the poloidal profiles; to second order, the radial profiles of density and rotation frequency evolve to steady state under the action of particle and angular momentum sources. The evolution of the poloidal profiles is decoupled from the evolution of the radial ones, thanks to the fact that the corresponding time scales belong to different orders in δ_{pi}: an algorithm is proposed to treat the 2D problem, alternating the solution of 1D problems.

TIME-IMPLICIT FLUID SIMULATION OF COLLISIONAL PLASMAS. P. W. Rambo and J. Denavit. *University of California, Lawrence Livermore National Laboratory, Livermore, California 94550, USA.*

A one-dimensional algorithm for fluid simulation of interpenetrating multi-component plasmas, developed earlier for the collisionless case, is extended to include collisions between species. The finite- differenced fluid equations, including collision forces, are coupled with the Poisson equation to give time-implicit solutions, which are stable and accurate over a wide range of the time scale parameters $\omega_p \Delta t$ and $\nu_c \Delta t$ (ω_p is the plasma frequency, ν_c is a typical collision frequency, and Δt is the time step). In regions where $\omega_p \Delta t \ll 1$ and $\nu_c \Delta t \ll 1$, electron dynamics and space-charge effects are resolved, while in regions where $\omega_p \Delta t \gg 1$ and/or $\nu_c \Delta t \gg 1$, the ambipolar and/or diffusion models are recovered. Results of tests are presented, including ohmic heating, shocks with an interface between different fluids, colliding plasmas in which a region of interpenetrating fluids is created, and plasma shocks with separate electron and ion fluids.

AN ALGORITHM FOR THE SOLUTION OF INVERSE LAPLACE PROBLEMS AND ITS APPLICATION IN FLAW IDENTIFICATION IN MATERIALS. Shuvra Das and Ambar K. Mitra. *Department of Engineering Science and Mechanics, Iowa State University, Ames, Iowa 50011, USA.*

An algorithm for solving an inverse problem in steady state heat conduction is developed. In this problem, the location and shape of the inner boundary of a doubly connected domain is unknown. Instead, additional experimental data are provided at several points on the outer boundary. Through an iterative process, the unknown boundary is determined by minimizing a functional. Convergence properties of the algorithm are examined, and the stopping criterion for the iterative process is developed from numerical experiments in a simple case. The scheme is shown to perform well for the complex case of an L-shaped crack in a square domain.

NUMERICAL ANALYSIS OF 2D MHD EQUILIBRIUM WITH NON-INDUCTIVE PLASMA CURRENT IN TOKAMAKS. K. Tani and M. Azumi. *Japan Atomic Energy Research Institute, Naka-machi, Naka-gun, Ibaraki-ken, Japan 311-01*; R. S. Devoto. *Lawrence Livermore National Laboratory, P.O. Box 5511, Livermore, California 94550, USA.*

We have developed a numerical code to investigate steady state neutral-beam-driven, ohmic and bootstrap currents which are consistent with MHD equilibrium. The code can describe the effects of mirror trapping, energy diffusion, and bounce motion of fast ions on the beam-driven current. The bootstrap current is evaluated for multi-species ions including impurity and unthermalized fast ions. An iterative algorithm is employed to obtain a self-consistent current and MHD equilibrium. MHD stability for the converged solution can also be investigated with the code.

A MULTIGRID CONJUGATE RESIDUAL METHOD FOR THE NUMERICAL SOLUTION OF THE HARTREE–FOCK EQUATION FOR DIATOMIC MOLECULES. Kjell Davstad. *Institute of Theoretical Physics, University of Stockholm, Vanadisvägen 9, S-113 46 Stockholm, Sweden.*

Discretization of the Hartree–Fock equations in operational form leads to unsymmetric positive definite and indefinite linear equations. To solve these equations a combination of the multigrid method and the Orthomin method with Gauss–Seidel relaxation as preconditioner is used. The differential equations are approximated to the sixth order and the solution is extrapolated to the eighth order. The method is fully parallelized. The largest molecule treated is CuH.

NOTE TO APPEAR

PARAMETERIZED SOLUTION OF ONE-DIMENSIONAL THERMAL DIFFUSION WITH A HEAT SOURCE AND A MOVING BOUNDARY. Edward J. Caramana and Robert B. Webster. *Group X-1; MS-E531, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA.*

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