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Abstracts of Papers to Appear in Future Issues

ACCURATE FLUX VECTOR SPLITTING FOR SHOCKS AND SHEAR LAYERS. R. Radespiel and N. Kroll, *DLR, Institute of Design Aerodynamics, Braunschweig, Germany.*

The advection upstream splitting method (AUSM) was recently developed by Liou and Steffen for accurate predictions of viscous flows. The special merits of AUSM compared to other upwind schemes are the low computational complexity and the low numerical diffusion. However, it is known that the original method also has several deficiencies. It locally produces pressure oscillations in the vicinity of shocks and in cases of adverse grid situations and flow alignment. In this paper a hybrid flux vector splitting scheme is proposed which switches from AUSM to van Leer at shock waves, ensuring a sharp and clean resolution of strong shocks. In order to achieve sufficient damping, a modified dissipative term is introduced, which prevents the scheme from being undamped as the Mach number approaches zero. Various modifications of the standard MUSCL implementations for second-order accuracy are proposed, which yield an accurate resolution of viscous shear layers without spurious oscillations. The ability of the improved flux vector splitting scheme is demonstrated by the computation of two- and three-dimensional viscous flows.

GENUINELY MULTIDIMENSIONAL UPWINDING FOR THE 2D SHALLOW WATER EQUATIONS. P. García-Navarro, M. E. Hubbard, and A. Priestley, *Department of Mathematics, P.O. Box 220, University of Reading, Whiteknights, Reading, United Kingdom.*

A multidimensional upwinding technique is applied to the simulation of 2D shallow water flows. It is adapted from fluctuation splitting methods recently proposed for the solution of the Euler system of equations on unstructured triangular grids. The basis of the numerical method is stated and the particular adaptation to the shallow water system is described. Numerical results of interest to hydraulic engineers are presented. Despite the complexities of the scheme advantages related to the use of a discretisation based on triangles would seem to make the schemes competitive with those currently in use.

THE METHOD OF AUXILIARY MAPPING FOR THE FINITE ELEMENT SOLUTIONS OF ELASTICITY PROBLEMS CONTAINING SINGULARITIES. Hae-Soo Oh, *Department of Mathematics, University of North Carolina at Charlotte, Charlotte, North Carolina 28223, U.S.A.*; Ivo Babŭska, *Institute for Physical Science and Technology, University of Maryland, College Park, Maryland 20742, U.S.A.*

We have introduced a new approach called the method of auxiliary mapping to deal with elliptic boundary value problems with singularities. In this paper this method is extended so that it can handle the plane elasticity problems containing singularities. In order to show the effectiveness, this method is compared with the conventional approach in the framework on the p-version of the finite element method. Moreover, it is demonstrated that this method yields a better solution for those elasticity problems containing strong singularities than does the h-p version of the finite element method.

SPURIOUS BEHAVIOR FOR A NUMERICAL SCHEME OF NONLINEAR ELLIPTIC EQUATIONS. F. Vadillo, *Departamento de Matematica Aplicada y Estadística e I. O., Facultad de Ciencias, Universidad del Pais Vasco, Apartado 644, 48080 Bilbao, Spain.*

In this paper we investigate finite difference approximations of nonlinear elliptic equations of the form $\Delta u + \lambda(u + u^p) = 0$ in three dimensions, where λ is a positive parameter. We show the existence of spurious solution branches, these solutions are spurious in the sense that they are not solutions of the differential problem. We also construct a modified problem describing the behaviour of numerical solutions, so the finite difference method may be regarded as an approximation of the modified problem. We present the results of some numerical experiments to substantiate our claims.

SEMI-IMPLICIT EXTENSION OF A GODUNOV-TYPE SCHEME BASED ON LOW MACH NUMBER ASYMPTOTICS. I. ONE-DIMENSIONAL FLOW. R. Klein, *Institut für Technische Mechanik, RWTH, Templergraben 64, 52056 Aachen, Germany.*

A single time scale, multiple space scale asymptotic analysis provides detailed insight into the low Mach number limit behavior of solutions of the compressible Euler equations. We use the asymptotics as a guideline for developing a low Mach number extension of an explicit higher order shock-capturing scheme. This semi-implicit scheme involves multiple pressure variables, large scale differencing and averaging procedures that are discretized versions of standard operations in multiple scales asymptotic analysis. Advection and acoustic wave propagation are discretized explicitly and upwind and only one scalar elliptic equation is to be solved implicitly at each time step. This equation is a pressure correction equation for incompressible flows when the Mach number is *zero*. In the low Mach number limit, the time step is restricted by a Courant number based essentially on the maximum flow velocity. For moderate and large Mach numbers the scheme reduces to the underlying explicit higher order shock capturing algorithm.

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