A NUMERICAL SOLUTION OF THE STEADY SOLIDIFICATION PROBLEM IN TWO DIMENSIONS BY BOUNDARY-FITTED COORDINATE SYSTEMS. Masatoshi Saitou, Elizaburo Kanda, and Mitsuo Kawashima, *Sumitomo Metal Mining Co., Ltd., Tokyo, JAPAN.*

A simple numerical scheme is proposed to solve the problem of determining the interface shape under the thermal equilibrium condition. The procedure is based on a finite difference method using boundary-fitted coordinate systems. Several examples are given. This simple numerical solution method can be easily applied to any arbitrary shape and the unsteady solidification problem.

A SEMI-SPECTRAL PRIMITIVE EQUATION OCEAN CIRCULATION MODEL USING VERTICAL SIGMA AND ORTHOGONAL CURVILINEAR HORIZONTAL COORDINATES. Dale B. Haidvogel, *The Johns Hopkins University, Baltimore, Maryland, USA*; John L. Wilkin, *Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA*; Roberta Young, *Massachusetts Institute of Technology, Cambridge, Massachusetts, USA.*

We describe a new diabatic primitive equation model for studying regional and basin-scale ocean circulation processes. The model features coordinate transformations that efficiently incorporate moderately irregular basin geometries and large variations in bottom topography and that permit the inclusion of both thermal and wind forcing. A novel semi-spectral solution procedure, in which the vertical structure of the model variables is represented as a finite sum of user-specifiable structure functions (e.g., Chebyshev polynomials), provides faster-than-algebraic convergence of the vertical approximation scheme. Model performance is assessed on a variety of test problems drawn from coastal and large-scale oceanography including unforced, linear wave propagation in both regular and irregular geometries; non-linear flow over rough bottom topography; and eddy/mean flow interaction in a wind-driven, mid-latitude ocean basin. Computational efficiency of the model is found to be comparable to other existing primitive equation ocean models despite the utilization of the higher order spectral methods.

TRANSPORT MODEL OF OPTICAL BEAMS IN A PLASMA. T. Kurki-Suonio, *University of California, Berkeley, California, USA*; T. Tajima, *University of Texas, Austin, Texas, USA.*

A new kind of a particle simulation algorithm suitable for following long time scale evolution of electromagnetic beams in plasma is presented. The algorithm is based on particle and field equations averaged over the rapid laser oscillations and the model constitutes the electromagnetic counterpart for the Zakharov's model for electrostatics. This code can be reduced to a fully fluid code, if so desired, by replacing the electron dynamics. Computational remarks upon implementation of the algorithm are given. Test results of the code applied to the Rayleigh spread and self-focusing of an intense laser beam in a plasma are discussed.

A TWO-DIMENSIONAL ADAPTIVE MESH GENERATION METHOD. Irfan Altas and John W. Stephenson, *University of Saskatchewan, Saskatoon, Saskatchewan, CANADA.*

An automatic two-dimensional adaptive mesh generation method is presented. The method is designed so that a small portion of the mesh can be modified without disturbing a large number of adjacent mesh points. The method can be used with or without boundary-fitted coordinate generation procedures. On the generated mesh a differential equation can be discretized by using classical difference formulas designed for uniform meshes as well as the difference formulas developed in this work. Both cases are illustrated by applying the method to the Hiemenz flow for which the exact solution of the Navier–Stokes equation is known [1] and to a two-dimensional viscous internal flow model problem.