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Abstracts of Papers to Appear

A LATTICE BOLTZMANN EQUATION FOR WAVES. Yan Guangwu. *State Key Laboratory of Nonlinear Mechanics (LNM), Institute of Mechanics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China; and Department of Mathematics, Jilin University, Changchun 130023, People's Republic of China.*

We propose a lattice Boltzmann model for the wave equation. Using a lattice Boltzmann equation and the Chapman–Enskog expansion, we get 1D and 2D wave equations with truncation error of order 2. Numerical tests show the method can be used to simulate wave motions.

AN ANALYSIS OF OPERATOR SPLITTING TECHNIQUES IN THE STIFF CASE. Bruno Sportisse. *Centre d'Enseignement et de Recherche en Mathématiques, Informatique et Calcul Scientifique, Ecole Nationale des Ponts et Chaussées (ENPC-CERMICS), rue Blaise Pascal, 77455 Champs sur Marne, France.*

Operator splitting methods are commonly used in many applications. We focus here on the case where the evolution equations to be simulated are stiff. We will more particularly consider the case of two operators: a stiff one and a non-stiff one. This occurs in numerous application fields (combustion, air pollution, reactive flows, etc.). The classical analysis of the splitting error may then fail, since the chosen splitting timestep Δt is in practice much larger than the fastest timescales: the asymptotic expansion $\Delta t \to 0$ is therefore no longer valid. We show here that singular perturbation theory provides an interesting framework for the study of splitting error. Some new results concerning the order of local errors are derived. The main result deals with the choice of the sequential order for the operators: the stiff operator has always to be last in the splitting scheme.

SOURCE RECONSTRUCTION IN A COASTAL EVOLUTION EQUATION. M. Spivack* and D. E. Reeve.† **Department of Applied Mathematics and Theoretical Physics, The University of Cambridge, Cambridge CB3 9EW, United Kingdom; and †School of Civil Engineering, University of Nottingham, Nottingham NG7 2RD, United Kingdom.*

A method is derived for the reconstruction of a source term in a linear parabolic equation describing seabed evolution over a fairly large time scale. The approach is based upon inversion of the formal solution for the direct problem and assumes that data are available on a regular grid at successive time steps. The methed is first applied to simulated data, both with and without additional random noise, and gives close agreement with the exact solution. It is then applied to measurements taken for a group of sandbanks near the east coast of the United Kingdom, and preliminary results are presented.

COMPUTING TOROIDAL FUNCTIONS FOR WIDE RANGES OF THE PARAMETERS. Amparo Gil,* Javier Segura,* and Nico M. Temme.† **Instituto de Bioingeniería, Universidad Miguel Hernández, Edificio La Galia, 03202-Elche, Alicante, Spain; and †CWI, Postbus 94079, 1090 GB Amsterdam, The Netherlands.*

Associated Legendre functions of half-odd degree and arguments larger than one, also known as toroidal harmonics, appear in the solution of Dirichlet problems with toroidal symmetry. It is shown how the use of series expansions, continued fractions, and uniform asymptotic expansions, together with the application of recurrence relations over degrees and orders, permits the evaluation of the whole set of toroidal functions for a wide range of

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arguments, orders, and degrees. In particular, we provide a suitable uniform asymptotic expansion for $P_\nu^m(x)$ (for large m) which fills the gap left by previous methods.

AN ADAPTIVE LOAD-BALANCING METHOD FOR PARALLEL MOLECULAR DYNAMICS SIMULATIONS. Yuefan Deng, Ronald F. Peierls, and Carlos Rivera. *Center for Scientific Computing, State University of New York, Stony Brook, New York 11794-3600; and IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598.*

We describe an adaptive method for achieving load balance in parallel computations simulating phenomena which are distributed over a spatially extended region, but are local in nature. We have tested the method on standard short-ranged parallel molecular dynamics calculations. The performance gain we observe confirms the value of the method for this type of calculation. We discuss possible generalizations of the method, for example, to higher dimensions.