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Abstracts of Papers to Appear

Computations of Compressible Multifluids. Rémi Abgrall* and Smadar Karni.† *Mathématiques Appliquées, University of Bordeaux, 351 Cours de la Libération, 33 405 Talence Cedex, France; and †Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109-1109.

Recent years have seen a growing interest in developing numerical algorithms for compressible multifluids. Computations ran into unexpected difficulties due to oscillations generated at material interfaces, and understanding of the underlying mechanisms was needed before these oscillations could be circumvented. This paper reviews some of the models and numerical algorithms that have been proposed recently and points to key ideas that they have in common. Noting the known fact that such oscillations do not arise in single fluid computations, an extremely simple algorithm is proposed which circumvents the oscillations and amounts to computing two different flux functions across material fronts, to update the different fluids on either of its sides.

General Algorithm for Improved Lattice Actions on Parallel Computing Architectures. Frédéric D. R. Bonnet,* Derek B. Leinweber,* and Anthony G. Williams.*,† *Special Research Center for the Subatomic Structure of Matter (CSSM) and Department of Physics and Mathematical Physics, University of Adelaide, Adelaide, South Australia 5005, Australia; and †Department of Physics and SCRI, Florida State University, Tallahasse, Florida 32306.

Quantum field theories underlie all of our understanding of the fundamental forces of nature. There are relatively few first principles approaches to the study of quantum field theories (such as quantum chromodynamics (QCD) relevant to the strong interaction) away from the perturbative (i.e., weak-coupling) regime. Currently the most common method is the use of Monte Carlo methods on a hypercubic space–time lattice. These methods consume enormous computing power for large lattices and it is essential that increasingly efficient algorithms be developed to perform standard tasks in these lattice calculations. Here we present a general algorithm for QCD that allows one to put any planar improved gluonic lattice action onto a parallel computing architecture. High-performance masks for specific actions (including non-planar actions) are also presented. These algorithms have been successfully employed by us in a variety of lattice QCD calculations using improved lattice actions on a 128 node Thinking Machines CM-5.

Adaptive Limiters to Improve the Accuracy of MUSCL Approach for Unsteady Flows. G. Billet and O. Louedin. Office Nationale d'Etudes et de Recherches Aérospatiales, BP 72-29, av. de la Division Leclerc, 92322 Châtillon Cedex, France.

An improvement of the accuracy of MUSCL approach is based on the using of AUSM splitting and a triad of limiters defined by the behaviour of each physical quantity. Some test cases are shown.

A Class of Explicit ENO Filters with Application to Unsteady Flows. Eric Garnier,* Pierre Sagaut,* and Michel Deville.† *Office Nationale d'Etudes et de Reoherches Aérospatiales, 29, Avenue de la Division Leclerc, BP 72 92322 Châtillon Cedex, France; and †Laboratoire de Mécanique des Fluides, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland.

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ENO filters are developed and compared with classical ENO schemes, TVD filters, and classical TVD scheme. The amplitude of the numerical dissipation provided by the filtering pass is computed by means of the ACM (Artificial Compression Method) switch and it is demonstrated that the use of this sensor markedly improve the quality of the results compared to those from classical approaches (shock-capturing schemes) in laminar unsteady flows. On a fully turbulent flow, it is demonstrated that the ACM sensor is not able to distinguish a turbulent fluctuation from a shock, whereas the sensor proposed by Ducros *et al.*, easily makes this distinction.

Splitting Methods for Non-autonomous Hamiltonian Equations. S. Blames and P. C. Moan. Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Silver Street, Cambridge CB3 9EW, England, United Kingdom.

We present an algorithm for numerically integrating non-autonomous Hamiltonian differential equations. Special attention is paid to the separable case and, in particular, a new fourth-order splitting method is presented which in a certain measure is optimal. In combination with a new way of handling non-autonomous problems, the schemes we present are based on Magnus expansions and they show very promising results when applied to Hamiltonian ODEs and PDEs.