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Abstracts of Papers to Appear in Future Issues

THREE-DIMENSIONAL SIMULATION OF INSTABILITIES AND RIVULET FORMATION IN HEATED FALLING FILMS. B. Ramaswamy,* S. Krishnamoorthy,† and S. W. Joo.‡ **Department of Mechanical and Environmental Engineering, University of California, Santa Barbara, Santa Barbara, California 93106-5070; †Department of Mechanical Engineering and Materials Science, Rice University, Houston, Texas 77251-1892; and ‡School of Mechanical Engineering, Yeungnam University, Kyongsan, Korea.*

A thin heated film draining on an inclined plate has been studied by integrating the three-dimensional conservation equations for mass, momentum, and energy in an arbitrary Lagrangian Eulerian frame of reference. The kinematic equation is solved to precisely update the interface location. The temporal discretization is done using a projection scheme and the spatial discretization is done using a finite element method. Detailed analysis of nonlinear dynamics associated with the rivulet formation is performed for layers subjected to both thermocapillary and surface-wave instabilities. Comparisons with long-wave theory are made to validate the numerical scheme.

HIGHER ORDER KFVS ALGORITHMS USING COMPACT UPWIND DIFFERENCE OPERATORS. K. S. Ravichandran. *Flosolver Unit, CTFD Division, National Aerospace Laboratories, Bangalore, India.*

A family of high order accurate compact upwind difference operators have been used, together with the split fluxes of the KFVS (kinetic flux vector splitting) scheme to obtain high order semidiscretizations of the 2D Euler equations of inviscid gas dynamics in general coordinates. A TVD multistage Runge–Kutta time stepping scheme is used to compute steady states for selected transonic/supersonic flow problems which indicate the higher accuracy and low diffusion realizable in such schemes.

EXPLICIT TIME MARCHING METHODS FOR THE TIME-DEPENDENT EULER COMPUTATIONS. C. H. Tai,* D. C. Chiang,† and Y. P. Su.† **Department of Mechanical Engineering; †Department of System Engineering, Chung Cheng Institute of Technology, Taoyuan, Taiwan 33509, Republic of China.*

Four explicit type time marching methods, including one proposed by the authors, are examined. The TVD conditions of this method are analyzed with the linear conservation law as the model equation. Performance of these methods when applied to the Euler equations are numerically tested. Seven examples are tested, the main concern is the performance of the methods when discontinuities with different strengths are encountered. When the discontinuity is getting stronger, spurious oscillation shows up for three existing methods, while the method proposed by the authors always gives the results with satisfaction. The effect of the limiter is also investigated. To put these methods in the same basis for the comparison the same spatial discretization is used. Roe's solver is used to evaluate the fluxes at the cell interface; spatially second-order accuracy is achieved by the MUSCL reconstruction.

AN ADAPTIVE WAVELET–VAGUELETTE ALGORITHM FOR THE SOLUTION OF PDEs. Jochen Fröhlich* and Kai Schneider.† **Konrad–Zuse–Zentrum Berlin, Heilbronner Str. 10, 10711 Berlin, Germany; †Fachbereich Chemie, Technische Chemie, Universität Kaiserslautern, Erwin–Schroedinger Straße, 67663 Kaiserslautern, Germany.*

The paper first describes a fast algorithm for the discrete orthonormal wavelet transform and its inverse without using the scaling function. This approach permits to compute the decomposition of a function into a lacunary wavelet basis, i.e., a basis constituted of a subset of all basis functions up to a certain scale, without modification. The construction is then extended to operator-adapted biorthogonal wavelets. This is relevant for the solution of certain nonlinear evolutionary PDEs where a priori information about the significant coefficients is available. We pursue the approach described in (J. Frölich and K. Schneider, *Europ. J. Mech. B/Fluids* **13,** 439, 1994) which is based on the explicit computation of the scalewise contributions of the approximated function to the values at points of hierarchical grids. Here, we present an improved construction employing the cardinal function of the multiresolution. The new method is applied to the Helmholtz equation and illustrated by comparative numerical results. It is then extended for the solution of a nonlinear parabolic PDE with semi-implicit discretization in time and self-adaptive wavelet discretization in space. Results with full adaptivity of the spatial wavelet discretization are presented for a one-dimensional flame front as well as for a two-dimensional problem.

THE PHASE-FIELD METHOD IN THE SHARP-INTERFACE LIMIT: A COMPARISON BETWEEN MODEL POTENTIALS. M. Fabbri* and V. R. Voller.† **Núcleo de Desenvolvimento Tecnológico, Universidade São Francisco, Itatiba, SP 13.251-900, Brazil; †Department of Civil and Mineral Engineering, University of Minnesota, Minneapolis, Minnesota 55455.*

The phase-field (PF) method for solidification phenomena is an open formulation based on a free-energy functional. Two common choices for the PF potential, here referred to briefly as the Caginalp and Kobayashi models, are compared with respect to their numeric results within the classical sharp-interface limit. Both qualitative and quantitative behavior are addressed, and an assessment of the computational effort required to approximate a sharp-interface problem is made. It is shown that the specific form of the free-energy potential does have a strong influence on the convergence of the PF results to their sharp-interface limit. Compliance of the PF solutions with the linear kinetic model for the interface temperature is also investigated. A simple one-dimensional solidification problem in the presence of kinetic undercooling is solved by the PF model and also by a deforming grid method. Our results support the view that, if care is exercised in formulating the phase–temperature coupling, there is a high degree of confidence in using the PF method for the numerical modeling of general solidification phenomena.

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