Basic Of Solitons

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Dissipative Solitons: From Optics to Biology and Medicine - Nail Akhmediev 2008-08-26
The dissipative soliton concept is a fundamental extension of the concept of solitons in conservative and integrable systems. It includes ideas from three major sources, namely standard soliton theory developed since the 1960s; nonlinear dynamics theory; and Prigogine's ideas of systems far from equilibrium. These three sources also correspond to the three component parts of this novel paradigm. This book explains the above principles in detail and gives the reader various examples.

Optical Soliton Control and its Management - Dr. N. Prathap 2021-08-11

INTRODUCTION TO OPTICAL FIBER Recent inventions and discoveries have revolutionized the telecommunication industry, but the future enhancement will based on the transmission and reception of multimedia in an efficient and effective way. In present, optical fibers are used instead of copper cables, which is very helpful to transform plenty of information with high speed and high range. The optical fiber cable gives infinite bandwidth for media transmission with low loss. The optical fiber is a cylindrical in shape and made up of low loss dielectric material such as silica glass. An optical or light signal communication is a system which use light pulse as the carrier for transmission and reception of signals. The silica glass fiber has low loss, higher bandwidth and high speed compare to normal copper cable communication. Nowadays the copper coaxial cables are replaced by optical fiber due to low loss in fiber and offers infinite bandwidth with low latency. Thus the fiber plays a major role in today's global application such as Telecommunication, defence, medical, networking, industrial, etc.

Physics of Solitons - Thierry Dauxois 2010-06-10

The basic properties of solitons are introduced here using examples from macroscopic physics (e.g. blood pressure pulses and fibre optical communications). The book then presents the main theoretical methods before discussing applications from solid state or atomic physics such as dislocations, excitations in spin chains, conducting polymers, ferroelectrics and Bose-Einstein condensates. Examples are also taken from biological physics and include energy transfer in proteins and DNA fluctuations. Throughout the book the authors emphasize a new approach to modelling

nonlinearities in physics.

Nonlinear Waves and Solitons on Contours and Closed Surfaces - Andrei Ludu 2007-09-09

The present volume is an introduction to nonlinear waves and soliton theory in the special environment of compact spaces such as closed curves and surfaces and other domain contours. The first part of the book introduces the mathematical concept required for treating the manifolds considered. An introduction to the theory of motion of curves and surfaces is given. The second and third parts discuss the modeling of various physical solitons on compact systems.

Glimpses of Soliton Theory - Alex Kasman 2010

Glimpses of Soliton Theory addresses some of the hidden mathematical connections in soliton theory which have been revealed over the last half-century. It aims to convince the reader that, like the mirrors and hidden pockets used by magicians, the underlying algebro-geometric structure of soliton equations provides an elegant and surprisingly simple explanation of something seemingly miraculous. --

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, Backlünd 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.

Optical Solitons - Kuppuswamy Porsezian 2008-01-11

Optical Solitons represent one of the most exciting and fascinating concepts in modern communications, arousing special interest due to their potential applications in optical fibre communication. This volume focuses on the explicit integration of analytical and experimental methods in nonlinear fibre optics and integrated optics. It covers all important recent technical issues in optical-soliton communication. For example, individual chapters are devoted to topics such as dispersion management and fibre Bragg grating. All authors are leading authorities in their fields.

Dissipative Optical Solitons - Mário F. S. Ferreira 2022-09-23

This book introduces the basic concept of a dissipative soliton, before going to explore recent theoretical and experimental results for various classes of dissipative optical solitons, high-energy dissipative solitons and their applications, and mode-locked fiber lasers. A soliton is a concept which describes various physical phenomena ranging from solitary waves forming on water to ultrashort optical pulses propagating in an optical fiber. While solitons are usually attributed to integrability, in recent years the notion of a soliton has been extended to various systems which are not necessarily integrable. Until now, the main emphasis has been given to well-known conservative soliton systems, but new avenues of inquiry were opened when physicists realized that solitary waves did indeed exist in a wide range of non-integrable and non-conservative systems

leading to the concept of so-called dissipative optical solitons. Dissipative optical solitons have many unique properties which differ from those of their conservative counterparts. For example, except for very few cases, they form zero-parameter families and their properties are completely determined by the external parameters of the optical system. They can exist indefinitely in time, as long as these parameters stay constant. These features of dissipative solitons are highly desirable for several applications, such as in-line regeneration of optical data streams and generation of stable trains of laser pulses by mode-locked cavities.

Solitons in Physics, Mathematics, and Nonlinear Optics - Peter J. Olver 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 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.

Basic Methods Of Soliton Theory - Ivan V Cherednik 1996-08-22

In the 25 years of its existence Soliton Theory has drastically expanded our understanding of “integrability” and contributed a lot to the reunification of Mathematics and Physics in the range from deep algebraic geometry and modern representation theory to quantum field theory and optical transmission lines.The book is a systematic introduction to the Soliton Theory with an emphasis on its background and algebraic aspects. It is the first one devoted to the general matrix soliton equations, which are of great importance for the foundations and the applications.Differential algebra (local conservation laws, Bäcklund-Darboux transforms), algebraic geometry (theta and Baker functions), and the inverse scattering method (Riemann-Hilbert problem) with well-grounded preliminaries are applied to various equations including principal chiral fields, Heisenberg magnets, Sin-Gordon, and Nonlinear Schrödinger equation.

Solitons - Mohamed Atef Helal 2022-11-12

This newly updated volume of the Encyclopedia of Complexity and Systems Science (ECSS) presents several mathematical models that describe this physical phenomenon, including the famous non-linear equation Korteweg-de-Vries (KdV) that represents the canonical form of solitons. Also, there

exists a class of nonlinear partial differential equations that led to solitons, e.g., Kadomtsev-Petviashvili (KP), Klein-Gordon (KG), Sine-Gordon (SG), Non-Linear Schrödinger (NLS), Korteweg-de-Vries Burger's (KdVB), etc. Different linear mathematical methods can be used to solve these models analytically, such as the Inverse Scattering Transformation (IST), Adomian Decomposition Method, Variational Iteration Method (VIM), Homotopy Analysis Method (HAM) and Homotopy Perturbation Method (HPM). Other non-analytic methods use the computational techniques available in such popular mathematical packages as Mathematica, Maple, and MATLAB. The main purpose of this volume is to provide physicists, engineers, and their students with the proper methods and tools to solve the soliton equations, and to discover the new possibilities of using solitons in multi-disciplinary areas ranging from telecommunications to biology, cosmology, and oceanographic studies.

Nonlinear Waves, Solitons and Chaos - Eryk Infeld 2000-07-13

This revised and updated second edition of a highly successful book is the only text at this level to embrace a universal approach to three major developments in classical physics; namely nonlinear waves, solitons and chaos. The authors now include new material on biology and laser theory, and go on to discuss important recent developments such as soliton metamorphosis. A comprehensive treatment of basic plasma and fluid configurations and instabilities is followed by a study of the relevant nonlinear structures. Each chapter concludes with a set of problems. This text will be particularly valuable for students taking courses in nonlinear aspects of physics. In general, it will be of value to final year undergraduates and beginning graduate

students studying fluid dynamics, plasma physics and applied mathematics.

Optical Solitons - Yuri S. Kivshar 2003-06-12

The current research into solitons and their use in fiber optic communications is very important to the future of communications. Since the advent of computer networking and high speed data transmission technology people have been striving to develop faster and more reliable communications media. Optical pulses tend to broaden over relatively short distances due to dispersion, but solitons on the other hand are not as susceptible to the effects of dispersion, and although they are subject to losses due to attenuation they can be amplified without being received and re-transmitted. This book is the first to provide a thorough overview of optical solitons. The main purpose of this book is to present the rapidly developing field of Spatial Optical Solitons starting from the basic concepts of light self-focusing and self-trapping. It will introduce the fundamental concepts of the theory of nonlinear waves and solitons in non-integrated but physically realistic models of nonlinear optics including their stability and dynamics. Also, it will summarize a number of important experimental verification of the basic theoretical predictions and concepts covering the observation of self-focusing in the earlier days of nonlinear optics and the most recent experimental results on spatial solitons, vortex solitons, and soliton interaction & spiraling. * Introduces the fundamental concepts of the theory of nonlinear waves and solitons through realistic models * Material is based on authors' years of experience actively working in and researching the field * Summarizes the most important experimental verification of the basic theories, predictions and concepts of this ever evolving field from the earliest

studies to the most recent

Solitons - Boling Guo 2018-03-19

This book provides an up-to-date overview of mathematical theories and research results on solitons, presenting related mathematical methods and applications as well as numerical experiments. Different types of soliton equations are covered along with their dynamical behaviors and applications from physics, making the book an essential reference for researchers and graduate students in applied mathematics and physics. Contents Introduction Inverse scattering transform Asymptotic behavior to initial value problems for some integrable evolution nonlinear equations Interaction of solitons and its asymptotic properties Hirota method Bäcklund transformations and the infinitely many conservation laws Multi-dimensional solitons and their stability Numerical computation methods for some nonlinear evolution equations The geometric theory of solitons Global existence and blow up for the nonlinear evolution equations The soliton movements of elementary particles in nonlinear quantum field The theory of soliton movement of superconductive features The soliton movements in condensed state systemsontents

Solitons in Optical Communications - Akira Hasegawa 1995

Solitons--waves that do not disperse as they travel through a medium--are the most recent and perhaps the most remarkable development in the revolution in telecommunications technology. When coupled with low loss fibers, semiconductor lasers, and erbium doped fibre amplifiers, solitons can carry--with perfect accuracy and at enormous rates--staggering amounts of information across vast distances. Authored by two leaders in the field, this book offers the best, most comprehensive

introduction to soliton behavior in optical fibers available. Topics range from the dielectric fiber to the concept of guiding center (average) solitons to transmission control to modulational instability. Solitons in Optical Communications will be avidly read by students and researchers in optical communications and applied mathematics looking for the definitive survey of the hottest topic in telecommunications engineering.

Solitons, Nonlinear Evolution Equations and Inverse Scattering - Mark J. Ablowitz 1991-12-12

This book will be a valuable addition to the growing literature in the area and essential reading for all researchers in the field of soliton theory.

Solitons in Mathematics and Physics - Alan C. Newell 1985-06-01

A discussion of the soliton, focusing on the properties that make it physically ubiquitous and the soliton equation mathematically miraculous.

Solitons in Crystalline Processes - Minoru Fujimoto 2017-11

Annotation Solitons in Crystalline Processes presents the soliton theory applied to crystalline processes for the first time. Starting with critical anomalies in binary transitions, the soliton idea leads to nonlinear waves in crystals, constituting the basic objective in this book. The theory explains logically not only structural transformations and mesoscopic disorder, but also the nonlinear mechanism of superconductivity with respect to the charge-current continuity substantiated by experimental studies; in contrast, for magnetic systems where solitons are relatively insignificant. Generally, solitons play the fundamental role in ordering processes in crystals, where the collective motion are essential for mesoscopic disorder in thermal equilibrium. This book is written as an introductory treatise with respect to the soliton concept, from

structural transitions where the crystal symmetry changes, to magnets and superconductors, describing the role of nonlinear excitations in detail. Parts I and II introduce the theory and experimental techniques, while Part III discusses soliton theory of lattice dynamics in detail, and Part IV discusses the applications of this theory to superconductivity and magnetism. Exercises are given for each chapter to further develop understanding, and mathematics are limited to those needed to understand the theory.

Solitons in Optical Fiber Systems - Mario F. S. Ferreira 2022-07-20

Solitons in Optical Fiber Systems Discover a robust exploration of the main properties and behaviors of solitons in fiber systems In Solitons in Optical Fiber Systems, distinguished researcher Dr. Mário F. S. Ferreira delivers a thorough treatment of the main characteristics of solitons in optical fiber communication systems and fiber devices, paying special attention to stationary and pulsating dissipative soliton pulses. The book discusses the technical aspects associated with the physical background and the theoretical description of soliton characteristics under different conditions. The author employs numerical analyses and variational approaches to describe soliton evolution and describes the phenomenon of supercontinuum generation and various solitonic effects observed in highly nonlinear fibers, like photonic crystal fibers. Readers will learn about different applications of fiber solitons in transmission systems, fiber lasers, couplers, and pulse compression schemes, as well as complex Ginzburg-Landau equations, which are used to model different types of dissipative systems. The book also includes: A thorough introduction to solitons, including the linear and nonlinear effects of a wave, the discovery of solitary waves, and the

discovery of solitons in optical fibers An exploration of fiber dispersion and nonlinearity, including optical fiber dispersion, the pulse propagation equation, and the impact of fiber dispersion Practical discussions of nonlinear effects in optical fibers, including self-phase modulation, cross-phase modulations, four-wave mixing, and stimulated raman scattering In-depth treatments of solitons in optical fibers, including modulation instability, dark solitons, bistable solitons, XPM-paired solitons, and the variational approach Perfect for senior undergraduate and graduate students in courses dealing with fiber-optics technology, Solitons in Optical Fiber Systems is also an ideal resource for engineers and technicians in the fiber-optics industry and researchers of nonlinear fiber optics.

Nonlinear Waves - Emmanuel Kengne 2023-03-27 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.

Introduction to non-Kerr Law Optical Solitons - Anjan Biswas 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

Spatial Solitons - Stefano Trillo 2013-06-05

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.

Optical Multi-Bound Solitons - Le Nguyen Binh 2018-09-03

Optical Multi-Bound Solitons describes the generation and transmission of multi-bound solitons with the potential to form the basis of the temporal coding of optical data packets for next-generation nonlinear optical systems. The book deals with nonlinear systems in terms of their fundamental principles, associated phenomena, and signal processing applications in contemporary optical systems for communications and laser systems, with a touch of mathematical representation of nonlinear equations to offer insight into the nonlinear dynamics at different phases. The text not only delineates the strong background physics of such systems but also: Discusses the phase evolution of the optical carriers under the soliton envelopes for

the generation of multi-bound solitons Explains the generation of multi-bound solitons through optical fibers Examines new types of multi-bound solitons in passive and active optical resonators Conducts bi-spectral analyses of multi-bound solitons to identify the phase and power amplitude distribution property of bound solitons Presents experimental techniques for the effective generation of bound solitons Optical Multi-Bound Solitons provides extensive coverage of multi-bound solitons from the dynamics of their formation to their transmission over guided optical media. Appendices are included to supplement a number of essential definitions, mathematical representations, and derivations, making this book an ideal theoretical reference text as well as a practical professional guidebook.

Waves Called Solitons - Michel Remoissenet 2013-04-17

Nonlinearity is a fascinating element of nature whose importance has been appreciated for many years when considering large-amplitude wave motions observed in various fields ranging from fluids and plasmas to solid-state, chemical, biological, and geological systems. Localized large-amplitude waves called solitons, which propagate without spreading and have particle-like properties, represent one of the most striking aspects of nonlinear phenomena. Although a wealth of literature on the subject, including theoretical and numerical studies, is available in good recent books and research journals, very little material has found its way into introductory texbooks and curricula. This is perhaps due to a belief that nonlinear physics is difficult and cannot be taught at an introductory level to undergraduate students and practitioners. Consequently, there is considerable interest in developing practical material suitable for students, at the lowest introductory level. This book is intended

to be an elementary introduction to the physics of solitons, for students, physicists, engineers and practitioners. We present the modeling of nonlinear phenomena where soliton-like waves are involved, together with applications to a wide variety of concrete systems and experiments. This book is designed as a book of physical ideas and basic methods and not as an up-to-the minute book concerned with the latest research results. The background in physics and the amount of mathematical knowledge assumed of the reader is within that usually accumulated by junior or senior students in physics.

Dissipative Solitons in Reaction Diffusion Systems - Andreas Liehr 2013-03-27

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 in Two-Dimensional Shallow Water - Yuji Kodama 2018-12-10

Web-like waves, often observed on the surface of shallow water, are examples of nonlinear waves. They are generated by nonlinear interactions among several obliquely propagating solitary waves, also known as solitons. In this book, modern mathematical tools?algebraic geometry, algebraic combinatorics, and representation theory, among others?are used to analyze these two-dimensional wave patterns. The author?s primary goal is to explain some details of the classification problem of the soliton solutions of the KP equation (or KP solitons) and their applications to shallow water waves. This book is intended for researchers and graduate students.

Physics of Solitons - Thierry Dauxois 2006-03-09

This textbook gives an instructive view of solitons and their applications for advanced students of physics.

Optical Solitons Due to Quadratic Nonlinearities - 2002

Introduction to Soliton Theory: Applications to Mechanics - Ligia Munteanu 2004-08-11

This monograph is planned to provide the application of the soliton theory to solve certain practical problems selected from the fields of solid mechanics, fluid mechanics and biomechanics. The work is based mainly on the authors' research carried out at their home institutes, and on some specified, significant results existing in the published literature. The methodology to study a given evolution equation is to seek the waves of permanent form, to test whether it possesses any symmetry properties, and whether it is stable and solitonic in nature. Students of physics, applied

mathematics, and engineering are usually exposed to various branches of nonlinear mechanics, especially to the soliton theory. The soliton is regarded as an entity, a quasi-particle, which conserves its character and interacts with the surroundings and other solitons as a particle. It is related to a strange phenomenon, which consists in the propagation of certain waves without attenuation in dissipative media. This phenomenon has been known for about 200 years (it was described, for example, by the Joule Verne's novel Les histoires de Jean Marie Cabidoulin, Éd. Hetzel), but its detailed quantitative description became possible only in the last 30 years due to the exceptional development of computers. The discovery of the physical soliton is attributed to John Scott Russell. In 1834, Russell was observing a boat being drawn along a narrow channel by a pair of horses.

Waves Called Solitons - M. Remoissenet 1996

This book is an elementary introduction to the fascinating world of waves called solitons. These large-amplitude waves, which can propagate over long distances without dispersing and which display particle-like properties, are one of the most striking manifestations of nonlinearity. The main concepts are introduced at an elementary level accessible to the undergraduate. In a self-contained and interdisciplinary whole, such topics as electrical, hydrodynamic, chemical, and optical solitons, are discussed. Many of the author's choices of emphasis have been made with experiments in mind; several experiments can readily be performed by the reader. This book is not meant for specialists but for students, physicists, engineers, and practitioners. The chapters are independently written in order that the reader should quickly find the required information. The second edition of this highly

praised book has new material, especially on nonlinear transmission lines, on various forms of modulational instabilities, and on quantum optical solitons.

Optical Solitons: Theoretical Challenges and Industrial Perspectives - Vladimir E. Zakharov 2013-04-17

1 2 V. E. Zakharov and S. Wabnitz 1 L. D. Landau Institute for Theoretical Physics, 2 Kosygin Str. , 117334 Moscow, Russia 2 Laboratoire de Physique, University of Bourgogne, 9 avenue A. Savary, 21078 Dijon, France After about a quarter of a century since the first theoretical predictions of op tical solitons, the industrial application of the optical soliton concept is near to reality in the booming field of modern telecommunications, where the de mand for high-speed data transmission and routing is of ever-growing. This book contains a set of lectures that were presented at a Les Houches school on optical solitons in September 1998. The school was successful in gathering among the lecturers most of the well-recognized world leaders in the field of optical solitons. A variety of different aspects of research into optical solitons was exposed in the lectures, ranging from the mathematical fundations of integrability theory to the rapidly evolving technological advances of fiber soliton-based telecommu nication systems. The overall impression that the participants and the students received from the school is that this field of research is an excellent example of the rapid transfer that occurs nowadays from basic science to the technological implementations of the first principles. The subjects that were covered by the lectures can be broadly grouped into four main categories: optical soliton the ory, fiber soliton telecommunications, optical soliton generation methods, and all-optical information processing via spatial solitons.

Solitons - P. G. Drazin 1989-02-09

This textbook is an introduction to the theory of solitons in the physical sciences.

Topological Solitons - Nicholas Manton 2004-06-10

Topological solitons occur in many nonlinear classical field theories. They are stable, particle-like objects, with finite mass and a smooth structure. Examples are monopoles and Skyrmions, Ginzburg-Landau vortices and sigma-model lumps, and Yang-Mills instantons. This book is a comprehensive survey of static topological solitons and their dynamical interactions. Particular emphasis is placed on the solitons which satisfy first-order Bogomolny equations. For these, the soliton dynamics can be investigated by finding the geodesics on the moduli space of static multi-soliton solutions. Remarkable scattering processes can be understood this way. The book starts with an introduction to classical field theory, and a survey of several mathematical techniques useful for understanding many types of topological soliton. Subsequent chapters explore key examples of solitons in one, two, three and four dimensions. The final chapter discusses the unstable sphaleron solutions which exist in several field theories.

Advanced Digital Optical Communications - Le Nguyen Binh 2017-11-22

This second edition of Digital Optical Communications provides a comprehensive treatment of the modern aspects of coherent homodyne and self-coherent reception techniques using algorithms incorporated in digital signal processing (DSP) systems and DSP-based transmitters to overcome several linear and nonlinear transmission impairments and frequency mismatching between the local oscillator and the carrier, as well as clock recovery and cycle slips. These modern transmission systems have emerged

as the core technology for Tera-bits per second (bps) and Peta-bps optical Internet for the near future. Featuring extensive updates to all existing chapters, Advanced Digital Optical Communications, Second Edition: Contains new chapters on optical fiber structures and propagation, optical coherent receivers, DSP equalizer algorithms, and high-order spectral DSP receivers Examines theoretical foundations, practical case studies, and MATLAB® and Simulink® models for simulation transmissions Includes new end-of-chapter practice problems and useful appendices to supplement technical information Downloadable content available with qualifying course adoption Advanced Digital Optical Communications, Second Edition supplies a fundamental understanding of digital communication applications in optical communication technologies, emphasizing operation principles versus heavy mathematical analysis. It is an ideal text for aspiring engineers and a valuable professional reference for those involved in optics, telecommunications, electronics, photonics, and digital signal processing.

Hamiltonian Methods in the Theory of Solitons - Ludwig Faddeev 2007-08-10

The main characteristic of this classic exposition of the inverse scattering method and its applications to soliton theory is its consistent Hamiltonian approach to the theory. The nonlinear Schrödinger equation is considered as a main example, forming the first part of the book. The second part examines such fundamental models as the sine-Gordon equation and the Heisenberg equation, the classification of integrable models and methods for constructing their solutions.

Optical Solitons - J. R. Taylor 1992-04-23

Provides an overview of our current understanding of optical soliton properties introducing the subject

for students and reviewing the most recent research.

Basics of Solitons - 1982

On solitons, mathematical theory, and its applications in applied mathematics and physics; papers presented at a seminar, Jadavpur University, Calcutta.

Solitons in Optical Fibers - Linn F. Mollenauer 2006-03-08

Solitons are waves that retain their form through obstacle and distance. Solitons can be found in hydrodynamics, nonlinear optics, plasma physics, and biology. Optical solitons are solitary light waves that hold their form over an expansive interval. Conservation of this form creates an effective model for long distance voice and data transmission. The application of this principle is essential to the technology of wired communications. Optical solitons produce crystal clear phone calls cross-country and internationally. It is because of these that someone on the other end of the phone sounds 'in the next room.' It is also pertinent to high-speed network information transmittal. Mollenauer and Gordon have written the only text that an engineer or graduate student will need to understand this foundation subject in optics. *Written by Linn Mollenauer and James Gordon who are celebrated for applying optical solitons to telecommnications *Combines mathematical developments with well-chosen practical examples and design formulas *Extensive material on the basic physics of fiber optic transmission and its practical applications

Slowly Varying Oscillations And Waves: From Basics To Modernity - Lev Ostrovsky 2022-02-23

The beauty of the theoretical science is that quite different physical, biological, etc. phenomena can often be described as similar mathematical objects, by similar differential (or other) equations. In the

20th century, the notion of 'theory of oscillations' and later 'theory of waves' as unifying concepts, meaning the application of similar methods and equations to quite different physical problems, came into being. In the variety of applications (quite possibly in most of them), the oscillatory process is characterized by a slow (as compared with the characteristic period) variation of its parameters, such as the amplitude and frequency. The same is true for the wave processes.This book describes a variety of problems associated with oscillations and waves with slowly varying parameters. Among them the nonlinear and parametric resonances, self-synchronization, attenuated and amplified solitons, self-focusing and self-modulation, and reaction-diffusion systems. For oscillators, the physical examples include the van der Pol oscillator and a pendulum, models of a laser. For waves, examples are taken from oceanography, nonlinear optics, acoustics, and biophysics. The last chapter of the book describes more formal asymptotic perturbation schemes for the classes of oscillators and waves considered in all preceding chapters.

Partial Differential Equations and Solitary Waves Theory - Abdul-Majid Wazwaz 2010-05-28

"Partial Differential Equations and Solitary Waves Theory" is a self-contained book divided into two parts: Part I is a coherent survey bringing together newly developed methods for solving PDEs. While some traditional techniques are presented, this part does not require thorough understanding of abstract theories or compact concepts. Well-selected worked examples and exercises shall guide the reader through the text. Part II provides an extensive exposition of the solitary waves theory. This part handles nonlinear evolution equations by methods such as Hirota’s bilinear method or the tanh-coth method. A self-contained treatment is presented to

discuss complete integrability of a wide class of nonlinear equations. This part presents in an accessible manner a systematic presentation of solitons, multi-soliton solutions, kinks, peakons, cuspons, and compactons. While the whole book can be used as a text for advanced undergraduate and graduate students in applied mathematics, physics and engineering, Part II will be most useful for graduate students and researchers in mathematics, engineering, and other related fields. Dr. Abdul-Majid Wazwaz is a Professor of Mathematics at Saint Xavier University, Chicago, Illinois, USA.