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COMPARISON OF DIFFERENT KRYLOV SUBSPACE METHODS EMBEDDED IN AN IMPLICIT FINITE VOLUME SCHEME FOR THE COMPUTATION OF VISCOUS AND INVISCID FLOW FIELDS ON UNSTRUCTURED GRIDS. Andreas Meister. *Institut für Angewandte Mathematik, Universität Hamburg, Bundesstrasse 55, 20146 Hamburg, Germany.* E-mail: meister@math.uni-hamburg.de.

In the past few years a great variety of different Krylov subspace methods have been developed and investigated for several model equations. This paper is devoted to the comparison of current preconditioned Krylov subspace methods concerning several inviscid and viscous flow problems of interest in engineering applications. Therefore, the design of an implicit finite volume approximation of the Navier–Stokes equations on unstructured grids is described whereby a new combination of an isotropic triangulation with unisotropic subgrids is presented to achieve high resolution for high Reynolds number flows. For the first time, based on a specific selection of different inviscid and viscous flow fields, a reliable answer can be given to the fundamental question concerning the choice of iterative method depending on the underlying flow field in the area of the Euler and Navier–Stokes equations to get a stable and fast numerical scheme.

GENERATION OF TURBULENT INFLOW DATA FOR SPATIALLY DEVELOPING BOUNDARY LAYER SIMULATIONS. Thomas S. Lund,* Xiaohua Wu,† and Kyle D. Squires.† **Center for Turbulence Research, Stanford University, Stanford, California 94305; †Department of Mechanical and Aerospace Engineering, Arizona State University, Tempe, Arizona 85287-6106.* E-mail: lund@ctr-next3.stanford.edu.

A method for generating three-dimensional, time-dependent turbulent inflow data for simulations of complex spatially developing boundary layers is described. The approach is to extract instantaneous planes of velocity data from an auxiliary simulation of a zero pressure gradient boundary layer. The auxiliary simulation is also spatially developing, but generates its own inflow conditions through a sequence of operations where the velocity field at a downstream station is rescaled and re-introduced at the inlet. This procedure is essentially a variant of the Spalart method, optimized so that an existing inflow–outflow code can be converted to an inflow-generation device through the addition of one simple subroutine. The proposed method is shown to produce a realistic turbulent boundary layer which yields statistics that are in good agreement with both experimental data and results from direct simulations. The method is used to provide inflow conditions for a large eddy simulation (LES) of a spatially evolving boundary layer spanning a momentum thickness Reynolds number interval of 1530–2150. The results from the LES calculation are compared with those from other simulations that make use of more approximate inflow conditions. When compared with the approximate inflow generation techniques, the proposed method is shown to be highly accurate, with little or no adjustment of the solution near the inlet boundary. In contrast, the other methods surveyed produce a transient near the inlet that persists several boundary layer thicknesses downstream. Lack of a transient when using the proposed method is significant since the adverse effects of inflow errors are typically minimized through a costly upstream elongation of the mesh. Extension of the method for non-zero pressure gradients is also discussed.

MULTISCALE COMPUTATION WITH INTERPOLATING WAVELETS. Ross A. Lippert,* T. A. Arias,† and Alan Edelman‡. **Department of Mathematics Room 2-342, †Department of Physics Room 12-110, ‡Department of Mathematics Room 2-380, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.* E-mail: ripper@mit.edu, muchomas@mit.edu, edelman@math.mit.edu.

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Multiresolution analyses based upon interpolets, interpolating scaling functions introduced by Deslauriers and Dubuc, are particularly well-suited to physical applications because they allow *exact* recovery of the multiresolution representation of a function from its sample values on a *finite* set of points in space. We present a detailed study of the application of wavelet concepts to physical problems expressed in such bases. The manuscript describes algorithms for the associated transforms which for properly constructed grids of variable resolution compute correctly without having to introduce extra grid points. We demonstrate that for the application of local homogeneous operators in such bases, the nonstandard multiply of Beylkin, Coifman, and Rokhlin also proceeds exactly for inhomogeneous grids of appropriate form. To obtain less stringent conditions on the grids, we generalize the nonstandard multiply so that communication may proceed between nonadjacent levels. The manuscript concludes with timing comparisons against naïve algorithms and an illustration of the scale-independence of the convergence rate of the conjugate gradient solution of Poisson's equation using a simple preconditioning.

TWO-LEVEL HIERARCHICAL FEM METHOD FOR MODELING PASSIVE MICROWAVE DEVICES. Sergey V. Polstyanko* and Jin-Fa Lee†. **Ansoft Corporation, 4 Station Square, Suite 660, Pittsburgh, Pennsylvania, 15219;* †*ECE Department, WPI, 100 Institute Rd., Worcester, Massachusetts 01609.* E-mail: sergey@ansoft.com, jinlee@ee.wpi.edu.

In recent years multigrid methods have been proven to be very efficient for solving large systems of linear equations resulting from the discretization of positive definite differential equations by either the finite difference method or the h-version of the finite element method. In this paper an iterative method of the multiple level type is proposed for solving systems of algebraic equations which arise from the p-version of the finite element analysis applied to indefinite problems. A two-level V-cycle algorithm has been implemented and studied with a Gauss–Seidel iterative scheme used as a smoother. The convergence of the method has been investigated, and numerical results for a number of numerical examples are presented.