Crystal Growth and Dendritic Solidification. James A. Sethian, *Department of Mathematics, University of California, Berkeley, California 94720, USA*; John Strain, *Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012, USA.*

We present a numerical method which computes the motion of complex solid/liquid boundaries in crystal growth. The model we solve includes physical effects such as crystalline anisotropy, surface tension, molecular kinetics, and undercooling. The method is based on two ideas. First, the equations of motion are recast as a single history-dependent boundary integral equation on the solid/liquid boundary. A fast algorithm is used to solve the integral equation efficiently. Second, the boundary is moved by solving a "Hamilton–Jacobi"-type equation (on a **fixed** domain) formulated by Osher and Sethian for a function in which the boundary is a particular level set. This equation is solved by finite difference schemes borrowed from the technology of hyperbolic conservation laws. The two ideas are combined by constructing a smooth extension of the normal velocity off the moving boundary, in a way suggested by the physics of the problem. Our numerical experiments show the evolution of complex crystalline shapes, development of large spikes and corners, dendrite formation and side-branching, and pieces of solid merging and breaking off freely.

A Boundary Element Solution for Two-Dimensional Viscous Sintering. G. A. L. van de Vorst, R. M. M. Mattheij, and H. K. Kuiken, *Department of Mathematics, University of Technology, P.O. Box 513, 5600 MB Eindhoven, THE NETHERLANDS.*

By viscous sintering is meant processes in which a granular compact is heated to a temperature at which the viscosity of the material under consideration becomes low enough for surface tension to cause the powder particles to deform and coalesce. For the sake of simplicity this process is modeled in a two-dimensional space. The governing (Stokes) equations describe the deformation of a two-dimensional viscous liquid region under the influence of the curvature of the outer boundary. However, some extra conditions are needed to ensure that these equations can be solved uniquely. A boundary element method is applied to solve the equations for an arbitrarily initial-shaped fluid region. The numerical problems that can arise in computing the curvature, in particular when this is varying rapidly, are discussed. A number of numerical examples are shown for simply connected regions which transform themselves into circles as time increases.

Explicit Adaptive-Grid Radiation Magnetohydrodynamics. Osman Yasar and Gregory A. Moses, *Department of Nuclear Engineering and Engineering Physics, University of Wisconsin-Madison, 1500 Johnson Drive, Madison, Wisconsin 53706, USA.*

An explicit adaptive-grid finite differencing method for one-dimensional radiation magnetohydrodynamics computations is described. Based on the equidistribution principle, this explicit procedure moves the grid points to regions with high spatial gradients in physical quantities, such as temperature, mass density, pressure, and momentum. The governing magnetic field, radiative transfer, and hydrodynamics equations are transformed to the moving adaptive reference frame. The time and spatially dependent radiation field is determined by solving the radiative transfer equation with the multigroup discrete ordinate S_N method with implicit time differencing. The magnetic field is solved through a diffusion equation resulted from Maxwell's equations and Ohm's law. The fluid equations are solved using a first-order upwind spatial differencing and explicit time differencing scheme. The coupling between the fluid and radiation field is treated explicitly by first solving for the radiation field and then the fluid equations. A conservative differencing scheme based on the control volume approach is chosen to retain the conservative nature of the governing equations.