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SHILOH BAILEY

Geometric Methods in Physics Springer
A study, by two of the major contributors to the theory, of the inverse scattering transform and its application to problems of nonlinear dispersive waves that arise in fluid dynamics, plasma physics, nonlinear optics, particle physics, crystal lattice theory, nonlinear circuit theory and other areas. A soliton is a localised pulse-like nonlinear wave that possesses remarkable stability properties. Typically, problems that admit soliton solutions are in the form of evolution equations that describe how some variable or set of variables evolve in time from a given state. The equations may take a variety of forms, for example, PDEs, differential difference equations, partial difference equations, and integrodifferential equations, as well as coupled ODEs of finite order. What is surprising is that, although these problems are nonlinear, the general solution that evolves from almost arbitrary initial data may be obtained without approximation.
Nonlinear Dynamics Springer Science & Business Media
This book presents an overview of the most recent advances in nonlinear science. It provides a unified view of nonlinear properties in many different systems and highlights many new developments. While volume 1 concentrates on mathematical theory and computational techniques and challenges, which are essential for the study of nonlinear science, this second volume deals with nonlinear excitations in several fields. These excitations can be localized and transport energy and matter in the form of breathers, solitons, kinks or quodons with very different characteristics, which are discussed in the book. They can also transport electric charge, in which case they are known as polarobreathers or solectrons. Nonlinear excitations can influence function and structure in biology, as for example, protein folding. In crystals and other condensed matter, they can modify transport properties, reaction kinetics and interact with defects. There are also engineering applications in electric lattices, Josephson junction arrays, waveguide arrays, photonic crystals and optical fibers. Nonlinear excitations are inherent to Bose-Einstein Condensates, constituting an excellent benchmark for testing their properties and providing a pathway for future discoveries in fundamental physics.
Solitons Springer
Although the theory and principles of optical waveguides have been established for more than a century, the technologies have only been realized in recent decades. Optical Waveguides: From Theory to Applied Technologies combines the most relevant aspects of waveguide theory with the study of current detailed waveguiding technologies, in particular, photonic devices, telecommunication applications, and biomedical optics. With self-contained chapters written by well-known specialists, the book features both fundamentals and applications. The first three chapters examine the theoretical foundations and bases of planar optical waveguides as well as critical optical properties such as birefringence and nonlinear optical phenomena. The next several chapters focus on contemporary waveguiding technologies that include photonic devices and telecommunications. The book concludes with discussions on additional technological applications, including biomedical optical waveguides and the potential of neutron waveguides. As optical waveguides play an increasing part in modern technology, photonics will become to the 21st century what electronics were to the 20th century. Offering both novel insights for experienced professionals and introductory material for novices, this book facilitates a better understanding of the new information era—the photonics century.
Theoretical Physics at the End of the Twentieth Century SIAM
Despite remarkable developments in the field, a detailed treatment of non-Kerr law media has not been published. Introduction to non-Kerr Law Optical Solitons is the first book devoted exclusively to optical soliton propagation in media that possesses non-Kerr law nonlinearities. After an introduction to the basic features of fiber-optic com
Lectures on Fluid Dynamics Springer Science & Business Media
Solitons were discovered by John Scott Russel in 1834, and have interested scientists and mathematicians ever since. They have been the subject of a large body of research in a wide variety of fields of physics and mathematics, not to mention engineering and other branches of science such as biology. This volume comprises the written versions of the talks presented at a workshop held at Queen's University in 1997, an interdisciplinary meeting wherein top researchers from many fields could meet, interact, and exchange ideas. Topics covered include mathematical and numerical aspects of solitons, as well as applications of solitons to nuclear and particle physics, cosmology, and condensed-matter physics. The book should be of interest to researchers in any field in which solitons are encountered.
Energy Research Abstracts Springer
With contributions by numerous experts
Solitons and the Inverse Scattering Transform Springer Science & Business Media
Bringing together over fifty contributions on all aspects of nonlinear and complex dynamics, this impressive topical collection is both a scientific and personal tribute, on the occasion of his 70th birthday, by many outstanding colleagues in the broad fields of research pursued by Prof. Manuel G Velarde. The topics selected reflect the research areas covered by the famous Instituto Pluridisciplinar at the Universidad Complutense of Madrid, which he co-founded over two decades ago, and include: fluid physics and related nonlinear phenomena at interfaces and in other geometries, wetting and spreading dynamics, geophysical and astrophysical flows, and novel aspects of electronic transport in anharmonic lattices, as well as topics in neurodynamics and robotics.
The sine-Gordon Model and its Applications Springer Nature
The Białowieża workshops on Geometric Methods in Physics, taking place in the unique environment of the Białowieża natural forest in Poland, are among the important meetings in the field. Every year some 80 to 100 participants both from mathematics and physics join to discuss new developments and to interchange ideas. The current volume was produced on the occasion of the XXXI meeting in 2012. For the first time the workshop was followed by a School on Geometry and Physics, which consisted of advanced lectures for graduate students and young researchers. Selected speakers of the workshop were asked to contribute, and additional review articles were added. The selection shows that despite its now long tradition the workshop remains always at the cutting edge of ongoing research. The XXXI workshop had as a special topic the works of the late Boris Vasilievich Fedosov (1938–2011) who is best known for a simple and very natural construction of a deformation quantization for any symplectic manifold, and for his contributions to index theory.
Photo-Excited Processes, Diagnostics and Applications Springer Science & Business Media
The dynamics of flows in density-stratified fluids has been and remains now an important topic for scientific enquiry. Such flows arise in many contexts, ranging from industrial settings to the oceanic and atmospheric environments. It is the latter topic which is the focus of this book. Both the ocean and atmosphere are characterised by the basic vertical density stratification, and this feature can affect the dynamics on all scales ranging from the micro-scale to the planetary scale. The aim of this book is to provide a “state-of-the-art” account of stratified flows as they are relevant to the ocean and atmosphere with a primary focus on meso-scale phenomena; that is, on phenomena whose time and space scales are such that the density stratification is a dominant effect, so that frictional and diffusive effects on the one hand and the effects of the earth’s rotation on the other hand can be regarded as of less importance. This in turn leads to an emphasis on internal waves.
Schrödinger Equations in Nonlinear Systems Springer
This book pays tribute to two pioneers in the field of Mathematical physics, Jiri Patera and Pavel Winternitz of the CRM. Each has contributed more than forty years to the subject of mathematical physics, particularly to the study of algebraic methods.
Introduction to Soliton Theory: Applications to Mechanics Birkhäuser
In the twenty years since Zabusky and Kruskal coined the term ``soliton'', this concept changed the outlook on certain types of nonlinear phenomena and found its way into all branches of physics. The present volume deals with a great variety of applications of the new concept in condensed-matter physics, which is particularly reached in experimentally observable occurrences. The presentation is not centred around the mathematical aspects; the emphasis is on the physical nature of the nonlinear phenomena occurring in particular situations. With its emphasis on concrete, mostly experimentally verifiable cases, ``Solitons'' constitutes a very readable and instructive introduction to the subject as well as an up-to-date account of current developments in a field of research reaching maturity.
Nonlinear Systems, Vol. 2 CRC Press
An overview of the basic concepts, methods and applications of nonlinear low-dimensional solid state physics based on the Frenkel--Kontorova model and its generalizations. The book covers many important topics such as the nonlinear dynamics of discrete systems, the dynamics of solitons and their interaction, commensurate and incommensurate systems, statistical mechanics of nonlinear systems, and nonequilibrium dynamics of interacting many-body systems.
The Frenkel-Kontorova Model Springer Science & Business Media
Solitary wave physics plays a significant role from modern optical physics to optical communication, optical switching and optical storage. This book gives an updated overview of optical solitons, as a reference and guide for advanced students and scientists working in the field.
Photorefractive Materials and Their Applications 1 Springer Science & Business Media
This book is a collection of papers from the 9th International ISAAC Congress held in 2013 in Kraków, Poland. The papers are devoted to recent results in mathematics, focused on analysis and a wide range of its applications. These include up-to-date findings of the following topics: - Differential Equations: Complex and Functional Analytic Methods - Nonlinear PDE - Qualitative Properties of Evolution Models - Differential and Difference Equations - Toeplitz Operators - Wavelet Theory - Topological and Geometrical Methods of Analysis - Queueing Theory and Performance Evaluation of Computer Networks - Clifford and Quaternion Analysis - Fixed Point Theory - M-Frame Constructions - Spaces of Differentiable Functions of Several Real Variables Generalized Functions - Analytic Methods in Complex Geometry - Topological and Geometrical Methods of Analysis - Integral

Transforms and Reproducing Kernels - Didactical Approaches to Mathematical Thinking Their wide applications in biomathematics, mechanics, queueing models, scattering, geomechanics etc. are presented in a concise, but comprehensible way, such that further ramifications and future directions can be immediately seen.

Journal of Nonlinear Mathematical Physics Vol. 14 Springer Science & Business Media

This book explores the diverse types of Schrödinger equations that appear in nonlinear systems in general, with a specific focus on nonlinear transmission networks and Bose–Einstein Condensates. In the context of nonlinear transmission networks, it employs various methods to rigorously model the phenomena of modulated matter-wave propagation in the network, leading to nonlinear Schrödinger (NLS) equations. Modeling these phenomena is largely based on the reductive perturbation method, and the derived NLS equations are then used to methodically investigate the dynamics of matter-wave solitons in the network. In the context of Bose–Einstein condensates (BECs), the book analyzes the dynamical properties of NLS equations with the external potential of different types, which govern the dynamics of modulated matter-waves in BECs with either two-body interactions or both two- and three-body interatomic interactions. It also discusses the method of investigating both the well-posedness and the ill-posedness of the boundary problem for linear and nonlinear Schrödinger equations and presents new results. Using simple examples, it then illustrates the results on the boundary problems. For both nonlinear transmission networks and Bose–Einstein condensates, the results obtained are supplemented by numerical calculations and presented as figures.

Solitons Springer Science & Business Media

Why writing a book about a specialized task of the large topic of complex systems? And who will read it? The answer is simple: The fascination for a didactically valuable point of view, the elegance of a closed concept and the lack of a comprehensive disquisition. The fascinating part is that field equations can have localized solutions exhibiting the typical characteristics of particles. Regarding the field equations this book focuses on, the field phenomenon of localized solutions can be described in the context of a particle formalism, which leads to a set of ordinary differential equations covering the time evolution of the position and the velocity of each particle. Moreover, starting from these particle dynamics and making the transition to many body systems, one considers typical phenomena of many body systems as shock waves and phase transitions, which themselves can be described as field phenomena. Such transitions between different level of modelling are well known from conservative systems, where localized solutions of quantum field theory lead to the mechanisms of elementary particle interaction and from this to field equations describing the properties of matter. However, in dissipative systems such transitions have not been considered yet, which is adjusted by the presented book. The elegance of a closed concept starts with the observation of self-organized current filaments in a semiconductor gas discharge system. These filaments move on random paths and exhibit certain particle features like scattering or the formation of bound states. Neither the reasons for the propagation of the filaments nor the laws of the interaction between the filaments can be registered by direct observations. Therefore a model is established, which is phenomenological in the first instance due to the complexity of the experimental system. This model allows to understand the existence of localized structures, their mechanisms of movement, and their interaction, at least, on a qualitative level. But this model is also the starting point for developing a data analysis method that enables the detection of movement and interaction mechanisms of the investigated localized solutions. The topic is rounded of by applying the data analysis to real experimental data and comparing the experimental observations to the predictions of the model. A comprehensive publication covering the interesting topic of localized solutions in reaction diffusion systems in its width and its relation to the well known phenomena of spirals and patterns does not yet exist, and this is the third reason for writing this book. Although the book focuses on a specific experimental system the model equations are as simple as possible so that the discussed methods should be adaptable to a large class of systems showing particle-like structures. Therefore, this book should attract not only the experienced scientist, who is interested in self-organization phenomena, but also the student, who would like to understand the investigation of a complex system on the basis of a continuous description.

Solitons World Scientific

Based on courses given at the CRM Banff summer school in 1999, this volume provides a snapshot of topics engaging theoretical physicists at the end of the twentieth century and the beginning of the twenty-first. Young physicists will find in these chapters pedagogical introductions to subjects currently active in theoretical physics, and more seasoned physicists will find a chance to share the excitement of fields outside their immediate research interests.

Environmental Stratified Flows Springer Science & Business Media

The dominant medium for soliton propagation in electronics, nonlinear transmission line (NLTL) has found wide application as a testbed for nonlinear dynamics and KdV phenomena as well as for practical applications in ultra-sharp pulse/edge generation and novel nonlinear communication schemes in electronics. While many texts exist covering solitons in general, there is as yet no source that provides a comprehensive treatment of the soliton in the electrical domain. Drawing on the award winning research of Carnegie Mellon’s David S. Ricketts, Electrical Solitons Theory, Design, and Applications is the first text to focus specifically on KdV solitons in the nonlinear transmission line. Divided into three parts, the book begins with the foundational theory for KdV solitons, presents the core underlying mathematics of solitons, and describes the solution to the KdV equation and the basic properties of that solution, including collision behaviors and amplitude-dependent velocity. It also examines the conservation laws of the KdV for loss-less and lossy systems. The second part describes the KdV soliton in the context of the NLTL. It derives the lattice equation for solitons on the NLTL and shows the connection with the KdV equation as well as the governing equations for a lossy NLTL. Detailing the transformation between KdV theory and what we measure on the oscilloscope, the book demonstrates many of the key properties of solitons, including the inverse scattering method and soliton damping. The final part highlights practical applications such as sharp pulse formation and edge sharpening for high speed metrology as well as high frequency generation via NLTL harmonics. It describes challenges to realizing a robust soliton oscillator and the stability mechanisms necessary, and introduces three prototypes of the circular soliton oscillator using discrete and integrated platforms.

Without Bounds: A Scientific Canvas of Nonlinearity and Complex Dynamics Springer Science & Business Media

This self-contained treatment covers all aspects of nonlinear dynamics, from fundamentals to recent developments, in a unified and comprehensive way. Numerous examples and exercises will help the student to assimilate and apply the techniques presented.

Geometries of Nature, Living Systems and Human Cognition Springer Science & Business Media

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