gradient regions of the flow. The numerical results presented show the flexibility of this approach and the accuracy attainable by solution-based refinement.

NUMERICAL METHODS FOR TWO-DIMENSIONAL ANALYSIS OF ELECTRICAL BREAKDOWN IN A NON-UNIFORM GAP. K. Ramakrishna. *Technology Laboratory, Systems Technology Division, IBM Corporation, Endicott, New York 13760-8003, U.S.A.*; I. M. Cohen and P. S. Ayyaswamy. *Department of Mechanical Engineering and Applied Mechanics, School of Engineering and Applied Science, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6315, U.S.A.*

A finite difference procedure used to analyze the two-dimensional evolution of the charged particle densities and electrostatic potential during the initial stages of electrical breakdown between a wire and a plane is described. The diffusion flux equations for the charged particle densities and Poisson's equation for the electrostatic potential constitute a set of coupled, two-dimensional, time dependent, nonlinear equations that govern the breakdown phenomena. In this paper, we have solved the problem by two different procedures: (a) A finite difference method that combines upwind difference scheme (UDS) for drift terms, central difference scheme (CDS) for the diffusion terms, and implicit time integration; and (b) a method that combines CDS for drift terms, CDS for the diffusion terms, and implicit time integration. In each case, Crank–Nicolson time integration has also been tried. It is concluded that method (a) is most suitable for discharge breakdown problems.

A PERTURBATIONAL h^4 EXPONENTIAL FINITE DIFFERENCE SCHEME FOR THE CONVECTIVE DIFFUSION EQUATION. G. Q. Chen and Z. Gao. *Institute of Mechanics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China*; Z. F. Yang. *Department of Mechanics, Peking University, Beijing 100871, People's Republic of China.*

A perturbational h^4 compact exponential finite difference scheme with diagonally dominant coefficient matrix and upwind effect is developed for the convective diffusion equation. Perturbations of second order are exerted on the convective coefficients and source term of an h^2 exponential finite difference scheme proposed in this paper based on a transformation to eliminate the upwind effect of the convective diffusion equation. Four numerical examples including one- to three-dimensional model equations of fluid flow and a problem of natural convective heat transfer are given to illustrate the excellent behavior of the present exponential schemes. Besides, the h^4 accuracy of the perturbational scheme is verified using double precision arithmetic.

NOTE TO APPEAR

SYSTOLIC CALCULATION OF PAIR INTERACTIONS USING THE CELL LINKED-LISTS METHOD ON MULTI-PROCESSOR SYSTEMS. F. Brugè. *Department of Physics, University of Palermo and C.N.R.-I.A.I.F., Via Archirafi 36, I-90123 Palermo, Italy.*