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Abstracts of Papers to Appear

Solution of Cartesian and Curvilinear Quantum Equations via Multiwavelets on the Interval. Bruce R. Johnson, Jeffrey L. Mackey, and James L. Kinsey. Department of Chemistry and Rice Quantum Institute, Rice University, MS 600, Houston, Texas 77251-1892.

It is shown how orthogonal compact-support multiwavelets may be used for the solution of quantum mechanical eigenvalue problems subject to specific boundary conditions. Special scaling functions and wavelets with convenient limiting behaviors at the edges of an interval are constructed in an analogy to earlier work on single wavelet families. All of the integrals required for Hamiltonian matrix elements involving both regular and edge functions are calculated efficiently through use of recursion and quadrature methods. It is demonstrated through accurate eigenvalue determination that both Cartesian and curvilinear degrees of freedom are readily accommodated with such a basis, using as examples the particle in a box and the hydrogen atom in spherical polar coordinates.

An Edge-Based Method for the Incompressible Navier-Stokes Equations on Polygonal Meshes. Jeffrey A. Wright* and Richard W. Smith.† *Streamline Numerics Inc., Gainesville, Florida 32605; †Coastal Systems Station, Naval Surface Warfare Center, Panama City, Florida 32407.

A pressure-based method is presented for discretizing the unsteady incompressible Navier-Stokes equations using hybrid unstructured meshes. An edge-based data structure and assembly procedure is adopted which leads naturally to a strictly conservative discretization which is valid for meshes comprised of n-sided polygons. Particular attention is given to the construction of a pressure-velocity coupling procedure which is supported by edge data resulting in a relatively simple numerical method that is consistent with the boundary and initial conditions required by the incompressible Navier-Stokes equations. Edge formulas are presented for assembling the momentum equations which are based on an upwind-biased linear reconstruction of the velocity field. Similar formulas are presented for assembling the pressure equation. The method is demonstrated to be second-order accurate in space and time for two Navier-Stokes problems admitting an exact solution. Results for several other well-known problems are also presented including lid-driven cavity flow, impulsively-started cylinder flow and unsteady vortex shedding from a circular cylinder. Although the method is by construction minimalist, it is shown to be accurate and robust for the problems considered.

Viscous-Plastic Sea Ice Dynamics with the EVP Model: Linearization Issues. Elizabeth C. Hunke. Group T-3 Fluid Dynamics, Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545.

Behavior of the elastic-viscous-plastic (EVP) model for sea ice dynamics is explored, with particular attention to a necessary numerical linearization of the internal ice stress term in the momentum equation. Improvements to both the mathematical and numerical formulations of the model have moderated the impact of linearizing the stress term; simulations with the original EVP formulation and the improved version are used to explain the consequences of using different numerical approaches. In particular, we discuss the model behavior in two regimes, low ice concentration such as occurs in the marginal ice zone, and very high ice concentration, where the ice is nearly rigid. Most of these results are highly relevant to the viscous-plastic (VP) ice dynamics model on which the EVP model is based. In the appendix we provide examples of certain pathologies that the VP model and its numerical formulations exhibit at steady state.

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