

Peter J. Olver
David H. Sattinger
Editors

Solitons in Physics, Mathematics, and Nonlinear Optics



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Solitons In Physics Mathematics And Nonlinear Optics

Chaohao Gu



Solitons In Physics Mathematics And Nonlinear Optics:

Solitons in Physics, Mathematics, and Nonlinear Optics Peter J. Olver, David H. Sattinger, 2012-12-06 This IMA Volume in Mathematics and its Applications SOLITONS IN PHYSICS MATHEMATICS AND NONLINEAR OPTICS is based on the proceedings of two workshops which were an integral part of the 1988-89 IMA program on NONLINEAR WAVES. The workshops focussed on the main parts of the theory of solitons and on the applications of solitons in physics, biology, and engineering with a special concentration on nonlinear optics. We thank the Coordinating Committee: James Glimm, Daniel Joseph, Barbara Keyfitz, An Majda, Alan Newell, Peter Olver, David Sattinger, and David Schaeffer for drawing planning and implementing the stimulating year-long program. We especially thank the Workshop Organizers for Solitons in Physics and Mathematics: Alan Newell, Peter Olver, and David Sattinger, and for Nonlinear Optics and Plasma Physics: David Kaup and Yuji Kodama for their efforts in bringing together many of the major figures in those research fields in which solitons in physics, mathematics, and nonlinear optics theories are used. A. Vner, Friedman, Willard, Miller Jr. PREFACE This volume includes some of the lectures given at two workshops: Solitons in Physics and Mathematics and Solitons in Nonlinear Optics and Plasma Physics held during the 1988-89 IMA year on Nonlinear Waves. Since their discovery by Kruskal and Zabusky in the early 1960s, solitons have had a profound impact on many fields ranging from engineering and physics to algebraic geometry.

Solitons in Physics, Mathematics, and Nonlinear Optics Peter J. Olver, David H. Sattinger, 1990-06-26 This IMA Volume in Mathematics and its Applications SOLITONS IN PHYSICS MATHEMATICS AND NONLINEAR OPTICS is based on the proceedings of two workshops which were an integral part of the 1988-89 IMA program on NONLINEAR WAVES. The workshops focussed on the main parts of the theory of solitons and on the applications of solitons in physics, biology, and engineering with a special concentration on nonlinear optics. We thank the Coordinating Committee: James Glimm, Daniel Joseph, Barbara Keyfitz, An Majda, Alan Newell, Peter Olver, David Sattinger, and David Schaeffer for drawing planning and implementing the stimulating year-long program. We especially thank the Workshop Organizers for Solitons in Physics and Mathematics: Alan Newell, Peter Olver, and David Sattinger, and for Nonlinear Optics and Plasma Physics: David Kaup and Yuji Kodama for their efforts in bringing together many of the major figures in those research fields in which solitons in physics, mathematics, and nonlinear optics theories are used. A. Vner, Friedman, Willard, Miller Jr. PREFACE This volume includes some of the lectures given at two workshops: Solitons in Physics and Mathematics and Solitons in Nonlinear Optics and Plasma Physics held during the 1988-89 IMA year on Nonlinear Waves. Since their discovery by Kruskal and Zabusky in the early 1960s, solitons have had a profound impact on many fields ranging from engineering and physics to algebraic geometry.

Introduction to non-Kerr Law Optical Solitons Anjan Biswas, Swapan Konar, 2006-11-10 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 *Solitons in Physics, Mathematics, and Nonlinear Optics* Peter J. Olver, David H. Sattinger, 1990-06-26 This IMA Volume in Mathematics and its Applications SOLITONS IN PHYSICS MATHEMATICS AND NONLINEAR OPTICS is based on the proceedings of two workshops which were an integral part of the 1988 89 IMA program on NONLINEAR WAVES The workshops focussed on the main parts of the theory of solitons and on the applications of solitons in physics biology and engineering with a special concentration on nonlinear optics We thank the Coordinating Committee James Glimm Daniel Joseph Barbara Keyfitz An Majda Alan Newell Peter Olver David Sattinger and David Schaeffer for drew planning and implementing the stimulating year long program We especially thank the Workshop Organizers for Solitons in Physics and Mathematics Alan Newell Peter Olver and David Sattinger and for Nonlinear Optics and Plasma Physics David Kaup and Yuji Kodama for their efforts in bringing together many of the major figures in those research fields in which solitons in physics mathematics and nonlinear optics theories are used A vner Friedman Willard Miller Jr PREFACE This volume includes some of the lectures given at two workshops Solitons in Physics and Mathematics and Solitons in Nonlinear Optics and Plasma Physics held during the 1988 89 LM A year on Nonlinear Waves Since their discovery by Kruskal and Zabusky in the early 1960 s solitons have had a profound impact on many fields ranging from engineering and physics to algebraic geometry **Introduction to non-Kerr Law Optical Solitons** Anjan Biswas, Swapan Konar, 2006-11-10 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 **Mathematical Theory of Dispersion-Managed Optical Solitons** Anjan Biswas, Daniela Milovic, Matthew Edwards, 2010-07-07 Mathematical Theory of Dispersion Managed Optical Solitons discusses recent advances covering optical solitons soliton perturbation optical cross talk Gabitov Turitsyn Equations quasi linear pulses and higher order Gabitov Turitsyn Equations Focusing on a mathematical perspective the book bridges the gap between concepts in engineering and mathematics and gives an outlook to many new topics for further research The book is intended for researchers and graduate students in applied mathematics physics and engineering and also it will be of interest to those who are conducting research in nonlinear fiber optics Dr Anjan Biswas is an Associate Professor at the Department of Applied Mathematics Dr Daniela Milovic is an Associate Professor at the Department of Telecommunications Faculty of Electronic Engineering University of Nis Serbia Dr Matthew Edwards is the Dean of the School of Arts and Sciences at Alabama A M University in Huntsville AL USA **Nonlinear Waves** Emmanuel Kengne, WuMing Liu, 2023-02-23 This book highlights the methods to engineer dissipative and magnetic nonlinear waves propagating in nonlinear systems In the first part of the book the authors present methodologically mathematical models of nonlinear waves propagating in one and two dimensional nonlinear transmission networks without with dissipative elements Based on these models the authors

investigate the generation and the transmission of nonlinear modulated waves in general and solitary waves in particular in networks under consideration In the second part of the book the authors develop basic theoretical results for the dynamics matter wave and magnetic wave solitons of nonlinear systems and of Bose Einstein condensates trapped in external potentials combined with the time modulated nonlinearity The models treated here are based on one two and three component non autonomous Gross Pitaevskii equations Based on the Heisenberg model of spin spin interactions the authors also investigate the dynamics of magnetization in ferromagnet with or without spin transfer torque This research book is suitable for physicists mathematicians engineers and graduate students in physics mathematics and network and information engineering

Soliton Theory and Its Applications Chaohao Gu, 2013-03-14 Soliton theory is an important branch of applied mathematics and mathematical physics An active and productive field of research it has important applications in fluid mechanics nonlinear optics classical and quantum fields theories etc This book presents a broad view of soliton theory It gives an expository survey of the most basic ideas and methods such as physical background inverse scattering Backlund transformations finite dimensional completely integrable systems symmetry Kac moody algebra solitons and differential geometry numerical analysis for nonlinear waves and gravitational solitons Besides the essential points of the theory several applications are sketched and some recent developments partly by the authors and their collaborators are presented

Nonlinear Optical Waves A.I. Maimistov, A.M. Basharov, 2013-03-09 A non linear wave is one of the fundamental objects of nature They are inherent to aerodynamics and hydrodynamics solid state physics and plasma physics optics and field theory chemistry reaction kinetics and population dynamics nuclear physics and gravity All non linear waves can be divided into two parts dispersive waves and dissipative ones The history of investigation of these waves has been lasting about two centuries In 1834 J S Russell discovered the extraordinary type of waves without the dispersive broadening In 1965 N J Zabusky and M D Kruskal found that the Korteweg de Vries equation has solutions of the solitary wave form This solitary wave demonstrates the particle like properties i e stability under propagation and the elastic interaction under collision of the solitary waves These waves were named solitons In succeeding years there has been a great deal of progress in understanding of soliton nature Now solitons have become the primary components in many important problems of nonlinear wave dynamics It should be noted that non linear optics is the field where all soliton features are exhibited to a great extent This book had been designed as the tutorial to the theory of non linear waves in optics The first version was projected as the book covering all the problems in this field both analytical and numerical methods and results as well However it became evident in the process of work that this was not a real task

Physics Briefs, 1993 Collision-Based Computing Andrew Adamatzky, 2012-12-06 Collision Based Computing presents a unique overview of computation with mobile self localized patterns in non linear media including computation in optical media mathematical models of massively parallel computers and molecular systems It covers such diverse subjects as conservative computation in billiard ball models and its cellular

automaton analogues implementation of computing devices in lattice gases Conway's Game of Life and discrete excitable media theory of particle machines computation with solitons logic of ballistic computing phenomenology of computation and self replicating universal computers Collision Based Computing will be of interest to researchers working on relevant topics in Computing Science Mathematical Physics and Engineering It will also be useful background reading for postgraduate courses such as Optical Computing Nature Inspired Computing Artificial Intelligence Smart Engineering Systems Complex and Adaptive Systems Parallel Computation Applied Mathematics and Computational Physics

Nonlinear Optics Boris I. Lembrikov, 2022-03-30 This book examines nonlinear optical effects in nonlinear nanophotonics plasmonics and novel materials for nonlinear optics It discusses different types of plasmonic excitations such as volume plasmons localized surface plasmons and surface plasmon polaritons It also examines the specific features of nonlinear optical phenomena in plasmonic nanostructures and metamaterials Chapters cover such topics as applications of nanophotonics novel materials for nonlinear optics based on nanoparticles polymers and photonic glasses

KdV '95 Michiel Hazewinkel, Hans W. Capel, Eduard M. de Jager, 2012-12-06 Exactly one hundred years ago in 1895 G de Vries under the supervision of D J Korteweg defended his thesis on what is now known as the Korteweg de Vries Equation They published a joint paper in 1895 in the Philosophical Magazine entitled On the change of form of long waves advancing in a rectangular canal and on a new type of long stationary wave and for the next 60 years or so no other relevant work seemed to have been done In the 1960s however research on this and related equations exploded There are now some 3100 papers in mathematics and physics that contain a mention of the phrase Korteweg de Vries equation in their title or abstract and there are thousands more in other areas such as biology chemistry electronics geology oceanology meteorology etc And of course the KdV equation is only one of what are now called Liouville completely integrable systems The KdV and its relatives continually turn up in situations when one wishes to incorporate nonlinear and dispersive effects into wave type phenomena This centenary provides a unique occasion to survey as many different aspects of the KdV and related equations The KdV equation has depth subtlety and a breadth of applications that make it a rarity deserving special attention and exposition

Zeitschrift für Angewandte Mathematik und Mechanik. Volume 71, Number 7/8 H. Heinrich, G. Schmid, 2022-03-21 No detailed description available for VOLUME 71 NUMBER 7 8 ZAMM 1991 E BOOK

Nonlinear Optical Waves A.I. Maimistov, A.M. Basharov, 1999-06-30 A non linear wave is one of the fundamental objects of nature They are inherent to aerodynamics and hydrodynamics solid state physics and plasma physics optics and field theory chemistry reaction kinetics and population dynamics nuclear physics and gravity All non linear waves can be divided into two parts dispersive waves and dissipative ones The history of investigation of these waves has been lasting about two centuries In 1834 J S Russell discovered the extraordinary type of waves without the dispersive broadening In 1965 N J Zabusky and M D Kruskal found that the Korteweg de Vries equation has solutions of the solitary wave form This solitary wave demonstrates the particle like properties i e stability under propagation and the elastic

interaction under collision of the solitary waves These waves were named solitons In succeeding years there has been a great deal of progress in understanding of soliton nature Now solitons have become the primary components in many important problems of nonlinear wave dynamics It should be noted that non linear optics is the field where all soliton features are exhibited to a great extent This book had been designed as the tutorial to the theory of non linear waves in optics The first version was projected as the book covering all the problems in this field both analytical and numerical methods and results as well However it became evident in the process of work that this was not a real task

Painlevé Transcendents Decio Levi, Pavel Winternitz, 2013-11-11 The NATO Advanced Research Workshop Painleve Transcendents their Asymp totics and Physical Applications held at the Alpine Inn in Sainte Adele near Montreal September 2 7 1990 brought together a group of experts to discuss the topic and produce this volume There were 41 participants from 14 countries and 27 lectures were presented all included in this volume The speakers presented reviews of topics to which they themselves have made important contributions and also re sults of new original research The result is a volume which though multiauthored has the character of a monograph on a single topic This is the theory of nonlinear ordinary differential equations the solutions of which have no movable singularities other than poles and the extension of this theory to partial differential equations For short we shall call such systems equations with the Painleve property The search for such equations was a very topical mathematical problem in the 19th century Early work concentrated on first order differential equations One of Painleve s important contributions in this field was to develop simple methods applicable to higher order equations In particular these methods made possible a complete analysis of the equation $f(y)y' = x$ where f is a rational function of y and y with coefficients that are analytic in x The fundamental result due to Painleve Acta Math

Odyssey of Light in Nonlinear Optical Fibers Kuppuswamy Porsezian, Ramanathan Ganapathy, 2017-12-19 Odyssey of Light in Nonlinear Optical Fibers Theory and Applications presents a collection of breakthrough research portraying the odyssey of light from optical solitons to optical rogue waves in nonlinear optical fibers The book provides a simple yet holistic view on the theoretical and application oriented aspects of light with a special focus on the underlying nonlinear phenomena Exploring the very frontiers of light wave technology the text covers the basics of nonlinear fiber optics and the dynamics of electromagnetic pulse propagation in nonlinear waveguides It also highlights some of the latest advances in nonlinear optical fiber technology discussing hidden symmetry reductions and Ablowitz Kaup Newell Segur AKNS hierarchies for nonautonomous solitons state of the art Brillouin scattering applications backpropagation and the concept of eigenvalue communication a powerful nonlinear digital signal processing technique that paves the way to overcome the current limitations of traditional communications methods in nonlinear fiber channels Key chapters study the feasibility of the eigenvalue demodulation scheme based on digital coherent technology by throwing light on the experimental study of the noise tolerance of the demodulated eigenvalues investigate matter wave solitons and other localized excitations pertaining to Bose Einstein condensates in atom optics and examine

quantum field theory analogue effects occurring in binary waveguide arrays plasmonic arrays etc as well as their ensuing nonlinear wave propagation Featuring a foreword by Dr Akira Hasegawa the father of soliton communication systems *Odyssey of Light in Nonlinear Optical Fibers Theory and Applications* serves as a curtain raiser to usher in the photonics era The technological innovations at the core of the book form the basis for the next generation of ultra high speed computers and telecommunication devices Computer Aided Proofs in Analysis Kenneth R. Meyer,Dieter S. Schmidt,2012-12-06 This IMA Volume in Mathematics and its Applications COMPUTER AIDED PROOFS IN ANALYSIS is based on the proceedings of an IMA Participating Institutions PI Conference held at the University of Cincinnati in April 1989 Each year the 19 Participating Institutions select through a competitive process several conferences proposals from the PIs for partial funding This conference brought together leading figures in a number of fields who were interested in finding exact answers to problems in analysis through computer methods We thank Kenneth Meyer and Dieter Schmidt for organizing the meeting and editing the proceedings A vner Friedman Willard Miller Jr PREFACE Since the dawn of the computer revolution the vast majority of scientific compu tation has dealt with finding approximate solutions of equations However during this time there has been a small cadre seeking precise solutions of equations and rigorous proofs of mathematical results For example number theory and combina torics have a long history of computer assisted proofs such methods are now well established in these fields In analysis the use of computers to obtain exact results has been fragmented into several schools *Waves Called Solitons* Michel Remoissenet,2013-03-09 In the third edition the presentation of new topics has been deliberately kept simple for pedagogical purposes Chapter 1 was completed by references to the tidal bore and magnetic envelope solitons Two new sections devoted to magnetic envelope solitons and signal processing with solitons have been added to Chap 4 Short comments on models describing blood pressure pulse propagation in terms of solitons were added to chapter 5 A description of a new mechanical transmission line with two equilibrium states has been included in Chap 6 Such an analog device is useful to illustrate the properties of kink solitons and to observe solitary waves with a compact shape called compactons New references concerning recent advances in experimental techniques and lattice effects were added to Chap 7 In Chap 8 a short introduction to spatial optical solitons in continuous and discrete systems was included Chapter 9 was completed by new sections devoted to nonlinear lattice models and energy localization The concepts of self trapped states and intrinsic localized modes or discrete breathers are dicussed Different analog chains which make it possible to observe the characteristic features of discrete breathers are described Contrary to previous chapters where we have considered reversible or conservative systems where solitons can exist owing to the dynamical balance between linear dispersion and nonlinearity Chapter 11 which is a new chapter is devoted to irreversible systems where nonlinearity can balance the effects of dissipation leading to diffusing solitary waves or diffusive solitons **Mathematics And The 21st Century - Proceedings Of The International Conference** A A Ashour,A-s F Obada,2001-04-02 Contents Millennium Lecture Cairo 15

January 2000 M Atiyah Trends for Science and Mathematics in the 21st Century P A Griffiths Arabic Mathematics and Rewriting the History of Mathematics R Rashed The Paradigm Shift in Mathematics Education A Scenario for Change W Ebeid Einstein's Theory of Spacetime and Gravity J Ehlers Moduli Problems in Geometry M S Narasimhan Enumerative Geometry from the Greeks to Strings C Procesi Optical Solitons Twenty Seven Years of the Last Millennium and Three More Years of the New R K Bullough Concepts of Non Smooth Dynamical Systems T Kopper Radical Theory Developments and Trends R Wiegandt On Minimal Subgroups of Finite Groups M Asaad Totally and Mutually Permutable Products of Finite Groups A Ballester Bolinches Asymptotic Behaviour of Solutions of Evolution Equations B Basit On Nonlinear Evolution Equations with Applications L Debnath A Robust Layer Resolving Numerical Method for a Free Convection Problem J tienne et al Growth Value Distribution and Zero Free Regions of Entire Functions and Sections F F Abi Khuzam Three Linear Preserver Problems A R Sourour Prediction Advances and New Research E K Al Hussaini Inference on Parameters of the Laplace Distribution Based on Type II Censored Samples Using Edgeworth Approximation N Balakrishnan et al Mathematical Models in the Theory of Accelerated Experiments V Bagdonavicius Conference Mathematics Cairo Egypt

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In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke contemplation, and ignite transformative change is actually awe-inspiring. Enter the realm of "**Solitons In Physics Mathematics And Nonlinear Optics**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound effect on the souls of its readers.

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