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Abstracts of Papers to Appear in Future Issues

COMPUTATION OF SELECTED EIGENVALUES OF GENERALIZED EIGENVALUE PROBLEMS. Narinder Nayar. *Deneb Robotics, P.O. Box 214687, Auburn Hills, Michigan, 48321, U.S.A.*; James M. Ortega. *Department of Computer Science, University of Virginia, Charlottesville, Virginia 22903, U.S.A.*

We examine and develop techniques for obtaining a few selected eigenvalues of the generalized eigenvalue problem $Ax = \lambda Bx$, where A and B are $n \times n$, nonsymmetric, banded complex matrices. One way of obtaining the desired eigenvalues is to use a direct method to compute all the eigenvalues. Direct methods are computationally intensive and destroy the sparsity of the matrices A and B. Iterative methods, on the other hand, maintain the sparsity of the matrices and compute only a few eigenvalues. The iterative algorithms that we consider are the Arnoldi and the Lanczos methods. We use a shift and invert strategy to increase the rate of convergence towards the desired eigenvalues. We compare these two approaches for a model problem, which arises from considering the linear stability of compressible boundary layers and some other test problems. We present a general scheme to compute the eigenvalues lying inside a "box" in the complex plane. We also outline a procedure to separate the converged eigenvalues from spurious approximations. In addition, this procedure can also improve the approximations to the eigenvalues of interest. Numerical results obtained on a CRAY Y-MP are presented.

A TENSOR PRODUCT B-SPLINE METHOD FOR NUMERICAL GRID GENERATION. Joseph W. Manke. *Boeing Computer Services Co., Seattle, Washington, U.S.A.*

We present a numerical grid generation method in which the Cartesian coordinate functions are expanded in tensor product B-spline basis functions and collocation is used to solve the elliptic grid generation equations. The efficiency of the method derives from the fact that the smoothness of the basis functions is exploited to compute fine grids in the physical domain over a coarse set of knots in the computational domain. We formulate the tensor product B-spline method, investigate its computational complexity, and compare its performance to the finite difference method for several 2D grids. We show that for comparable grids the computational cost of the tensor product B-spline method is less than the cost of the finite difference method.

PERTURBATION THEORY IN LIGHT-CONE QUANTIZATION. Alex Langnau and Stanley J. Brodsky. *Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309, U.S.A.*

A new algorithm for the automatic computation of Feynman diagram amplitudes in quantum field theory is presented. Once the topology of a diagram is defined, the algorithm constructs all corresponding light-cone time-orderings. We explore the method for two- and three-loop calculations in QED.

DIRECT NUMERICAL SIMULATION OF TRANSITION AND TURBULENCE IN A SPATIALLY EVOLVING BOUNDARY LAYER. Man Mohan Rai. *NASA Ames Research Center, Moffett Field, California 94035, U.S.A.*; Parviz Moin. *Stanford University, Stanford, California 94305, U.S.A. and NASA Ames Research Center, Moffett Field, California 94035, U.S.A.*

A high-order-accurate finite-difference approach to direct simulations of transition and turbulence in compressible flows is described. The technique involves using a zonal grid system, upwind-biased differences for the convective terms, central differences for the viscous terms, and an iterative-implicit time-integration scheme. The integration method is used to compute transition and turbulence on a flat plate. The main objective is to determine the computability of such a flow with currently available computer speeds and storage and to address some of the algorithmic issues such as accuracy, inlet and exit boundary conditions, and grid-point requirements. A novel feature of the present study is the presence of high levels of broad band freestream fluctuations. The computed data are in qualitative agreement with experimental data (from experiments on which the computation is modeled). The computational results indicate that the essential features of the transition process have been captured. Additionally, the finite-difference method presented in this study can, in a straightforward manner, be used for complex geometries.

A FCT METHOD FOR STAGGERED MESH. P. M. Velarde. *Instituto de Fusión Nuclear, Madrid, Spain.*

A finite difference method on a staggered mesh for shock hydrodynamics with diffusion controlled via flux corrected transport is described. The algorithm is conservative, free streaming invariant, and well behaved around shocks. This method is second order in accuracy in the worse case with several third- and fourth-order features. The algorithm is designed in Lagrangian coordinates and an arbitrary mesh can be used when remapping with piecewise parabolic method.

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