COURANT 10

THIERRY CAZENAVE

LECTURE
NOTES

Semilinear Schrödinger Equations

AMS

Semilinear Schrodinger Equations

Aleksandr A. Pankov,Klaus Pflüger

Semilinear Schrodinger Equations:

   Semilinear Schrodinger Equations Thierry Cazenave,2003 The nonlinear Schrodinger equation has received a great deal of attention from mathematicians particularly because of its applications to nonlinear optics This book presents various mathematical aspects of the nonlinear Schrodinger equation It studies both problems of local nature and problems of global nature   Bound States for Semilinear Schrödinger Equations with Sign-changing Potential ,2005   *Solutions of Semilinear Schrödinger Equations in Hs* Hartmut Pecher,1996   *Schrödinger Equations in Nonlinear Systems* Wu-Ming Liu,Emmanuel Kengne,2019-03-20 This book explores the diverse types of Schr dinger equations that appear in nonlinear systems in general with a specific focus on nonlinear transmission networks and Bose Einstein Condensates In the context of nonlinear transmission networks it employs various methods to rigorously model the phenomena of modulated matter wave propagation in the network leading to nonlinear Schr dinger NLS equations Modeling these phenomena is largely based on the reductive perturbation method and the derived NLS equations are then used to methodically investigate the dynamics of matter wave solitons in the network In the context of Bose Einstein condensates BECs the book analyzes the dynamical properties of NLS equations with the external potential of different types which govern the dynamics of modulated matter waves in BECs with either two body interactions or both two and three body interatomic interactions It also discusses the method of investigating both the well posedness and the ill posedness of the boundary problem for linear and nonlinear Schr dinger equations and presents new results Using simple examples it then illustrates the results on the boundary problems For both nonlinear transmission networks and Bose Einstein condensates the results obtained are supplemented by numerical calculations and presented as figures   **A Semilinear Schrödinger Equation in the Presence of a Magnetic Field** Andrzej Szulkin,2002   *Defocusing Nonlinear Schrödinger Equations* Benjamin Dodson,2019-03-28 This study of Schr dinger equations with power type nonlinearity provides a great deal of insight into other dispersive partial differential equations and geometric partial differential equations It presents important proofs using tools from harmonic analysis microlocal analysis functional analysis and topology This includes a new proof of Keel Tao endpoint Strichartz estimates and a new proof of Bourgain s result for radial energy critical NLS It also provides a detailed presentation of scattering results for energy critical and mass critical equations This book is suitable as the basis for a one semester course and serves as a useful introduction to nonlinear Schr dinger equations for those with a background in harmonic analysis functional analysis and partial differential equations   **Geometric Numerical Integration and Schrödinger Equations** Erwan Faou,2012 The goal of geometric numerical integration is the simulation of evolution equations possessing geometric properties over long periods of time Of particular importance are Hamiltonian partial differential equations typically arising in application fields such as quantum mechanics or wave propagation phenomena They exhibit many important dynamical features such as energy preservation and conservation of adiabatic invariants over long periods of time In this setting a natural question is

how and to which extent the reproduction of such long time qualitative behavior can be ensured by numerical schemes Starting from numerical examples these notes provide a detailed analysis of the Schrodinger equation in a simple setting periodic boundary conditions polynomial nonlinearities approximated by symplectic splitting methods Analysis of stability and instability phenomena induced by space and time discretization are given and rigorous mathematical explanations are provided for them The book grew out of a graduate level course and is of interest to researchers and students seeking an introduction to the subject matter *Evolution Equations of Hyperbolic and Schrödinger Type* Michael Ruzhansky,Mitsuru Sugimoto,Jens Wirth,2012-08-04 Evolution equations of hyperbolic or more general p evolution type form an active field of current research This volume aims to collect some recent advances in the area in order to allow a quick overview of ongoing research The contributors are first rate mathematicians This collection of research papers is centred around parametrix constructions and microlocal analysis asymptotic constructions of solutions energy and dispersive estimates and associated spectral transforms Applications concerning elasticity and general relativity complement the volume The book gives an overview of a variety of ongoing current research in the field and therefore allows researchers as well as students to grasp new aspects and broaden their understanding of the area *Existence and Gap Bifurcation of Multiple Solutions of Semilinear Schrödinger Equations* Tobias Weth,1998 **The Nonlinear Schrödinger Equation** Catherine Sulem,Pierre-Louis Sulem,2007-06-30 Filling the gap between the mathematical literature and applications to domains the authors have chosen to address the problem of wave collapse by several methods ranging from rigorous mathematical analysis to formal aymptotic expansions and numerical simulations **On a Semilinear Schrödinger Equation with Critical Sobolev Exponent** ,2000 **Semi-classical Analysis For Nonlinear Schrodinger Equations: Wkb Analysis, Focal Points, Coherent States (Second Edition)** Remi Carles,2020-10-05 The second edition of this book consists of three parts The first one is dedicated to the WKB methods and the semi classical limit before the formation of caustics The second part treats the semi classical limit in the presence of caustics in the special geometric case where the caustic is reduced to a point or to several isolated points The third part is new in this edition and addresses the nonlinear propagation of coherent states The three parts are essentially independent Compared with the first edition the first part is enriched by a new section on multiphase expansions in the case of weakly nonlinear geometric optics and an application related to this study concerning instability results for nonlinear Schr dinger equations in negative order Sobolev spaces The third part is an overview of results concerning nonlinear effects in the propagation of coherent states in the case of a power nonlinearity and in the richer case of Hartree like nonlinearities It includes explicit formulas of an independent interest such as generalized Mehler s formula generalized lens transform **Lagrangian and Hamiltonian Methods for Nonlinear Control 2003** A Astolfi,Francisco Gordillo,A J Van Der Schaft,2003-10-07 This is the second of a series of IFAC Workshops initiated in 2000 The first one chaired and organized by Profs N Leonard and R Ortega was held in Princeton in March 2000 This proceedings

volume looks at the role played by Lagrangian and Hamiltonian methods in disciplines such as classical mechanics quantum mechanics fluid dynamics electrodynamics celestial mechanics and how such methods can be practically applied in the control community Presents and illustrates new approaches to nonlinear control that exploit the Lagrangian and Hamiltonian structure of the system to be controlled Highlights the important role of Lagrangian and Hamiltonian Structures as design methods   *Global Solutions of Nonlinear Schrodinger Equations* Jean Bourgain,1999 This volume presents recent progress in the theory of nonlinear dispersive equations primarily the nonlinear Schrodinger NLS equation The Cauchy problem for defocusing NLS with critical nonlinearity is discussed New techniques and results are described on global existence and properties of solutions with Large Cauchy data Current research in harmonic analysis around Strichartz s inequalities and its relevance to nonlinear PDE is presented and several topics in NLS theory on bounded domains are reviewed Using the NLS as an example the book offers comprehensive insight on current research related to dispersive equations and Hamiltonian PDEs   Nontrivial Solution of a Semilinear Schrödinger Equation C. Troestler,Michel Willem,1995   *Nonlinear Fractional Schrödinger Equations in R^N* Vincenzo Ambrosio,2021-04-19 This monograph presents recent results concerning nonlinear fractional elliptic problems in the whole space More precisely it investigates the existence multiplicity and qualitative properties of solutions for fractional Schr dinger equations by applying suitable variational and topological methods The book is mainly intended for researchers in pure and applied mathematics physics mechanics and engineering However the material will also be useful for students in higher semesters and young researchers as well as experienced specialists working in the field of nonlocal PDEs This is the first book to approach fractional nonlinear Schr dinger equations by applying variational and topological methods   **On a Semilinear Schrödinger Equation with Periodic Potential** Aleksandr A. Pankov,Klaus Pflüger,1996   **Invariant Measures for Stochastic Nonlinear Schrödinger Equations** Jialin Hong,Xu Wang,2019-08-22 This book provides some recent advance in the study of stochastic nonlinear Schr dinger equations and their numerical approximations including the well posedness ergodicity symplecticity and multi symplecticity It gives an accessible overview of the existence and uniqueness of invariant measures for stochastic differential equations introduces geometric structures including symplecticity and conformal multi symplecticity for nonlinear Schr dinger equations and their numerical approximations and studies the properties and convergence errors of numerical methods for stochastic nonlinear Schr dinger equations This book will appeal to researchers who are interested in numerical analysis stochastic analysis ergodic theory partial differential equation theory etc   *Blow-up for Higher-Order Parabolic, Hyperbolic, Dispersion and Schrodinger Equations* Victor A. Galaktionov,Enzo L. Mitidieri,Stanislav I. Pohozaev,2014-09-22 Blow up for Higher Order Parabolic Hyperbolic Dispersion and Schrodinger Equations shows how four types of higher order nonlinear evolution partial differential equations PDEs have many commonalities through their special quasilinear degenerate representations The authors present a unified approach to deal with these quasilinear PDEs The book   Local

<u>Existence and Breakdown of Scattering Behavior for Semilinear Schrödinger Equations</u> Gyu Eun Lee,2021 In this thesis we study the behavior of solutions to some semilinear Schr odinger equations at short and long time scales We first consider the nonlinear Schr odinger equations with power type nonlinearity in three dimensions with periodic boundary conditions We show that this equation is locally well posed in critically scaling Sobolev spaces H s bb T 3 We then investigate the long time asymptotic behavior of solutions to NLS in Euclidean space with defocusing mass subcritical power type and Hartree nonlinearities We discuss the divide between the wealth of results on the scattering theory for these equations in weighted L 2 spaces and the paucity of analogous results in L 2 bb R d To explain this we show that the scattering problems for these equations are well posed in weighted L 2 spaces in the sense that the scattering operators attain their natural and maximal regularity Furthermore we show that these scattering problems are ill posed in L 2 in the sense that the scattering operators cannot be extended to all of L 2 without losing a positive and in the case of Hartree infinite amount of regularity

Unveiling the Power of Verbal Artistry: An Emotional Sojourn through **Semilinear Schrodinger Equations**

In a world inundated with screens and the cacophony of fast transmission, the profound energy and emotional resonance of verbal artistry usually diminish into obscurity, eclipsed by the regular onslaught of noise and distractions. Yet, located within the musical pages of **Semilinear Schrodinger Equations**, a charming work of literary brilliance that pulses with raw feelings, lies an unique journey waiting to be embarked upon. Published with a virtuoso wordsmith, that mesmerizing opus guides viewers on a psychological odyssey, gently revealing the latent potential and profound influence stuck within the complicated internet of language. Within the heart-wrenching expanse with this evocative analysis, we shall embark upon an introspective exploration of the book is main themes, dissect its interesting publishing fashion, and immerse ourselves in the indelible impression it leaves upon the depths of readers souls.

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