JOURNAL OF COMPUTATIONAL PHYSICS **94**, 250–254 (1991)

Abstracts of Papers to Appear in Future Issues

QUANTUM INVERSE SCATTERING PROBLEM AS A CAUCHY PROBLEM. D. I. Abramov, *Department of Theoretical Physics, Leningrad State University 198904, USSR.*

An approach to the inverse problem of quantum scattering at fixed angular momentum l using new nonlinear equations is proposed. In this approach energy levels, normalization constants and Jost function of the problem on the interval with variable left boundary $[r, \infty)$ are considered. These functions as functions of r numbered by energy E as an index (discrete or continuous) satisfy the infinite system of ordinary first-order differential equations. The scattering data serve as initial conditions for this system, and the inverse scattering problem is reduced to the Cauchy problem. As the functions considered in our treatment are slowly varying functions of r, the equations presented here are convenient for practical calculations. Some numerical examples show that the problem of reconstruction of potential can be solved with high accuracy even with the simplest algorithms.

A NUMERICAL METHOD FOR SUSPENSION FLOW. Deborah Sulsky, *Department of Mathematics and Statistics, University of New Mexico, Albuquerque, New Mexico 87545, U.S.A.*; J. U. Brackbill, *Los Alamos National Laboratory, Los Alamos, New Mexico 87545, U.S.A.*

Peskin's immersed boundary technique is modified to give a new numerical method for studying a fluid with suspended elastic particles. As before, the presence of the suspended particles is transmitted to the fluid through a force density term in the fluid equations. As a result, one set of equations holds in the entire computational domain, eliminating the need to apply boundary conditions on the surface of suspended objects. The new method computes the force density by discretizing the stress–strain constitutive equations for an elastic solid on a grid, using data provided by clusters of Lagrangian points. This approach clearly specifies the material properties of the suspended objects. A simple data structure for the Lagrangian points makes it easy to model suspended solids with arbitrary shape and size. The method is validated by comparing numerical results for elastic vibrations and particle settling in viscous fluids, with theory and analysis. The capability of the method to do a wide range of problems is illustrated by qualitative results for lubrication and cavity flow problems.

ON THE ERRORS INCURRED CALCULATING DERIVATIVES USING CHEBYSHEV POLYNOMIALS. Kenneth S. Breuer and Richard M. Everson, *Center for Fluid Mechanics, Turbulence and Computation, Brown University, Providence, Rhode Island 02912, U.S.A.*

The severe errors associated with the computation of derivatives of functions approximated by Chebyshev polynomials are investigated. When using standard Chebyshev transform methods, it is found that the maximum error in the computed first derivative grows as N^2, where $N+1$ is the number of Chebyshev polynomials used to approximate the function. The source of the error is found to be magnification of roundoff error by the recursion equation, which links coefficients of a function to those of its derivative. Tight coupling between coefficients enables propagation of errors from high-frequency to low-frequency modes. Matrix multiplication techniques exhibit errors of the same order of magnitude. However, standard methods for computing the matrix elements are shown to be ill-conditioned and to magnify the differentiation errors by an additional factor of N^2. For both the transform and the matrix methods, the errors are found to be most severe near the boundaries of the domain, where they grow

0021-9991/91 $3.00