approximation methods, the dispersion integrals for an arbitrary distribution function with continuous derivative are systematically expanded in terms of a set of orthogonal functions for which the corresponding dispersion functions are known. Realizations of this general approach are discussed for unmagnetized plasmas and generalizations to treat relativistic and magnetized plasmas are also outlined. The method developed here enables the dispersion integrals for an arbitrary distribution to be calculated both systematically and efficiently for the first time for either real or complex arguments.

ON APPLICATIONS OF A COMPLEX VARIABLE METHOD IN COMPRESSIBLE FLOWS. Prabir Daripa, *Texas A&M University, College Station, Texas, USA.*

In this paper, we develop a complex variable formulation for the potential equations of compressible fluid flow and discuss the possibility of its application to the solution of compressible fluid flow problems. A numerical method to solve inverse problems using this formulation is discussed.