Abstracts of Papers to Appear in Future Issues

AN IMPLICIT DIFFERENCE SCHEME FOR THE LONG-TIME EVOLUTION OF LOCALIZED SOLUTIONS OF A GENERALIZED BOUSSINESQ SYSTEM. C. I. Christov and G. A. Maugin. *Laboratoire de Modélisation en Mécanique, CNRS URA 229, Université Pierre et Marie Curie, (Paris VI), Tour 66, 4 Place Jussieu, boite 162, 75252 Paris Cedex 05, France.*

We consider the nonlinear system of equations built up from a generalized Boussinesq equation coupled with a wave equation which is a model for the one-dimensional dynamics of phases in martensitic alloys. The strongly implicit scheme employing Newton's quasilinearisation allows us to track the long-time evolution of the localized solutions of the system. Two distinct classes of solutions are encountered for the pure Boussinesq equation. The first class consists of oscillatory pulses whose envelopes are localized waves. The second class consists of smoother solutions whose shapes are either heteroclinic (kinks) or homoclinic (bumps). The homoclinics decrease in amplitude with time while their support increases. An appropriate self-similar scaling is found analytically and confirmed by the direct numerical simulations to high accuracy. The rich phenomenology resulting from the coupling with the wave equation is also investigated.

FREE SURFACE SIMULATIONS USING A CONSERVATIVE 3D CODE. T. G. Thomas, D. C. Leslie, and J. J. R. Williams. *Turbulence Unit, Queen Mary and Westfield College, University of London, Mile End Road, London E1 4NS, United Kingdom.*

This paper describes the development and testing of a 3D finite difference code written specifically to model turbulence in an open channel with a moving free surface. The code has been developed so that either a full simulation or a large eddy simulation (LES) of the turbulence may be performed. The free surface may undergo arbitrarily large deformations but the slope may not exceed a limit related to the aspect ratio of the mesh and so the possibility of breaking waves is excluded. The LES application demands numerical approximations which conserve mass, momentum, and total energy with high precision, and it permits wave motion with very little numerical dispersion or dissipation. We describe a novel numerical method for tracking the free surface using a split-merge technique which combines the volume of fluid and height function methods in a way that is conservative.

OPEN BOUNDARY CONDITIONS FOR A NUMERICAL SHELF SEA MODEL. Dong-Jian Guo and Qing-Cun Zeng. *Laboratory of Numerical Modelling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China.*

The barotropic numerical shelf sea model of the Institute of Atmospheric Physics, Chinese Academy of Sciences, is outlined first. For computing economy, a splitting method is applied by dividing the governing equations into three stages which are integrated with different time-steps. Open boundary conditions suitable for the different stages are derived from the locally linearized versions of the split governing equations. For the adjustment stage, the governing equations are converted to an equivalent set of characteristic equations, which represent waves propagating into or out of the computational domain. The outgoing waves are described by characteristic equations, while the incoming waves are suppressed by a nonreflecting boundary condition. For the development stage, general analytical solutions are found. At outflow points the boundary values at the upper time-level are obtained from data at the present time-level within and on the boundary via the analytical solutions, while the boundary values at inflow points remain constant in time. For the forcing-dissipation stage no boundary conditions are necessary. Numerical verification of the proposed open boundary conditions is described; the results are satisfactory.

PROGRESS WITH MULTIGRID SCHEMES FOR HYPERSONIC FLOW PROBLEMS. R. Radespiel, *DLR, Braunschweig, Germany*; R. C. Swanson, *NASA Langley Research Center, Hampton, Virginia 23681, U.S.A.*

Several multigrid schemes are considered for the numerical computation of viscous hypersonic flows. For each scheme, the basic solution algorithm employs upwind spatial discretization with explicit multistage time stepping. Two-level versions of the various multigrid algorithms are applied to the two-dimensional advection equation, and Fourier analysis is used to determine their damping properties. The capabilities of the multigrid methods are assessed by solving three different hypersonic flow problems. Some new multigrid schemes based on semicoarsening strategies are shown to be quite effective in relieving the stiffness caused by the high-aspect-ratio cells required to resolve high Reynolds number flows. These schemes exhibit good convergence rates for Reynolds numbers up to 200×10^6 and Mach numbers up to 25.

A COMPARISON OF SOME QUADRATURE METHODS FOR APPROXIMATING CAUCHY PRINCIPAL VALUE INTEGRALS. A. Natarajan and N. Mohankumar. *Safety Research and Health Physics Programme, Indira Gandhi Centre for Atomic Research, Kalpakkam, India.*

Cauchy principal value integrals are evaluated by the IMT quadrature scheme, which like the TANH quadrature scheme is essentially a trapezoidal scheme, after making a transformation of the variable of integration. Numerical results for some test problems demonstrate that the IMT scheme is superior to the TANH scheme, while both these methods are comparable to, or even better than, the standard methods like the Gaussian or the Chebyshev schemes, in terms of accuracy and simplicity.

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