

The Versatile Soliton

Alexandre T. Filippov

The Versatile Soliton

Karl Erik Lonngren, Alwyn Scott



The Versatile Soliton:

The Versatile Soliton Alexandre T. Filippov, 2000-09-21 In this engaging book the concept of the soliton is traced from the beginning of the last century to modern times with its recent applications *Glimpses of Soliton Theory* Alex Kasman, 2010 Solitons are explicit solutions to nonlinear partial differential equations exhibiting particle like behavior This is quite surprising both mathematically and physically Waves with these properties were once believed to be impossible by leading mathematical physicists yet they are now not only accepted as a theoretical possibility but are regularly observed in nature and form the basis of modern fiber optic communication networks *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 Assuming only multivariable calculus and linear algebra as prerequisites this book introduces the reader to the KdV Equation and its multisoliton solutions elliptic curves and Weierstrass wp functions the algebra of differential operators Lax Pairs and their use in discovering other soliton equations wedge products and decomposability the KP Equation and Sato s theory relating the Bilinear KP Equation to the geometry of Grassmannians Notable features of the book include careful selection of topics and detailed explanations to make this advanced subject accessible to any undergraduate math major numerous worked examples and thought provoking but not overly difficult exercises footnotes and lists of suggested readings to guide the interested reader to more information and use of the software package Mathematica to facilitate computation and to animate the solutions under study This book provides the reader with a unique glimpse of the unity of mathematics and could form the basis for a self study one semester special topics or capstone course Solitons are explicit solutions to nonlinear partial differential equations exhibiting particle like behavior This is quite surprising both mathematically and physically Waves with these properties were once believed to be impossible by leading mathematical physicists yet they are now not only accepted as a theoretical possibility but are regularly observed in nature and form the basis of modern fiber optic communication networks *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 Assuming only multivariable calculus and linear algebra as prerequisites this book introduces the reader to the KdV Equation and its multisoliton solutions elliptic curves and Weierstrass wp functions the algebra of differential operators Lax Pairs and their use in discovering other soliton equations wedge products and decomposability the KP Equation and Sato s theory relating the Bilinear KP Equation to the geometry of Grassmannians Notable features of the book include careful selection of topics and detailed explanations to make this advanced subject

accessible to any undergraduate math major numerous worked examples and thought provoking but not overly difficult exercises footnotes and lists of suggested readings to guide the interested reader to more information and use of the software package Mathematica to facilitate computation and to animate the solutions under study This book provides the reader with a unique glimpse of the unity of mathematics and could form the basis for a self study one semester special topics or capstone course

Topological and Non-Topological Solitons in Scalar Field Theories Yakov M. Shnir, 2018-07-26

Solitons emerge in various non linear systems as stable localized configurations behaving in many ways like particles from non linear optics and condensed matter to nuclear physics cosmology and supersymmetric theories This book provides an introduction to integrable and non integrable scalar field models with topological and non topological soliton solutions Focusing on both topological and non topological solitons it brings together debates around solitary waves and construction of soliton solutions in various models and provides a discussion of solitons using simple model examples These include the Korteweg de Vries system sine Gordon model kinks and oscillons and skyrmions and hopfions The classical field theory of scalar field in various spatial dimensions is used throughout the book in presentation of related concepts both at the technical and conceptual level Providing a comprehensive introduction to the description and construction of solitons this book is ideal for researchers and graduate students in mathematics and theoretical physics

Soliton Nature Sergei Eremenko, 2019-12-04

Dedicated to a broad audience and scientists this new generation easy to read pictorial interactive book uses beautiful photography video channel and computer scripts in R and Python to demonstrate existing and explore new solitons the magnificent and versatile energy concentration phenomenon of nature With 200 images and videos collected around the world and on magnificent Australian beaches we describe captivating stand alone ocean solitons capable of travelling hundreds of miles uninterrupted Along with scary tsunamis the tricky solitonic bores propagating upstream narrow river channels may cause disasters for coastal cities Sudden killer rogue waves endanger even large ships Powerful tornadoes surfing tubes whirlpools and rotating galaxies are solitonic vortices Unique videos of breathers and soliton envelope waves with legendary Ninth Wave in the middle are commented by some legendary scientists Beautiful photography of square grid waves confirms tendency of nature to produce multi dimensional formations Solitonic dislocations and defects are widespread in metal shapes around us Solitonic energy localization effects appear in swing movements of humans perfected them in many sports and dances We also explore new solitonic hypothesis and theories Geosolitons may have played an important role in formation of mountain ranges and sedimentary rocks Using solitonic functions for heart blood pressure pulses may lead to new generation devices Solitonic dislocation and stability effects may exist in behaviour of correlated financial markets New class of atomic solitons can be used to describe Higgs boson the god particle fields spacetime quanta and other fundamental building blocks of nature Readers are welcomed to subscribe and provide own videos to our dedicated video channel and website www.solitonnature.com

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 Schr dinger 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 **Mathematical Reviews** ,2006 **Choice** ,2001 IEICE Transactions on Electronics ,2002

Nonlinear Guided Waves and Their Applications ,2002 *Analog Science Fiction & Fact* ,2003 **Modeling Pattern Formation in Myxobacteria** Oleg Adolfovich Igoshin,2004 **The Mathematical Gazette** ,2001 ,2004 Solitons in Nuclear and Elementary Particle Physics Alan Chodos,E. Hadjimichael,Chia-Hsiung Tze,1984 Optical Amplifiers and Their Applications Mikhail N. Zervas,Alan E. Willner,Shinya Sasaki,1997 Includes bibliographical references p 506 520 and index **La Rivista del Nuovo cimento** Società italiana di fisica,2004 International Conference on Transparent Optical Networks ,2001 *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 *VLSI Technologies Through the 80s and Beyond* Denis J. McGreivy,Kenneth A. Pickar,1982 **Solitons in Action** Karl Erik Lonngren,Alwyn Scott,1978

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The Versatile Soliton Introduction

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