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Abstracts of Papers to Appear in Future Issues

REZONING FOR HIGHER ORDER VORTEX METHODS. Henrik O. Nordmark, *Department of Mathematics, Center of Research and Advanced Studies (CINVESTAV), Mexico City, MEXICO.*

The vortex method is a numerical method for approximating the flow of an incompressible, inviscid fluid. We consider the two-dimensional case. The accuracy depends on the choice of the cutoff function which approximates the delta function, on the cutoff parameter δ and on the smoothness of the initial data. We present a class of infinite-order cutoff functions with arbitrarily high rates of decay at infinity. We also present an eighth-order cutoff function with compact support. We test two versions of rezoning. Version 1 has been suggested and tested by Beale and Majda, while version 2 is new. Using rezoning, we test the eighth-order cutoff function and one infinite-order cutoff function on three test problems for which the solution of Euler's equation is known analytically. The accuracy of the infinite-order cutoff function is greater than that of the eighth-order cutoff function when the flow is very smooth. We also compute the evolution of two circular vorticity patches and the evolution of one square vorticity patch over long time intervals. Finally, we make a comparison between the direct method of velocity evaluation and the Rokhlin–Greengard algorithm. The numerical experiments indicate that for smooth flows, high-order cutoffs combined with rezoning give high accuracy for long time integrations.

THE ARCTAN/TAN AND KEPLER–BURGER MAPPINGS FOR PERIODIC SOLUTIONS WITH A SHOCK, FRONT, OR INTERNAL BOUNDARY LAYER. John P. Boyd, *Department of Atmospheric, Oceanic and Space Science and Laboratory for Scientific Computation, University of Michigan, Ann Arbor, Michigan 48109, U.S.A.*

Many periodic solutions have internal regions of rapid change—internal boundary layers. Shock waves and geophysical fronts are one class of examples. A second class is composed of functions which decay rapidly away from a central peak or peaks. Spherical harmonics, Mathieu eigenfunctions, prolate spheroidal wave functions, and geophysical Hough functions may all be locally approximated by Hermite functions (in the appropriate parameter range) and decay exponentially fast outside a narrow subinterval. Similarly, the large amplitude cnoidal waves of the Korteweg–deVries equation are narrow, isolated peaks which are well approximated by the $\operatorname{sech}^2(y)$ form of the solitary wave. In this article, we show that a change-of-coordinate is a powerful tool for resolving such internal boundary layers. In the first part, we develop a general theory of mappings for the spherical harmonic/cnoidal wave class of examples, which decay rapidly away towards the edges of the spatial period. The particular map $y = \arctan(L \tan(x))$ is a particularly effective choice. Four numerical examples show that this map and the Fourier pseudospectral method are a good team. In the second part, we generalize the earlier theory to describe mappings which asympote to a constant but non-zero resolution at the ends of the periodicity interval. We explain why the "Kepler–Burger" mapping is particularly suitable for shock and fronts.

HIGH ORDER FILTERING METHODS FOR APPROXIMATING HYPERBOLIC SYSTEMS OF CONSERVATION LAWS. F. Lafon and S. Osher, *Department of Mathematics, University of California, Los Angeles, California 90024-1555, U.S.A.*

In the computation of discontinuous solutions of hyperbolic systems of conservation laws, the recently developed ENO (essentially non-oscillatory) schemes appear to be very useful. However, they are

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