Basic Of Solitons

Approach your problems from the It isn't that they can't see the end and begin with the answers. solution. It is that they can't Then one day, perhaps you will see the problem. find the final question. G.K. Chesterton. The Scandal of 'The Hermit Clad in Crane Father Brown 'The Point of a Pin'. Feathers' in R. van Gulik's The Chinese Maze Murders. Growing specialization and diversification have brought a host of mono graphs and textbooks on increasingly topics. However, the "tree" of knowledge of mathematics and related fields does not grow only by putting forth new branches. It also happens, quite often in fact, that branches which were thought to be completely disparate are suddenly seen to be related. Further, the kind and level of sophistication of mathematics applied in various sciences has changed drastically in recent years: measure theory is used (non-trivially) in regional and theoretical economics; algebraic geometry interacts with physics; the Minkowsky lemma, coding theory and the structure of water meet one another in packing and covering theory; quantum fields, crystal defects and mathematical pro gramming profit from homotopy theory; Lie algebras are relevant to filtering; and prediction and electric engineering can use Stein spaces. And in addition to this there are such new emerging subdisciplines as "complete integrable systems", "chaos, synergetics and large-scale order", which are almost impossible to fit into the existing classifica tion schemes. The draw upon widely different sections of mathematics.

Readership: Physicists, mathematicians and mathematical physicists.
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. A classroom-tested introduction to integrated and fiber optics This text offers an in-depth treatment of integrated and fiber optics, providing graduate students, engineers, and scientists with a solid foundation of the principles, capabilities, uses, and limitations of guided-wave optic devices and systems. In addition to the transmission properties of dielectric waveguides and optical fibers, this book covers the principles of directional couplers, guided-wave gratings, arrayed-waveguide gratings, and fiber optic polarization components. The material is fully classroom-tested and carefully structured to help readers grasp concepts quickly and apply their knowledge to solving problems. Following an overview, including important nomenclature and notations, the text investigates three major topics: Integrated optics Fiber optics Pulse evolution and broadening in optical waveguides Each chapter starts with basic principles and gradually builds to more advanced concepts and applications. Compelling reasons for including each topic are given, detailed explanations of each concept are provided, and steps for each derivation are carefully set forth. Readers learn how to solve complex problems using physical concepts and simplified mathematics. Illustrations throughout the text aid in understanding key concepts, while problems at the end of each chapter test the readers' grasp of the material. The author has designed the text for upper-level undergraduates, graduate students in physics and electrical and computer engineering, and scientists. Each chapter is self-contained, enabling instructors to choose a subset of topics to match their particular

course needs. Researchers and practitioners can also use the text as a self-study guide to gain a better understanding of photonic and fiber optic devices and systems.

Solitons, Nonlinear Evolution Equations and Inverse Scattering

Electrical Solitons

Nonlinear Optics

Progress in Optics

Topological Solitons

This monograph is devoted to an entirely new branch of nonlinear physics - solitary intrinsic states, or autosolitons, which form in a broad class of physical, chemical and biological dissipative systems. Autosolitons are often observed as highly nonequilibrium regions in slightly nonequilibrium systems, in many ways resembling ball lightning which occurs in the atmosphere. We develop a new approach to problems of self-organization and turbulence, treating these phenomena as a result of spontaneous formation and subsequent evolution of autosolitons. Scenarios of self-organization involve sophisticated interactions between autosolitons, whereas turbulence is regarded as a pattern of autosolitons which appear and disappear at random in different parts of the system. This monograph is the first attempt to provide a comprehensive summary of the theory of autosolitons as developed by the authors over the years of research. The monograph is comprised of three more or less autonomous parts. Part I deals with the physical nature and experimental studies of autosolitons and self organization in various physical systems: semiconductor and gas plasma, heated gas mixture, semiconductor structures,

composite superconductors, optical and magnetic media, systems with uniformly generated combustion matter, distributed gas-discharge and electronic systems. We discuss feasibility of autosolitons in the form of highly nonequilibrium regions in slightly nonequilibrium gases and semiconductors, "hot" and "cold" regions in semiconductor and gas plasmas, static, pulsating and traveling combustion fronts.

This volume is an introduction to nonlinear waves and soliton theory in the special environment of compact spaces such a closed curves and surfaces and other domain contours. It assumes familiarity with basic soliton theory and nonlinear dynamical systems. The first part of the book introduces the mathematical concept required for treating the manifolds considered, providing relevant notions from topology and differential geometry. An introduction to the theory of motion of curves and surfaces - as part of the emerging field of contour dynamics - is given. The second and third parts discuss the modeling of various physical solitons on compact systems, such as filaments, loops and drops made of almost incompressible materials thereby intersecting with a large number of physical disciplines from hydrodynamics to compact object astrophysics. This book is intended for graduate students and researchers in mathematics, physics and engineering. This new edition has been thoroughly revised, expanded and updated.

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

The second edition of a highly successful book on nonlinear waves, solitons and chaos.

Nonlinearities in Periodic Structures and Metamaterials

Theory, Design, and Applications

Basic Methods Of Soliton Theory

Waves Called Solitons

Baryons As Skyrme Solitons - Proceedings Of The International Workshop

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.

The book is devoted to the mathematical theory of soliton phenomena on the plane. The inverse spectral transform method which is a main tool for the study of the (2+1)-dimensional soliton

equation is reviewed. The ?-problem and the Riemann-Hilbert problem method are discussed. Several basic examples of soliton equations are considered in detail. This volume is addressed both to the nonexpert and to the researcher in the field. This is the first literature dealing specifically with multidimensional solition equations. Contents:IntroductionDressing Method, The Kadomtsev-Petviashvili EquationThe Modified Kadomtsev-Petviashvili EquationThe Davey-Stewartson EquationThe Ishimori EquationThe 2+1-Dimensional Integrable Sine-Gordon EquationExtensions of the ?-Dressing Method Readership: Applied mathematicians, mathematical physicists and researchers in chaos and in nonlinear sciences. keywords:Bibliography;Korteweg De Vries Equation;Dressing Method;Riemann-Hilbert Problems;Inverse Scattering Transform;Kadomtsev-Petviashvili Equations;Modified Kadomtsev-Petviashvili Equations;Modified Korteweg- De Vries Equation;Miura Transform;Davey-Stewartson Equations;Ishimori Equations;Heisenberg-

Ferromagnet Model;Sine-Gordon Equation
“The remarkable discovery for the algebraic structure governing the sequence of conserved quantities in the kdV, KP or non-linear Schrödinger dynamics was a long time restricted to a one-dimensional spatial coordinate system. The multidimensional analogs are much harder and for this reason very intriguing to tame. The book by Konopelchenko offers a first organized exposition of the inverse spectral transform technique applied to 2D integrable systems of the same category. The elegant and original combination of complex analysis, spectral theory and infinite dimensional algebra is a high mark of this text.” Professor Mihai Putinar University of California at Santa Barbara
The first nonlinear optical effect was observed in the 19th century by John Kerr. Nonlinear optics, however, started to grow up only after the invention of the laser, when intense light sources became easily available. The seminal studies by Peter Franken and Nicolaas Bloembergen, in the 1960s,

paved the way for the development of today’s nonlinear photonics, the field of research that encompasses all the studies, designs, and implementations of nonlinear optical devices that can be used for the generation, communication, and processing of information. This field has attracted significant attention, partly due to the great potential of exploiting the optical nonlinearities of new or advanced materials to induce new phenomena and achieve new functions. According to Clarivate Web of Science, almost 200,000 papers were published that refer to the topic “nonlinear optic*”. Over 36,000 papers were published in the last four years (2015–2018) with the same keyword, and over 17,000 used the keyword “nonlinear photonic*”. The present Special Issue of Micromachines aims at reviewing the current state of the art and presenting perspectives of further development. Fundamental and applicative aspects are considered, with special attention paid to hot topics that may lead to technological and scientific breakthroughs.

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.

Inverse Spectral Transform Method

Theoretical and Experimental Challenges

Autosolitons

The Defocusing Nonlinear Schr?dinger Equation

Many Degrees of Freedom in Field Theory

Nonlinear Optical Systems: Principles, Phenomena, and Advanced Signal Processing is a simplified overview of the evolution of technology associated with nonlinear systems and advanced signal processing. This book's coverage ranges from fundamentals to phenomena to the most cutting-edge aspects of

systems for next-generation biomedical monitoring an

Optical information processing of the future is associated with a new generation of compact nanoscale optical devices operating entirely with light. Moreover, adaptive features such as self-guiding, reconfiguration and switching become more and more important. Nonlinear devices offer an enormous potential for these applications. Consequently, innovative concepts for all-optical communication and information technologies based on nonlinear effects in photonic-crystal physics and nanoscale devices as metamaterials are of high interest. This book focuses on nonlinear optical phenomena in periodic media, such as photonic crystals, optically-induced, adaptive lattices, atomic lattices or metamaterials. The main purpose is to describe and overview new physical phenomena that result from the interplay between nonlinearities and structural periodicities and is a guide to actual and future developments for the expert reader in optical information processing, as well as in

the physics of cold atoms in optical lattices.

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.

It is ironic that the ideas ofNewton, which described a beam of light as a stream ofparticles made it difficult for him to explain things like thin film interference. Yet these particles, called 'photons', have caused the adjective 'photonic' to gain common usage, when referring to optical phenomena. The purist might argue that only when we are confronted by the particle nature of light should we use the word photonics. Equally, the argument goes on, only when we are face-to face with an integrable system, i. e. one that possesses an infinite number of conserved quantities, should we say soliton rather than solitary wave. Scientists and engineers are pragmatic, however, and they are happy to use the word 'soliton' to describe what appears to be an excitation that is humped, multi humped, or localised

long enough for some use to be made of it. The fact that such 'solitons' may stick to each other (fuse) upon collision is often something to celebrate for an application, rather than just evidence that, after all, these are not really solitons, in the classic sense. 'Soliton', therefore, is a widely used term with the qualification that we are constantly looking out for deviant behaviour that draws our attention to its solitary wave character. In the same spirit, 'photonics' is a useful generic cover-all noun, even when 'electromagnetic theory' or 'optics' would suffice.

Concepts and Experiments

Nonlinear Optical Systems

Mathematical Methods for Physicists

Slowly Varying Oscillations And Waves: From Basics To Modernity

Nonlinear Waves, Solitons and Chaos

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.

Solitons were discovered by John Scott Russel in 1834 and have intrigued scientists and mathematicians ever since. They have been the subject of a large body of research not only in mathematics and physics, but also engineering, biology, and other disciplines. This volume comprises the presentations at an interdisciplinary workshop held at Querns University in Kingston, Ontario. It includes chapters on mathematical and numerical aspects of solitons, recent developments in string theory, and applications of solitons in such areas as nuclear and particle physics, cosmology, and condensed-matter physics.

In the forty-eight years that have gone by since the first volume of Progress in Optics was published, optics has become one of the most dynamic fields of science. The volumes in this series which have appeared up to now contain more than 300 review articles by distinguished research workers, which have become permanent records for many important developments. - 3D optical microscopy - Transformation optics and geometry of light - Photorefractive solitons - Stimulated scattering effects - Optical vortices and polarization singularities - Quantum feedforward control of light

*The first complete guide to nonlinear theory and practice for engineers Nonlinear Optics is a highly accessible, applications-oriented introduction to a new and rapidly growing field. An indispensable resource for both electrical engineering students and professionals working in the telecommunications and optoelectronics industry, it: * Treats the subject of nonlinear optics in purely classical terms for electrical engineers * Offers*

*numerous real-world examples clearly demonstrating the connection between theory and practical application * Features helpful chapter-end problems and numerous examples * Explores current and future applications of nonlinear optics in telecommunications, computers, and other fields Due to its many applications in fiber-optic communications and optoelectronics the propagation of light through nonlinear media is an increasingly important topic among electrical engineers. Unfortunately, books geared to the specific concerns of electrical engineering students and professionals in the telecommunications and optoelectronics industry continue to be in short supply. This book is designed to fill that gap. Nonlinear Optics is a complete, self-contained, applications-oriented introduction to the field. In an effort to make this book as accessible as possible to its intended audience, E. G. Sauter has foregone quantum mechanical descriptions, choosing instead to treat the subject of nonlinear optics in purely classical terms. He has also included numerous real-world examples that clearly demonstrate the connection between theory and practical application. The book begins with the theoretical foundations for the practical discussions that follow. Dr. Sauter treats the basic relations between polarization and electric field strength, the different nonlinear effects of polarizations of order two and three, wave propagation of complex phasors in nonlinear media and anisotropic media, and the conservation of energy and momentum in nonlinear processes. Over the six chapters that follow, these theories are applied to specific cases, including the linear electrooptic effects; second harmonic generation; parametric effects; four-wave mixing, including the Raman and Brillouin effects; and the optical Kerr effect.*

The remaining chapters present in-depth discussions of pulse propagation, solitons, and nonlinear effects in glass fibers. Helpful problems appear at the end of each chapter, and numerous worked and unworked examples are scattered throughout the text to elucidate principles and clarify complex material. A highly accessible, applications-oriented introduction to a new and rapidly growing field, Nonlinear Optics is an indispensable resource for both electrical engineering students and working professionals.

Solitons and Particles

Advanced Digital Optical Communications

Optical Solitons

Principles, Phenomena, and Advanced Signal Processing

Solitons & Polarons in Conducting Polymers

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

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.

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.

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.

From Dark Solitons to Vortices and Vortex Rings

Physics of Solitons
Solitons
Les Houches Workshop, September 28 – October 2, 1998
Foundations for Guided-Wave Optics

1.1 Why Study Solitons? The last century of physics, which was initiated by Maxwell's completion of the theory of electromagnetism, can, with some justification, be called the era of linear physi cs. ~Jith few excepti ons, the methods of theoreti ca 1 phys ics have been dominated by linear equations (Maxwell, Schrodinger), linear mathematical objects (vector spaces, in particular Hilbert spaces), and linear methods (Fourier transforms, perturbation theory, linear response theory) . Naturally the importance of nonlinearity, beginning with the Navier-Stokes equations and continuing to gravitation theory and the interactions of par ticles in solids, nuclei, and quantized fields, was recognized. However, it was hardly possible to treat the effects of nonlinearity, except as a per turbation to the basis solutions of the linearized theory. During the last decade, it has become more widely recognized in many areas of "field physics" that nonlinearity can result in qualitatively new phenom ena which cannot be constructed via perturbation theory starting from linear ized equations. By "field physics" we mean all those areas of theoretical physics for which the description of physical phenomena leads one to consider field equations, or partial differential equations of the form (1.1.1) ~t or ~tt = F(~, ~x ...) for one- or many-component "fields" Ht, x, y ...) (or their quantum analogs).

Volumes 30 and 31 of this series, dealing with "Many Degrees of Freedom," contain the proceedings of the 1976 International Summer Institute of Theoretical Physics, held at the university of Bielefeld from August 23 to September 4, 1976. This institute was the eighth in a series of summer schools devoted to particle physics and organized by universities and research institutes in

the Federal Republic of Germany. Many degrees of freedom and collective phenomena play a critical role in the description and understanding of elementary particles. The lectures in this volume were intended to display how these structures occur in various recent developments of mathematical physics. Lectures ranged from classical nonlinear field theory over classical soliton models, constructive quantum field theory with soliton solutions and gauge models to the recent unified description of renormalization group tech niques in probabilistic language and to quantum statisti cal dynamics in terms of derivations. The Institute took place at the Center for Inter disciplinary Research of the University of Bielefeld. On behalf of all participants, it is a pleasure to thank the officials and the administration of the Center for their cooperation and help before and during the Insti tute. Special thanks go to V.C. Fulland, M. Kamper, and A. Kottenkamp for their rapid and competent preparation of the manuscripts.

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

The need for advanced transmission techniques over long haul optically amplified communications has prompted a convergence of digital and optical communications. Digital Optical Communications explores the practical applications of this union and applies digital modulation techniques to optical communications systems.After reviewing the fundamental

Solitons in Molecular Systems

Massive WDM and TDM Soliton Transmission Systems

Nonlinear Photonics Devices

Nonlinear Waves and Solitons on Contours and Closed Surfaces

Optical Solitons: Theoretical Challenges and Industrial Perspectives

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

Most of the material in this volume is new. The first three chapters deal with three important fiber-optic components--fiber-based gratings, couplers, and interferometers--that serve as the building blocks of lightwave technology. In view of the enormous impact of rare-earth-doped fibers, amplifiers and lasers made by using such fibers are covered in Chapters 4 and 5. The last three chapters describe important applications of nonlinear fiber optics and are devoted to pulse-compression techniques, fiber-optic communication systems, and soliton-based transmission schemes. This volume should serve well the need of the scientific community interested in such fields as ultrafast phenomena, optical amplifiers and lasers,

and optical communications. It will also be useful to graduate students as well as scientists and engineers involved in lightwave technology. * Training resource for engineers involved with lightwave technology * Covers the importance of nonlinear effects in designing WDM lightwave systems * Up to date information for researchers

This volume on Advanced Electronic Technologies and Systems based on Low Dimensional Quantum Devices closes a three years series of NATO -AS!' s. The first year was focused on the fundamental properties and applications. The second year was devoted to Devices Based on Low-Dimensional Semiconductor Structures. The third year is covering Systems Based on Low-Dimensional Quantum Semiconductor Devices. The three volumes containing the lectures given at the three successive NATO -ASI's constitute a complete review on the latest advances in semiconductor Science and Technology from the methods of fabrication of the quantum structures through the fundamental physics am basic knowledge of properties and projection of performances to the technology of devices and systems. In the first volume: " Fabrication, Properties and Application of Low Dimensional Semiconductors" are

described the practical ways in which quantum structures are produced, the present status of the technology, difficulties encountered, and advances to be expected. The basic theory of Quantum Wells, Double Quantum Wells and Superlattices is introduced and the fundamental aspects of their optical properties are presented. The effect of reduction of dimensionality on lattice dynamics of quantum structures is also discussed. In the second volume: " Devices Based on Low Dimensional Structures" the fundamentals of quantum structures and devices in the two major fields: Electro-Optical Devices and Pseudomorphic High Eectron Mobility Transistors are extensively discussed.

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 Electronic Technologies and Systems Based on Low-Dimensional Quantum Devices

Ultrafast Fiber Switching Devices and Systems

Solitons in Physics, Mathematics, and Nonlinear Optics

Digital Optical Communications

From Fibers to Photonic Crystals

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. Bose?Einstein condensation is a phase

transition in which a fraction of particles of a boson gas condenses into the same quantum state known as the Bose?Einstein condensate (BEC). The aim of this book is to present a wide array of findings in the realm of BECs and on the nonlinear Schr?dinger-type models that arise therein. The Defocusing Nonlinear Schr?dinger Equation is a broad study of nonlinear excitations in self-defocusing nonlinear media. It summarizes state-of-the-art knowledge on the defocusing nonlinear Schr?dinger-type models in a single volume and contains a wealth of resources, including over 800 references to relevant articles and monographs and a meticulous index for ease of navigation.

This 1992 book surveys the field of ultrafast fiber switching devices and systems that have potential processing speeds in excess of 50 gigabits-per-second. The treatment covers basic physical principles, device physics and systems applications. The purpose of the book is to provide a complete tour of the key research issues and approaches in ultrafast switching. Topics covered include routing and logic devices, solitons in optical fibers, and the application of ultrafast gates to telecommunications transmission systems, local area networks and optical computing.

The author is a member of the Technical Staff in basic research at AT&T Bell Laboratories, Holmdel, and is excellently positioned to provide this state-of-the-art survey in this exciting and advancing field. The book will be of great value to all researchers and graduate students working in the areas of high-speed electronics, optical data processing, nonlinear guided-wave optics, and photonic switching.
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.

Applications of Nonlinear Fiber Optics

Spatial Solitons

Solitons in Multidimensions

Soliton-driven Photonics

A New Approach to Problems of Self-Organization and Turbulence

Polyacetylence, (CH)x is the simplest conjugated polymer. Prestine polyacetylence is a good insulator, whereas its highly doped version exhibits metal-like electrical conductivity. This book gives a detailed introduction to this rapidly-developing field is given along with a collection of original papers. The

main purpose is to help chemists and physicists grasp the main ideas and most important facts; an expert may also find it useful as a reference volume.
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.
This book summarizes the proceedings of the invited talks presented at the "International Symposium on Massive TDM and WDM Optical Soliton Tra- mission Systems" held in Kyoto during November 9-12, 1999. The symposium is the third of the series organized by Research Group for Optical Soliton C- munications (ROSC) chaired by Akira Hasegawa. The research group, ROSC, was established in Japan in April 1995 with a support of the Japanese Ministry of Post and Telecommunications to promote collaboration and information - change among communication service companies, communication industries and academic circles in the theory and application of optical solitons. The symposium attracted enthusiastic response from worldwide researchers in the field of soliton based communications and intensive

discussions were made. In the symposium held in 1997, new concept of soliton transmission based on dispersion management of optical fibers were presented. This new soliton is now called the dispersion managed soliton. The present symposium mainly focuses the theoretical and experimental developments of dispersion managed solitons. It is remarkable that the concept of the dispersion managed soliton, which was just born two years ago when the naming was not even given yet, has become the center of soliton research in two years. The dispersion managed soliton has an enhanced power in maintaining reasonable signal to noise ratio, yet has reduced Gordon-Haus timing jitter by reduced averagedispersion. The dispersion managed soliton also has demonstrated its power in soliton based WDM transmissions.

Introduction to non-Kerr Law Optical Solitons

A ROSC Symposium