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# Abstracts of Papers to Appear in Future Issues

MULTIGRID LINE SMOOTHERS FOR HIGHER ORDER UPWIND DISCRETIZATIONS OF CONVECTION-DOMINATED PROBLEMS. C. W. Oosterlee,* F. J. Gaspar,‡ T. Washio,§ and R. Wienands.* **GMD, Institute for Algorithms and Scientific Computing, D-53754 Sankt Augustin, Germany; ‡C.P.S. University of Zaragoza, 50008 Zaragoza, Spain; §C&C Research Laboratories, NEC Europe Ltd., D-53757 Sankt Augustin, Germany.*

In this paper we present new multigrid line smoothers for the solution of higher order discretizations of scalar convection-dominated problems directly. The behavior of the smoothers is analyzed theoretically with Fourier smoothing and two-grid analysis. A parallel tri-line variant is presented and evaluated. The smoothers are applied to scalar convection-diffusion problems, discretized with limiters and systems of incompressible Navier–Stokes and Euler equations.

A REFLECTIONLESS SPONGE LAYER ABSORBING BOUNDARY CONDITION FOR THE SOLUTION OF MAXWELL'S EQUATIONS WITH HIGH-ORDER STAGGERED FINITE DIFFERENCE SCHEMES. Peter G. Petropoulos,* Li Zhao,† and Andreas C. Cangellaris.‡ **Department of Mathematics, Southern Methodist University, Dallas, Texas 75275; ‡Department of Electrical and Computer Engineering, University of Arizona, Tucson, Arizona 85721; ‡Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801.*

We develop, implement, and demonstrate a reflectionless sponge layer for truncating computational domains in which the time-dependent Maxwell equations are discretized with high-order staggered nondissipative finite difference schemes. The well-posedness of the Cauchy problem for the sponge layer equations is proved, and the stability and accuracy of their discretization is analyzed. With numerical experiments we compare our approach to classical techniques for domain truncation that are based on second- and third-order physically accurate local approximations of the true radiation condition. These experiments indicate that our sponge layer results in a greater than three orders of magnitude reduction of the lattice truncation error over that afforded by such classical techniques. We also show that our strongly well-posed sponge layer performs as well as the ill-posed split-field Berenger PML absorbing boundary condition. Being an unsplit-field approach, our sponge layer results in ~25% savings in computational effort over that required by a split-field approach.

A REAL-TIME PARALLEL APPLICATION: THE DETECTION OF GRAVITATIONAL WAVES BY A NETWORK OF HETEROGENEOUS WORKSTATIONS. Stefano Marano,* Mario Medugno,† and Maurizio Longo.‡ **Dipartimento di Ingegneria Elettronica, Università degli Studi di Napoli "Federico II," Napoli, Italy; †C.N.R., Centro di Ricerche per il Calculo Parallelo e i Supercalcolatori (CPS), Italy; ‡Dipartimento di Ingegneria dell' Informazione ed Ingegneria Elettrica. Università degli Studi di Salerno, Salerno, Italy.*



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We deal with the detection of gravitational chirp signals among noisy data, where the reception and the detection are piped and run in parallel. We consider the classical theory of signal detection, which yields a detector with a "bank-of-filters" structure. We investigate distributed network computing in order to implement such a detector by heterogeneous high performance workstations interconnected via an Ethernet network. The goal is to design a distributed detector running on a number of available workstations. The computation is decomposed across the workstations in such a way to minimize communications and to match the acquisition rate. Our approach is general and can be used for networks of workstations different from those used in our experimentation. We point out that the classical performance analysis seems inappropriate if applied to real-time detection by heterogeneous distributed systems, because the execution time requirements are disregarded. To take into account such constraints we characterize the algorithm, evaluate performances on different workstations, and propose a task decomposition strategy assigning the appropriate *Grain* to each workstation.

LINEAR STABILITY ANALYSIS OF THERMO-LATTICE BOLTZMANN MODELS. Pavol Pavlo,* George Vahala,†,‡ Linda Vahala,§ and Min Soe.† **Institute of Plasma Physics, Academic Science, Czech Republic; †Department of Physics, William & Mary, Williamsburg, Virginia 23187; ‡ICASE, NASA-Langley, Hampton, Virginia 23681; §Department of Electrical & Computer Engineering, Old Dominion University, Norfolk, Virginia 23529; †Department of Physics, William & Mary, Williamsburg, Virginia 23187*

The numerical stability of thermo-lattice Boltzmann (TLBE) models is presented. The TLBE algorithm is linearized and represented in matrix form. The spectral radius of the resulting matrix is obtained by the method of powers. In particular, the numerical stability of two 2-speed 13-bit TLBE models—one based on the hexagonal lattice, and the other on a square lattice—is examined. For these two TLBE models, as a function of the energy density, the achievable Reynolds number (before the onset of grid modes) is more than an order of magnitude greater for the hexagonal grid than for the square grid.

THE THREE-DIMENSIONAL FOURIER GRID HAMILTONIAN METHOD. F. Brau and C. Semay. *Université de Mons-Hainaut, Place du Parc 20, B-7000 Mons, Belgium.*

A method to compute the bound state eigenvalues and eigenfunctions of a Schrödinger equation or a spinless Salpeter equation with central interaction is presented. This method is the generalization to the three-dimensional case of the Fourier grid Hamiltonian method for a one-dimensional Schrödinger equation. It requires only the evaluation of the potential at equally spaced grid points and yields the radial part of the eigenfunctions at the same grid points. It can be easily extended to the case of coupled channel equations and to the case of nonlocal interactions.