Abstracts of Papers to Appear in Future Issues

DISSIPATION ADDITIONS TO FLUX-DIFFERENCE SPLITTING. Hong-Chia Lin. *Department of Mechanical Engineering, Nan-Rong Institute of Technology, Yenshui 73701, Tainan County, Taiwan, Republic of China.*

Although the flux-difference splitting methods for solving the Euler equations are generally very robust and no explicit dissipation is required, there are situations where explicit dissipation is needed. Two cases, a slowly moving shock problem and a blunt body calculation, are discussed in this paper. The slowly moving shock problem is tested extensively by Roe's Riemann solver and a cure for Roe's Riemann solver is proposed. For the second-order scheme it is found necessary to reduce the second-order accuracy to first-order accuracy inside the shock layer. For the supersonic blunt body calculation adding dissipation in the linear waves in Roe's Riemann solver can prevent numerical instability in the subsonic pocket. The drawback of Yee's formula to cure the instability when used on viscous flow calculation is demonstrated. A better solution based on the pressure gradient is proposed.

AN ADAPTIVE DISCONTINUOUS FINITE ELEMENT METHOD FOR THE TRANSPORT EQUATION. Jens Lang and Artur Walter. *Konrad Zuse Zentrum für Informationstechnik Berlin, Heilbronner Strasse 10, D-10711, Berlin-Wilmersdorf, Germany.*

In this paper we introduce a discontinuous finite element method. In our approach, it is possible to combine the advantages of finite element and finite difference methods. The main ingredients are numerical flux approximation and local orthogonal basis functions. The scheme is defined on arbitrary triangulations and two different error indicators are derived. Especially the second one is closely connected to our approach and able to handle arbitrary varying flow directions. Numerical results are given for boundary value problems in two dimensions. They demonstrate the performance of the scheme, combined with the two error indicators.

A POSITIVE FINITE-DIFFERENCE ADVECTION SCHEME. W. Hundsdorfer, B. Koren, M. van Loon, and J. G. Verwer. *CWI, P.O. Box 94079, 1090 GB Amsterdam, The Netherlands.*

This paper examines a class of explicit finite-difference advection schemes derived along the method of lines. An important application field is large-scale atmospheric transport. The paper therefore focuses on the demand of positivity. For the spatial discretization, attention is confined to conservative schemes using five points per direction. The fourth-order central scheme and the family of κ-schemes, comprising the second-order central, the second-order upwind, and the third-order upwind biased, are studied. Positivity is enforced through flux limiting. It is concluded that the limited third-order upwind discretization is the best candidate from the four examined. For the time integration attention is confined to a number of explicit Runge–Kutta methods of orders two up to four. With regard to the demand of positivity, these integration methods turn out to behave almost equally and no best method could be identified.

SPECIAL MESHES FOR FINITE DIFFERENCE APPROXIMATIONS TO AN ADVECTION–DIFFUSION EQUATION WITH PARABOLIC LAYERS. Alan F. Hegarty. *Department of Mathematics and Statistics, University of Limerick, Limerick, Ireland;* John J. H. Miller. *Department of Mathematics, Trinity College, Dublin 2, Ireland;* Eugene O'Riordan. *Department of Mathematics, Regional Technical College, Tallaght, Dublin 24, Ireland;* G. I. Shishkin. *Institute of Mathematics and Mechanics, Russian Academy of Sciences, Ekaterinburg, Russia.*

In this paper a model problem for fluid flow at high Reynolds number is examined. Parabolic boundary layers are present because part of the boundary of the domain is a characteristic of the reduced differential equation. For such problems it is shown, by numerical example, that upwind finite difference schemes on uniform meshes are not ε-uniformly convergent in the discrete L_∞ norm, where ε is the singular perturbation parameter. A discrete L_∞ ε-uniformly convergent method is constructed for a singularly perturbed elliptic equation, whose solution contains parabolic boundary layers for small values of the singular perturbation parameter ε. This method makes use of a special piecewise uniform mesh. Numerical results are given that validate the theoretical results, obtained earlier by the last author, for such special mesh methods.

AN ADVANCING FRONT DELAUNAY TRIANGULATION ALGORITHM DESIGNED FOR ROBUSTNESS. Dimitri J. Mavriplis. *ICASE Mail Stop 132C, NASA Langley Research Center, Hampton, Virginia 23665, U.S.A.*

A new algorithm is described for generating an unstructured mesh about an arbitrary two-dimensional configuration. Mesh points are generated automatically by the algorithm in a manner which ensures a smooth variation of elements, and the resulting triangulation constitutes the Delaunay triangulation of these points. The algorithm combines the mathematical elegance and efficiency of Delaunay triangulation algorithms with the desirable point placement features, boundary integrity, and robustness that are traditionally associated with advancing-front-type mesh generation strategies. The method offers increased robustness over previous algorithms in that it cannot fail, regardless of the initial boundary point distribution and the prescribed cell size distribution throughout the flow-field.

0021-9991/95 $6.00