FLIP MHD: A PARTICLE-IN-CELL METHOD FOR MAGNETOHYDRODYNAMICS. J. U. Brackbill, *Los Alamos National Laboratory, New Mexico, USA.*

The fluid-implicit-particle-method, FLIP, is extended to magnetohydrodynamic (MHD) flow in two or three dimensions. FLIP-MHD incorporates a Lagrangian representation of the field and is shown to preserve contact discontinuities, to preserve the Galilean invariance of the MHD flow equations, and to give a grid magnetic Reynolds number up to 16. The conservation of mass, momentum, magnetic flux, and energy are demonstrated by analysis and numerical examples. Results from numerical calculations in two dimensions of the convection of a contact discontinuity, Rayleigh–Taylor unstable flow, and a confined eddy are presented.

MULTIDOMAIN SPECTRAL SOLUTION OF THE EULER GAS-DYNAMICS EQUATIONS. David A. Kopriva, *The Florida State University, Tallahassee, Florida, USA.*

We present interface treatments for computing the Euler gas-dynamics equations by a multidomain Chebyshev spectral collocation method. These treatments are suitable for use at the corners of subdomains and for patched or overlapping subdomains. They can be applied to interfaces placed in subsonic, supersonic, or transonic regions of a flow. Computed results indicate, that the solutions are spectrally accurate, can be more accurate and more efficient than a single domain calculation, and that reflections of waves at interfaces are not significant.

AN EFFICIENT FINITE ELEMENT METHOD FOR TREATING SINGULARITIES IN LAPLACE'S EQUATION. Lorraine G. Olson, Georgios C. Georgiou, and William W. Schultz, *University of Michigan, Ann Arbor, Michigan, USA.*

We present a new finite element method for solving partial differential equations with singularities caused by abrupt changes in boundary conditions or sudden changes in boundary shape. Terms from the local solution supplement the ordinary basis functions in the finite element solution. All singular contributions reduce to boundary integrals after a double application of the divergence theorem to the Galerkin integrals, and the essential boundary conditions are weakly enforced using Lagrange multipliers. The proposed method eliminates the need for high-order integration, improves the overall accuracy, and yields very accurate estimates for the singular coefficients. It also accelerates the convergence with regular mesh refinement and converges rapidly with the number of singular functions. Although here we solve the Laplace equation in two dimensions, the method is applicable to a more general class of problems.

NOTES TO APPEAR

A NUMERICAL ALGORITHM FOR HAMILTONIAN SYSTEMS. G. Rowlands, *University of Warwick, UNITED KINGDOM.*

AN EIGHTH-ORDER FORMULA FOR THE NUMERICAL INTEGRATION OF THE ONE-DIMENSIONAL SCHRÖDINGER EQUATION. A. C. Allison, *University of Glasgow, UNITED KINGDOM*; A. D. Raptis and T. E. Simos, *National Technical University of Athens, GREECE.*

DERIVATION OF IMPLICIT DIFFERENCE SCHEMES BY THE METHOD OF DIFFERENTIAL APPROXIMATION. Edward J. Caramana, *Los Alamos National Laboratory, New Mexico, USA.*