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KEY=EQUATIONS - ASHTYN JASE

Nonlinear Wave Equations

American Mathematical Soc. **The theory of nonlinear wave equations in the absence of shocks began in the 1960s. Despite a great deal of recent activity in this area, some major issues remain unsolved, such as sharp conditions for the global existence of solutions with arbitrary initial data, and the global phase portrait in the presence of periodic solutions and traveling waves. This book, based on lectures presented by the author at George Mason University in January 1989, seeks to present the sharpest results to date in this area. The author surveys the fundamental qualitative properties of the solutions of nonlinear wave equations in the absence of boundaries and shocks. These properties include the existence and regularity of global solutions, strong and weak singularities, asymptotic properties, scattering theory and stability of solitary waves. Wave equations of hyperbolic, Schrodinger, and KdV type are discussed, as well as the Yang-Mills and the Vlasov-Maxwell equations. The book offers readers a broad overview of the field and an understanding of the most recent developments, as well as the status of some important unsolved problems. Intended for mathematicians and physicists interested in nonlinear waves, this book would be suitable as the basis for an advanced graduate-level course.**

Nonlinear Wave Equations, Formation of Singularities

American Mathematical Soc. **This is the second volume in the University Lecture Series, designed to make more widely available some of the**

outstanding lectures presented in various institutions around the country. Each year at Lehigh University, a distinguished mathematical scientist presents the Pitcher Lectures in the Mathematical Sciences. This volume contains the Pitcher lectures presented by Fritz John in April 1989. The lectures deal with existence in the large of solutions of initial value problems for nonlinear hyperbolic partial differential equations. As is typical with nonlinear problems, there are many results and few general conclusions in this extensive subject, so the author restricts himself to a small portion of the field, in which it is possible to discern some general patterns. Presenting an exposition of recent research in this area, the author examines the way in which solutions can, even with small and very smooth initial data, ``blow up'' after a finite time. For various types of quasi-linear equations, this time depends strongly on the number of dimensions and the ``size'' of the data. Of particular interest is the formation of singularities for nonlinear wave equations in three space dimensions.

Nonlinear Wave Equations

A Conference in Honor of Walter A. Strauss on the Occasion of His Sixtieth Birthday, May 2-3, 1998, Brown University

American Mathematical Soc. **This volume presents original research papers and expository articles from the conference in honor of Walter A. Strauss's sixtieth birthday held at Brown University in Providence (RI). The book offers a collection of original papers and expository articles mainly devoted to the study of nonlinear wave equations. The articles cover a wide range of topics, including scattering theory, dispersive waves, classical field theory, mathematical fluid dynamics, kinetic theory, stability theory, and variational methods. The book offers a nice cross-section of current trends and research directions in the study of nonlinear wave equations and related topics.**

Nonlinear Wave Equations

CRC Press **This work examines the mathematical aspects of nonlinear wave propagation, emphasizing nonlinear hyperbolic problems. It introduces the tools that are most effective for exploring the problems of local and global existence, singularity formation, and large-time behaviour of solutions, and**

for the study of perturbation methods.

Lectures on Non-linear Wave Equations

Lectures on the Energy Critical Nonlinear Wave Equation

American Mathematical Soc. **This monograph deals with recent advances in the study of the long-time asymptotics of large solutions to critical nonlinear dispersive equations. The first part of the monograph describes, in the context of the energy critical wave equation, the "concentration-compactness/rigidity theorem method" introduced by C. Kenig and F. Merle. This approach has become the canonical method for the study of the "global regularity and well-posedness" conjecture (defocusing case) and the "ground-state" conjecture (focusing case) in critical dispersive problems. The second part of the monograph describes the "channel of energy" method, introduced by T. Duyckaerts, C. Kenig, and F. Merle, to study soliton resolution for nonlinear wave equations. This culminates in a presentation of the proof of the soliton resolution conjecture, for the three-dimensional radial focusing energy critical wave equation. It is the intent that the results described in this book will be a model for what to strive for in the study of other nonlinear dispersive equations. A co-publication of the AMS and CBMS.**

Nonlinear Wave Equations

Springer **This book focuses on nonlinear wave equations, which are of considerable significance from both physical and theoretical perspectives. It also presents complete results on the lower bound estimates of lifespan (including the global existence), which are established for classical solutions to the Cauchy problem of nonlinear wave equations with small initial data in all possible space dimensions and with all possible integer powers of nonlinear terms. Further, the book proposes the global iteration method, which offers a unified and straightforward approach for treating these kinds of problems. Purely based on the properties of solut ions to the corresponding linear problems, the method simply applies the contraction mapping principle.**

Nonlinear Wave Equations Perturbed by Viscous Terms

Walter de Gruyter **The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. Editorial Board Lev Birbrair, Universidade Federal do Ceará, Fortaleza, Brasil Victor P. Maslov, Russian Academy of Sciences, Moscow, Russia Walter D. Neumann, Columbia University, New York, USA Markus J. Pflaum, University of Colorado, Boulder, USA Dierk Schleicher, Jacobs University, Bremen, Germany**

Dispersive Equations and Nonlinear Waves

Generalized Korteweg–de Vries, Nonlinear Schrödinger, Wave and Schrödinger Maps

Springer **The first part of the book provides an introduction to key tools and techniques in dispersive equations: Strichartz estimates, bilinear estimates, modulation and adapted function spaces, with an application to the generalized Korteweg-de Vries equation and the Kadomtsev-Petviashvili equation. The energy-critical nonlinear Schrödinger equation, global solutions to the defocusing problem, and scattering are the focus of the second part. Using this concrete example, it walks the reader through the induction on energy technique, which has become the essential methodology for tackling large data critical problems. This includes refined/inverse Strichartz estimates, the existence and almost periodicity of minimal blow up solutions, and the development of long-time Strichartz inequalities. The third part describes wave and Schrödinger maps. Starting by building heuristics about multilinear estimates, it provides a detailed outline of this very active area of geometric/dispersive PDE. It focuses on concepts and ideas and should provide graduate students with a stepping stone to this exciting direction of research.**

Nonlinear Wave Equations

Nonlinear Waves

Theory, Computer Simulation, Experiment

Morgan & Claypool Publishers **The Boussinesq equation is the first model of surface waves in shallow water that considers the nonlinearity and the dispersion and their interaction as a reason for wave stability known as the Boussinesq paradigm. This balance bears solitary waves that behave like quasi-particles. At present, there are some Boussinesq-like equations. The prevalent part of the known analytical and numerical solutions, however, relates to the 1d case while for multidimensional cases, almost nothing is known so far. An exclusion is the solutions of the Kadomtsev-Petviashvili equation. The difficulties originate from the lack of known analytic initial conditions and the nonintegrability in the multidimensional case. Another problem is which kind of nonlinearity will keep the temporal stability of localized solutions. The system of coupled nonlinear Schroedinger equations known as well as the vector Schroedinger equation is a soliton supporting dynamical system. It is considered as a model of light propagation in Kerr isotropic media. Along with that, the phenomenology of the equation opens a prospect of investigating the quasi-particle behavior of the interacting solitons. The initial polarization of the vector Schroedinger equation and its evolution evolves from the vector nature of the model. The existence of exact (analytical) solutions usually is rendered to simpler models, while for the vector Schroedinger equation such solutions are not known. This determines the role of the numerical schemes and approaches. The vector Schroedinger equation is a spring-board for combining the reduced integrability and conservation laws in a discrete level. The experimental observation and measurement of ultrashort pulses in waveguides is a hard job and this is the reason and stimulus to create mathematical models for computer simulations, as well as reliable algorithms for treating the governing equations. Along with the nonintegrability, one more problem appears here - the multidimensionality and necessity to split and linearize the operators in the appropriate way.**

Linear and Nonlinear Waves

John Wiley & Sons **Now in an accessible paperback edition, this classic work is just as relevant as when it first appeared in 1974, due to the increased use of nonlinear waves. It covers the behavior of waves in two parts, with**

the first part addressing hyperbolic waves and the second addressing dispersive waves. The mathematical principles are presented along with examples of specific cases in communications and specific physical fields, including flood waves in rivers, waves in glaciers, traffic flow, sonic booms, blast waves, and ocean waves from storms.

Three Problems in the Theory of Nonlinear Wave Equations

Solitons and Nonlinear Wave Equations

Lectures on Nonlinear Wave Equations

International Pressof Boston Incorporated **This work presents three types of problems in the theory of nonlinear wave equations that have varying degrees of non-trivial overlap with harmonic analysis. The author discusses results including existence for certain quasilinear wave equations and for semilinear wave equations.**

On Solutions of Nonlinear Wave Equations

Nonlinear Oscillations of Hamiltonian PDEs

Springer Science & Business Media **Many partial differential equations (PDEs) that arise in physics can be viewed as infinite-dimensional Hamiltonian systems. This monograph presents recent existence results of nonlinear oscillations of Hamiltonian PDEs, particularly of periodic solutions for completely resonant nonlinear wave equations. The text serves as an introduction to research in this fascinating and rapidly growing field. Graduate students and researchers interested in variational techniques and nonlinear analysis applied to Hamiltonian PDEs will find inspiration in the book.**

Nonlinear Wave Equations

American Mathematical Soc. **This volume contains the proceedings of the AMS Special Session on Nonlinear Waves and Integrable Systems, held on April 13-14, 2013, at the University of Colorado, Boulder, Colorado. The field of nonlinear waves is an exciting area of modern mathematical research that also plays a major role in many application areas from physics and fluids. The articles in this volume present a diverse cross section of topics from this field including work on the Inverse Scattering Transform, scattering theory, inverse problems, numerical methods for dispersive wave equations, and analytic and computational methods for free boundary problems. Significant attention to applications is also given throughout the articles with an extensive presentation on new results in the free surface problem in fluids. This volume will be useful to students and researchers interested in learning current techniques in studying nonlinear dispersive systems from both the integrable systems and computational points of view.**

Nonlinear Wave Equations and Solitary Waves

New Approaches to Nonlinear Waves

Springer **The book details a few of the novel methods developed in the last few years for studying various aspects of nonlinear wave systems. The introductory chapter provides a general overview, thematically linking the objects described in the book. Two chapters are devoted to wave systems possessing resonances with linear frequencies (Chapter 2) and with nonlinear frequencies (Chapter 3). In the next two chapters modulation instability in the KdV-type of equations is studied using rigorous mathematical methods (Chapter 4) and its possible connection to freak waves is investigated (Chapter 5). The book goes on to demonstrate how the choice of the Hamiltonian (Chapter 6) or the Lagrangian (Chapter 7) framework allows us to gain a deeper insight into the properties of a specific wave system. The final chapter discusses problems encountered when attempting to verify the theoretical predictions using numerical or laboratory experiments. All the chapters are illustrated by ample constructive examples demonstrating the applicability of these novel methods and approaches to a wide class of evolutionary dispersive PDEs, e.g. equations from Benjamin-Oro, Boussinesq, Hasegawa-Mima, KdV-type, Klein-Gordon, NLS-type, Serre, Shamel , Whitham and Zakharov. This**

makes the book interesting for professionals in the fields of nonlinear physics, applied mathematics and fluid mechanics as well as students who are studying these subjects. The book can also be used as a basis for a one-semester lecture course in applied mathematics or mathematical physics.

On Periodic Solutions of Nonlinear Wave Equations

Nonlinear Wave Equations

Nonlinear Wave Equations

Periodic Solutions to Nonlinear Wave Equations

Global Existence of Solutions to Nonlinear Wave Equations by Weighted Strichartz Inequalities

Nonlinear Wave Equations

An Integral Equation for the Solution of Nonlinear Wave Equations

Nonlinear Dispersive Waves

Asymptotic Analysis and Solitons

Cambridge University Press **The field of nonlinear dispersive waves has developed enormously since the work of Stokes, Boussinesq and Korteweg–de Vries (KdV) in the nineteenth century. In the 1960s, researchers developed effective asymptotic methods for deriving nonlinear wave equations, such as the KdV equation, governing a broad class of physical phenomena that admit special solutions including those commonly known as solitons. This book describes the underlying approximation techniques and methods for finding solutions to these and other equations. The concepts and methods covered include wave dispersion, asymptotic analysis, perturbation theory, the method of multiple scales, deep and shallow water waves, nonlinear optics including fiber optic communications, mode-locked lasers and dispersion-managed wave phenomena. Most chapters feature exercise sets, making the book suitable for advanced courses or for self-directed learning. Graduate students and researchers will find this an excellent entry to a thriving area at the intersection of applied mathematics, engineering and physical science.**

Global Regularity for Nonlinear Wave Equations

On Solutions of Nonlinear Wave Equations

Algebraic and Spectral Methods for Nonlinear Wave Equations

Longman Sc & Tech

Scattering for Critical Nonlinear Wave Equations

Ad-hoc Solutions of Nonlinear Wave

Equations

Nonlinear Wave Equations with Dispersion, Dissipation and Amplification

Nonlinear Waves in Elastic Media

CRC Press **Nonlinear Waves in Elastic Media explores the theoretical results of one-dimensional nonlinear waves, including shock waves, in elastic media. It is the first book to provide an in-depth and comprehensive presentation of the nonlinear wave theory while taking anisotropy effects into account. The theory is completely worked out and draws on 15 years of research by the authors, one of whom also wrote the 1965 classic Magnetohydrodynamics. Nonlinear Waves in Elastic Media emphasizes the behavior of quasitransverse waves and analyzes arbitrary discontinuity disintegration problems, illustrating that the solution can be non-unique - a surprising result. The solution is shown to be especially interesting when anisotropy and nonlinearity effects interact, even in small-amplitude waves. In addition, the text contains an independent mathematical chapter describing general methods to study hyperbolic systems expressing the conservation laws. The theoretical results described in Nonlinear Waves in Elastic Media allow, for the first time, discovery and interpretation of many new peculiarities inherent to the general problem of discontinuous solutions and so provide a valuable resource for advanced students and researchers involved with continuum mechanics and partial differential equations.**

On Solutions of Nonlinear Wave Equations (Classic Reprint)

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imperfection in the original, such as a blemish or missing page, may be replicated in our edition. We do, however, repair the vast majority of imperfections successfully; any imperfections that remain are intentionally left to preserve the state of such historical works.

The Geometry of Nonlinear Wave Equations in Two Independent Variables

Methods for Exact Solution

Relativistic Nonlinear Wave Equations with Groups of Internal Symmetry

"A nonlinear wave equation invariant with respect to unitary representations of the Lorentz group is considered in an attempt to describe extended particles with spin and positive definite energy by means of a self-confined classical field. The wave function has an infinite number of components and, in the specific representations used, the corresponding internal degree of freedom is identified with the spin. A fractional power of the scalar bilinear invariant appears as an appropriate choice for the nonlinearity in order that all the stationary states be localized. Two approximation methods are proposed and both lead to results that bear a resemblance to the results of the MIT bag model." --

Numerical Spectral Methods for Nonlinear Wave Equations

Nonlinear Waves

This work has important applications in fluid dynamics (e.g. long waves in stratified fluids, solitons generated by ships), nonlinear optics (e.g. self-induced transparence, and self-focussing of light), digital communications via solitons, inverse scattering in one and higher dimensions. Areas of Study Include: Solutions of nonlinear multidimensional systems; arising in Physics; inverse problems, especially in multidimensions; and DBAR

methodololgy; Riemann-Hilbert boundary value problems; and inverse problems; Solitons in multidimensional systems, solitons, generated by ships in narrow channels; Nonlinear systems with external focussing; Semi infinite boundary value problems; IST for nonlinear singular integro-differential equations; the Benjamin-Ono equation, the intermediate Long Wave Equation, the Sine-Hilbert equation, multidimensional generalizations; Discrete IST and numerical simulations; Painleve equations; Focussing singularities in nonlinear wave propagation; Applications to surface waves, internal waves, shear flows; nonlinear optics, S.I.T., relativity etc; Direct linearizing methods for nonlinear evolution equations; Multidimensional generalizations of the Sine-Gordon and wave equations arising in differential geometry; Algebraic methods and symmetries of multidimensional nonlinear evolution equations; and Solutions to semiperiodic multidimensional equations.