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Abstracts of Papers to Appear in Future Issues

FINITE INTERPOLATION IN GREEN FUNCTION DETERMINISTIC NUMERICAL METHODS. S. Taddei, *Dipartimento di Fisica, Sezione di Firenze, Università degli Studi di Firenze and Istituto Nazionale di Fisica Nucleare, Largo Enrico Fermi 2, I-50125, Florence, Italy*.

An expansion on a finite set of interpolating functions is used within the framework of Green function deterministic numerical methods. Applications to some problems with one-dimensional, central, and tensor potentials are described. The precision of the numerical results is strongly improved.

ASYMPTOTICALLY STABLE FOURTH-ORDER ACCURATE SCHEMES FOR THE DIFFUSION EQUATION ON COMPLEX SHAPES. Saul Abarbanel and Adi Ditkowski, *School of Mathematical Sciences, Department of Applied Mathematics, Tel Aviv University, Tel Aviv, Israel.*

An algorithm which solves the multidimensional diffusion equation on complex shapes to fourth-order accuracy and is asymptotically stable in time is presented. This *bounded-error* result is achieved by constructing, on a *rectangular grid*, a differentiation matrix whose symmetric part is negative definite. The differentiation matrix accounts for the Dirichlet boundary condition by imposing penalty-like terms. Numerical examples in 2D show that the method is effective even where standard schemes, stable by traditional definitions, fail. The ability of the paradigm to be applied to arbitrary geometric domains is an important feature of the algorithm.

AN ANALYSIS OF FINITE VOLUME, FINITE ELEMENT, AND FINITE DIFFERENCE METHODS USING SOME CONCEPTS FROM ALGEBRAIC TOPOLOGY. Claudio Mattiussi, *CLAMPCO Sistemi s.r.l.—NIRLAB, AREA Science Park, Padriciano 99, 34012 Trieste, Italy*.

In this paper we apply the ideas of algebraic topology to the analysis of the finite volume and finite element methods, illuminating the similarity between the discretization strategies adopted by the two methods, in the light of a geometric interpretation proposed for the role played by the weighting functions in finite elements. We discuss the intrinsic discrete nature of some of the factors appearing in the field equations, underlining the exception represented by the constitutive term, the discretization of which is maintained as the key issue for numerical methods devoted to field problems. We propose a systematic technique to perform this task, present a rationale for the adoption of two dual discretization grids, and point out some optimization opportunities in the combined selection of interpolation functions and cell geometry for the finite volume method. Finally, we suggest an explanation for the intrinsic limitations of the classical finite difference method in the construction of accurate high order formulas for field problems.

A NUMERICAL METHOD FOR THE COMPUTATION OF THE DISPERSION OF A CLOUD OF PARTICLES BY A TURBULENT GAS FLOW FIELD. K. Domelevo and L. Sainsaulieu, *Centre de Mathématiques Appliquées, Ecole Polytechnique, 91128 Palaiseau Cedex, France; CERMICS, ENPC, Central 2, La Courtine, 93167 Noisy-le-Grand Cedex, France*.

The paper is concerned with the construction of a numerical method for the computation of the dispersion of a cloud of liquid droplets by a turbulent gas flow field. The cloud of droplets is modeled by a semifluid system intermediate between a fluid model and a kinetic description of the dispersed phase. The semifluid model is deduced from the kinetic model by integration with respect to the velocity variables and makes it possible to describe clouds of particles such that the velocity distribution of any family of particles with a given radius and a given temperature found at a given location of the physical space is a Gaussian function. A numerical scheme, consistent with the semifluid model and inspired by Perthame's or Deshpande's kinetic schemes, is proposed. The interactions with the gas phase are taken into account thanks to a particle in cell method. Numerical experiments illuminate the features of the method.

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