of standard iterative schemes to solve the resulting systems of algebraic equations. In this paper, we extend these high accuracy approximations to the solution of Navier–Stokes equations. Solutions are obtained for the model problem of driven cavity and are compared with solutions obtained using other approximations and those obtained by other authors. It is discovered that the high-order approximations do indeed produce high-accuracy solutions and have a potential for use in solving important problems of viscous fluid flows.

CONSERVATIVE SCHEME FOR A MODEL OF NONLINEAR DISPERSIVE WAVES AND ITS SOLITARY WAVES INDUCED BY BOUNDARY MOTION. Qianshun Chang, Goubin Wang, and Boling Guo, *Academia Sinica, Bejing, PEOPLE'S REPUBLIC OF CHINA.*

A conservative difference scheme is given for a model of nonlinear dispersive waves. Convergence and stability of the scheme are proved. By means of this scheme, we explore numerically the relationship between the boundary data and the amplitudes and the number of solitary waves it produces.

NONLINEAR FOURIER ANALYSIS FOR THE INFINITE-INTERVAL KORTEWEG–DE VRIES EQUATION I: AN ALGORITHM FOR THE DIRECT SCATTERING TRANSFORM. A. R. Osborne, *Universita and Istituto di Cosmo-Geofisica, Torino, ITALY.*

The nonlinear Fourier analysis of wave motion governed approximately by the Korteweg–de Vries (KdV) equation on the infinite line is the central point of discussion. We assume that the wave amplitude is recorded in the form of a discrete space or time series which is determined either by experimental measurement or by computer simulation of the physical system of interest. We develop numerical data analysis procedures based upon the scattering transform solution to the KdV equation as given by Gardner *et al.* We are motivated by the observation that historically the Fourier transform has been ubiquitously used to spectrally analyze linear wave data; here we develop methods for employing the scattering transform as a tool to similarly analyze nonlinear wave data. Specifically we develop numerical methods to evaluate the direct scattering transform (DST) of a space or time series: the approach thus provides a basis for analyzing and interpreting nonlinear wave behavior in the wavenumber or frequency domain. The DST spectrum separates naturally into soliton and radiation components and may be simply interpreted in terms of the large-time asymptotic state of the infinite-line KdV equation.

NONLINEAR FOURIER ANALYSIS FOR THE INFINITE-INTERVAL KORTEWEG–DE VRIES EQUATION II: NUMERICAL TESTS OF THE DIRECT SCATTERING TRANSFORM. A. Provenzale and A. R. Osborne, *Universita and Istituto di Cosmo-Geofisica, Torino, ITALY.*

A recursive algorithm for computing the direct scattering transform (DST) of a discrete space or time series whose dynamics is described approximately by the infinite-line Korteweg–de Vries (KdV) equation is tested for numerical accuracy by considering several example problems for which the exact DST spectrum is known. The effects of truncation, roundoff, discretization, and noise errors are specifically addressed. Procedures for estimating errors in a general experimental context are developed and the nonlinear filtering of noise is discussed.

SPECTRAL METHOD SOLUTION OF THE STOKES EQUATIONS ON NONSTAGGERED GRIDS. Mark R. Schumack, William W. Schultz, and John P. Boyd, *University of Michigan, Ann Arbor, Michigan, USA.*

The Stokes equations are solved using spectral methods with staggered and nonstaggered grids. Numerous ways to avoid the problem of spurious pressure modes are presented, including new techniques using the pseudospectral method and a method solving the weak form of the governing equations

(a variation on the "spectral element" method developed by Patera). The pseudospectral methods using nonstaggered grids are simpler to implement and have comparable or better accuracy than the staggered grid formulations. Three test cases are presented: a formulation with an exact solution, a formulation with homogeneous boundary conditions, and the driven cavity problem. The solution accuracy is shown to be greatly improved for the driven cavity problem when the analytical solution of the singular flow behavior in the upper corners is separated from the computational solution.

BASIS-SPLINE COLLOCATION METHOD FOR THE LATTICE SOLUTION OF BOUNDARY VALUE PROBLEMS. A. S. Umar, *Vanderbilt University, Nashville, Tennessee, USA*; J. WU, M. R. STRAYER, AND C. BOTTCHER, *Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.*

We study a particular utilization of the basis-spline collocation method (BSCM) for the lattice solution of boundary value problems. We demonstrate the implementation of a general set of boundary conditions. Among the selected problems are the Schrödinger equation in radial coordinates, the Poisson and the generalized Helmholtz equations in radial and three-dimensional Cartesian coordinates.

TREATMENT OF ANGULAR DERIVATIVES IN THE SCHRÖDINGER EQUATION BY THE FINITE FOURIER SERIES METHOD. R. P. Ratowsky and J. A. Fleck, Jr., *Lawrence Livermore National Laboratory, Livermore, California, USA.*

We describe a finite Fourier series method for treating the angular derivatives in the angular momentum term of the time-dependent Schrödinger equation in spherical coordinates. The method involves a power series expansion of the evolution operator and treatment of singularities at $\theta = 0$ by L'Hospital's rule. It is demonstrated that the method is accurate across the entire spectrum of the angular momentum operator for an appropriate sampling grid.

AN INVERSE COORDINATE MULTIGRID METHOD FOR FREE BOUNDARY MAGNETOHYDROSTATICS. P. S. Cally, *Monash University, Clayton, Victoria, AUSTRALIA.*

The equations of 2D magnetohydrostatic equilibrium with free (pressure) boundary conditions are expressed in inverse (*i.e.*, flux) coordinates for both cartesian and axisymmetric geometries. The resulting quasi-linear elliptic system is solved using FAS full multigrid with line relaxation as the smoothing procedure. If field line connectivity is specified in the ignorable coordinate (*i.e.*, field shear or twist is given), the system is governed by integro-differential equations, which are solved in the same way. Convergence rates are generally excellent, though an expanding fluxtube model, which provides a particularly difficult test, results in somewhat slower, though still acceptable, convergence.

A COMPARISON OF DIFFERENT PROPAGATION SCHEMES FOR THE TIME-DEPENDENT SCHRÖDINGER EQUATION. C. Leforestier and O. Roncero, *Université de Paris-Sud, Orsay, FRANCE*; R. Bisseling, *Koninklijke/Shell Laboratory, Amsterdam, THE NETHERLANDS*; C. Cerjan and M. D. Feit, *Lawrence Livermore National Laboratory, Livermore, California, USA*; R. Friesner, *University of Texas, Austin, Texas, USA*; A. Guldberg, *Radmansquade, Copenhagen, DENMARK*; A. Hammerich and R. Kosloff, *The Hebrew University, Jerusalem, ISRAEL*; G. Jolicard, *Université de Besançon, Besançon, FRANCE*; W. Karrlein, *Institut für Physikalische Chemie, Wurzburg, WEST GERMANY (FRG)*; H.-D. Meyer, *Universität Heidelberg, Heidelberg, WEST GERMANY (FRG)*; N. Lipkin, *Technion-Israel Institute of Technology, Haifa, ISRAEL.*

A comparison of three widely used time propagation algorithms for the time-dependent Schrödinger equation is described. A typical evolution problem is chosen to demonstrate the efficiency and accuracy