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Abstracts of Papers to Appear in Future Issues

A NEW FINITE-DIFFERENCE DIFFUSION SCHEME. J. M. Hobson, N. Wood, and P. J. Mason. *UK Meteorological Office, London Road, Bracknell, Berkshire, RG12 2SZ, United Kingdom.*

A new second-order accurate, explicit diffusion scheme is presented and discussed. The scheme is derived as a weighted average of the conventional, forward-in-time, explicit diffusion scheme over one grid length and the same scheme, but over two grid lengths. Varying the weighting factors produces a family of schemes. For optimum use, a new scheme with the weighting factor dependent on the viscous stability number is proposed. It is slightly more computationally expensive than the conventional explicit scheme (typically by 25%) but is numerically stable at viscous stability numbers four times as large. Further, it is about 20% computationally less expensive than the fully implicit scheme even in the simplest one-dimensional model. This "three-level, locally implicit" scheme has been implemented in both a simple one-dimensional diffusion model and also in a complex three-dimensional large-eddy simulation model. It has been found to behave well and is profitable in both models.

A NUMERICAL MODEL FOR THE SIMULATION OF QUENCH IN THE ITER MAGNETS. L. Bottura. *CERN, Division AT-MA, CH-1211 Geneva 23, Switzerland.*

A computational model describing the initiation and evolution of normal zones in the cable-in-conduit superconductors designed for the international thermonuclear experimental reactor (ITER) is presented. Because of the particular geometry of the ITER cables, the model treats separately the helium momenta in the two cooling channels and the temperatures of the cable constituents. The numerical implementation of the model is discussed in conjunction with the selection of a well-suited solution algorithm. In particular, the solution procedure chosen is based on an implicit upwind finite element technique with adaptive time step and mesh size adjustment possibilities. The time step and mesh adaption procedures are described. Examples of application of the model are also reported.

CAPTURING SHOCK REFLECTIONS: AN IMPROVED FLUX FORMULA. Rosa Donat and Antonio Marquina. *Universitat de València 46100-Burjassot, València, Spain.*

Godunov type schemes, based on exact or approximation solutions to the Riemann problem, have proven to be an excellent tool to compute approximate solutions to hyperbolic systems of conservation laws. However, there are many instances in which a particular scheme produces inappropriate results. In this paper we consider several situations in which Roe's scheme gives incorrect results (or blows up all together) and we propose an alternative flux formula that produces numerical approximations in which the pathological behavior is either eliminated or reduced to computationally acceptable levels.

A CONTROL VOLUME FINITE ELEMENT NUMERICAL SIMULATION OF THE DRYING OF SPRUCE. W. J. Ferguson and I. W. Turner. *School of Mathematics, Queensland University of Technology, Gardens Point Campus, GPO Box 2434, Brisbane, Q4001, Australia.*

Drying is a process which involves heat and mass transfer both inside the porous material, where a phase change in moisture occurs from the liquid to the gaseous state, and in the external boundary layer of the convected hot dry air, which heats the porous medium. The equations which govern this process consist of three tightly coupled, highly nonlinear partial differential equations for the unknown system variables of moisture content, temperature, and pressure. Due to the inherently complex boundary conditions and intricate physical geometries in any practical drying problem, an analytical solution is not possible. In order to obtain a transient drying solution it is necessary to resort to a numerical technique. Earlier researchers in this field have employed finite difference, finite element, and cell-centered control volume computational models to obtain a numerical solution to this complex problem. This paper presents a novel application of the hybrid *control volume finite element* scheme, which will lay the foundations for the solution of a timber drying problem on a deforming mesh. In order to test the performance of the simulation code over a range of differing drying conditions, numerical solutions to two timber drying problems are presented in this paper: first, a low temperature drying case with a dry bulb temperature of 80°C, and, second, for a case where the dry bulb temperature is above the boiling point of water at 120°C.

ARBITRARY LAGRANGIAN–EULERIAN NUMERICAL PREDICTION FOR LOCAL SCOUR CAUSED BY TURBULENT FLOWS. Satoru Ushijima. *Central Research Institute of Electric Power Industry* (*CRIEPI*), *1646 Abiko Abiko-shi, Chiba-ken, 270-11, Japan.*

A numerical prediction method has been developed for local scour on a sand bed due to turbulent flows on the basis of the arbitrary Lagrangian–Eulerian formulation, in which three-dimensional body-fitted coordinates are properly generated for the sand bed profile unsteadily deformed by the flows. The curvilinear coordinates are generated with reasonable accuracy by means of cubic spline interpolations. The equations for momentum, turbulent quantities, and sand concentration are discretized in a Lagrangian scheme so as to preserve second-order accuracy with respect to time and space. The convection of the variables is evaluated with third-order accuracy, taking account of the velocity of the grid point caused by ALE formulation. On the other hand, the sand bed profiles are predicted with the continuity equation for sand by evaluating the total flux consisting of the bed and suspended loads caused by the tractive and convective forces of the turbulent flows. This prediction method is applied to the results of a three-dimensional local scour experiment. From the comparison with the experimental results, it is verified that the sand bed profiles are satisfactorily predicted and that the predicted results are largely improved compared with those based on the Eulerian coordinate system.

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