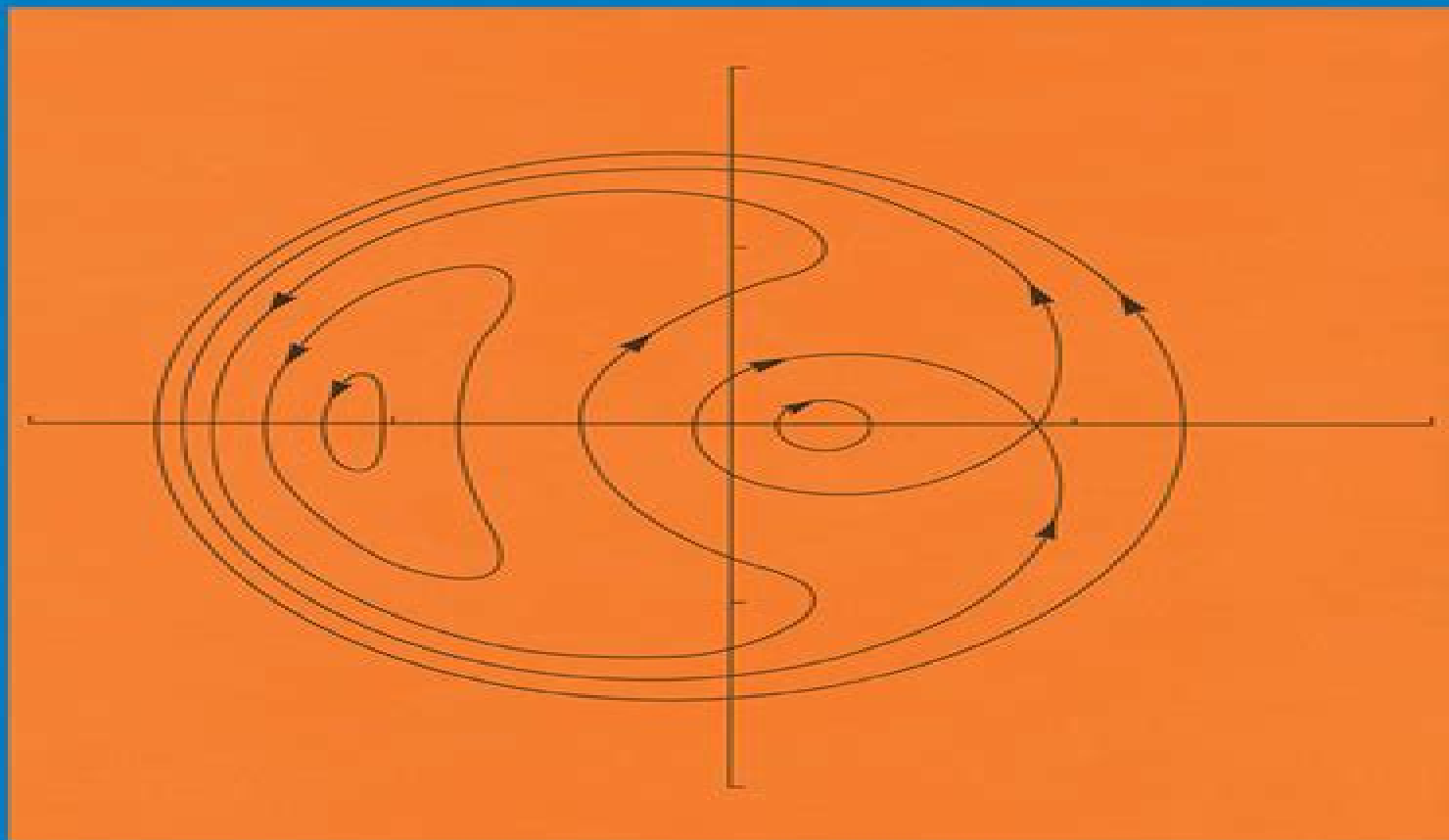


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Nonlinear Ordinary Differential Equations

R. GRIMSHAW



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Existence Theory For Nonlinear Ordinary Differential Equations

**Abdallah Afoukal, Brahim Es-
sebbar, Khalil Ezzinbi, Gaston Mandata
N'Guérékata**

Existence Theory For Nonlinear Ordinary Differential Equations:

Existence Theory for Nonlinear Ordinary Differential Equations Donal O'Regan, 2014-03-14 We begin our applications of fixed point methods with existence of solutions to certain first order initial value problems This problem is relatively easy to treat illustrates important methods and in the end will carry us a good deal further than may first meet the eye Thus we seek solutions to $y' = f(t, y)$ where $f \in C([a, b] \times \mathbb{R}, \mathbb{R})$ and $f(t, 0) \equiv 0$ We shall seek solutions that are defined either locally or globally on I according to the assumptions imposed on f Notice that (1.1) is a system of first order equations because y takes its values in \mathbb{R}^n In section 3.2 we will first establish some basic existence theorems which guarantee that a solution to (1.1) exists for $t \geq 0$ and near zero Familiar examples show that the interval of existence can be arbitrarily short depending on the initial value y_0 and the nonlinear behaviour of f As a result we will also examine in section 3.2 the dependence of the interval of existence on f and y_0 We mention in passing that in the results which follow the interval I can be replaced by any bounded interval and the initial value can be specified at any point in I The reasoning needed to cover this slightly more general situation requires minor modifications on the arguments given here

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Handbook of Differential Equations: Ordinary Differential Equations A. Canada, P. Drabek, A. Fonda, 2004-09-09 The book contains seven survey papers about ordinary differential equations The common feature of all papers consists in the fact that nonlinear equations are focused on This reflects the situation in modern mathematical modelling nonlinear mathematical models are more realistic and describe the real world problems more accurately The implications are that new methods and approaches have to be looked for developed and adopted in order to understand and solve nonlinear ordinary differential equations The purpose of this volume is to inform the mathematical community and also other scientists interested in and using the mathematical apparatus of ordinary differential equations about some of these methods and possible applications

Nonlinear Differential Equations Svatopluk

Fucik,Alois Kufner,2014-12-03 Studies in Applied Mathematics 2 Nonlinear Differential Equations focuses on modern methods of solutions to boundary value problems in linear partial differential equations The book first tackles linear and nonlinear equations free boundary problem second order equations higher order equations boundary conditions and spaces of continuous functions The text then examines the weak solution of a boundary value problem and variational and topological methods Discussions focus on general boundary conditions for second order ordinary differential equations minimal surfaces existence theorems potentials of boundary value problems second derivative of a functional convex functionals Lagrange conditions differential operators Sobolev spaces and boundary value problems The manuscript examines noncoercive problems and vibrational inequalities Topics include existence theorems formulation of the problem vanishing nonlinearities jumping nonlinearities with finite jumps rapid nonlinearities and periodic problems The text is highly recommended for mathematicians and engineers interested in nonlinear differential equations **Functional Differential**

Equations Constantin Corduneanu,Yizeng Li,Mehran Mahdavi,2016-03-25 Features new results and up to date advances in modeling and solving differential equations Introducing the various classes of functional differential equations Functional Differential Equations Advances and Applications presents the needed tools and topics to study the various classes of functional differential equations and is primarily concerned with the existence uniqueness and estimates of solutions to specific problems The book focuses on the general theory of functional differential equations provides the requisite mathematical background and details the qualitative behavior of solutions to functional differential equations The book addresses problems of stability particularly for ordinary differential equations in which the theory can provide models for other classes of functional differential equations and the stability of solutions is useful for the application of results within various fields of science engineering and economics Functional Differential Equations Advances and Applications also features Discussions on the classes of equations that cannot be solved to the highest order derivative and in turn addresses existence results and behavior types Oscillatory motion and solutions that occur in many real world phenomena as well as in man made machines Numerous examples and applications with a specific focus on ordinary differential equations and functional differential equations with finite delay An appendix that introduces generalized Fourier series and Fourier analysis after periodicity and almost periodicity An extensive Bibliography with over 550 references that connects the presented concepts to further topical exploration Functional Differential Equations Advances and Applications is an ideal reference for academics and practitioners in applied mathematics engineering economics and physics The book is also an appropriate textbook for graduate and PhD level courses in applied mathematics differential and difference equations differential analysis and dynamics processes CONSTANTIN CORDUNEANU PhD is Emeritus Professor in the Department of Mathematics at The University of Texas at Arlington USA The author of six books and over 200 journal articles he is currently Associate Editor for seven journals a member of the American Mathematical Society Society for Industrial and Applied Mathematics and the

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THEORY OF CAUSAL DIFFERENTIAL EQUATIONS

S. Leela,V. Lakshmikantham,2010-01-01 The problems of modern society are both complex and inter disciplinary Despite the parent diversity of problems however often tools developed in one context are adaptable to an entirely different situation For example consider the well known Lyapunov s second method This interesting and fruitful technique has gained increasing significance and has given decisive impetus for modern development of stability theory of discrete and dynamic system It is now recognized that the concept of Lyapunov function and theory of differential inequalities can be utilized to investigate qualitative and quantitative properties of a variety of nonlinear problems Lyapunov function serves as a vehicle to transform a given complicated system into a simpler comparison system Therefore it is enough to study the properties of the simpler system to analyze the properties of the complicated system via an appropriate Lyapunov function and the comparison principle It is in this perspective the present monograph is dedicated to the investigation of the theory of causal differential equations or differential equations with causal operators which are nonanticipative or abstract Volterra operators As we shall see in the first chapter causal differential equations include a variety of dynamic systems and consequently the theory developed for CDEs Causal Differential Equations in general covers the theory of several dynamic systems in a single framework

Positive Solutions of Differential, Difference and Integral Equations

R.P. Agarwal,Donal O'Regan,Patricia J.Y. Wong,2013-04-17 In analysing nonlinear phenomena many mathematical models give rise to problems for which only nonnegative solutions make sense In the last few years this discipline has grown dramatically This state of the art volume offers the authors recent work reflecting some of the major advances in the field as well as the diversity of the subject Audience This volume will be of interest to graduate students and researchers in mathematical analysis and its applications whose work involves ordinary differential equations finite differences and integral equations

Infinite

Interval Problems for Differential, Difference and Integral Equations R.P. Agarwal,Donal O'Regan,2012-12-06 Infinite interval problems abound in nature and yet until now there has been no book dealing with such problems The main reason for this seems to be that until the 1970 s for the infinite interval problem all the theoretical results available required rather technical hypotheses and were applicable only to narrowly defined classes of problems Thus scientists mainly offered and used special devices to construct the numerical solution assuming tacitly the existence of a solution In recent years a mixture of classical analysis and modern fixed point theory has been employed to study the existence of solutions to infinite interval problems This has resulted in widely applicable results This monograph is a cumulation mainly of the authors research over a

period of more than ten years and offers easily verifiable existence criteria for differential difference and integral equations over the infinite interval. An important feature of this monograph is that we illustrate almost all the results with examples. The plan of this monograph is as follows. In Chapter 1 we present the existence theory for second order boundary value problems on infinite intervals. We begin with several examples which model real world phenomena. A brief history of the infinite interval problem is also included. We then present general existence results for several different types of boundary value problems. Here we note that for the infinite interval problem only two major approaches are available in the literature.

Ordinary Differential Equations with Applications Carmen Chicone, 2024-05-19. This book developed during 20 years of the author teaching differential equations courses at his home university is designed to serve as a text for a graduate level course focused on the central theory of the subject with attention paid to applications and connections to other advanced topics in mathematics. Core theory includes local existence and uniqueness, the phase plane, Poincaré-Bendixson theory, Lyapunov and linearized stability, linear systems, Floquet theory, the Grobman-Hartman theorem, persistence of rest points and periodic orbits, the stable and center manifold theorems and bifurcation theory. This edition includes expanded treatment of deterministic chaos, perturbation theory for periodic solutions, boundary value problems, optimization and a wide range of their applications. In addition it contains a formulation and new proof of a theorem on instability of rest points in the presence of an eigenvalue with positive real part and new proofs of differential inequalities and Lyapunov's center theorem. New sections present discussions of global bifurcation, the Crandall-Rabinowitz theorem and Alekseev's formula. Of particular note is a new chapter on basic control theory, a discussion of optimal control and a proof of a useful special case of the maximum principle. A key feature of earlier editions, a wide selection of original exercises, is respected in this edition with the inclusion of a wealth of new exercises. Reviews of the first edition: As an applied mathematics text on linear and nonlinear equations, the book by Chicone is written with stimulating enthusiasm. It will certainly appeal to many students and researchers. F. Verhulst, SIAM Review. The author writes lucidly and in an engaging conversational style. His book is wide ranging in its subject matter, thorough in its presentation and written at a generally high level of generality, detail and rigor. D. S. Shafer, Mathematical Reviews.

The Gibbs Phenomenon in Fourier Analysis, Splines and Wavelet Approximations A.J. Jerri, 1998-08-31. This book represents the first attempt at a unified picture for the presence of the Gibbs or Gibbs-Wilbraham phenomenon in applications, its analysis and the different methods of filtering it out. The analysis and filtering cover the familiar Gibbs phenomenon in Fourier series and integral representations of functions with jump discontinuities. In addition it will include other representations such as general orthogonal series expansions, general integral transforms, spline approximation and continuous as well as discrete wavelet approximations. The material in this book is presented in a manner accessible to upperclassmen and graduate students in science and engineering as well as researchers who may face the Gibbs phenomenon in the varied applications that involve the Fourier and the other approximations of functions with jump

discontinuities Those with more advanced backgrounds in analysis will find basic material results and motivations from which they can begin to develop deeper and more general results We must emphasize that the aim of this book the first on the sUbject to satisfy such a diverse audience is quite difficult In particular our detailed derivations and their illustrations for an introductory book may very well sound repeti tive to the experts in the field who are expecting a research monograph To answer the concern of the researchers we can only hope that this book will prove helpful as a basic reference for their research papers

Singular Quadratic Forms in Perturbation Theory Volodymyr Koshmanenko,2012-12-06 The notion of singular quadratic form appears in mathematical physics as a tool for the investigation of formal expressions corresponding to perturbations devoid of operator sense Numerous physical models are based on the use of Hamiltonians containing perturba tion terms with singular properties Typical examples of such expressions are Schrodin ger operators with O potentials AD and Hamiltonians in quantum field theory with perturbations given in terms of operators of creation and annihilation P

Harmonic Analysis in Hypercomplex Systems Yu.M. Berezansky,A.A. Kalyuzhnyi,2013-06-29 First works related to the topics covered in this book belong to J Delsarte and B M Le vitan and appeared since 1938 In these works the families of operators that generalize usual translation operators were investigated and the corresponding harmonic analysis was constructed Later starting from 1950 it was noticed that in such constructions an important role is played by the fact that the kernels of the corresponding convolutions of functions are nonnegative and by the properties of the normed algebras generated by these convolutions That was the way the notion of hypercomplex system with continu ous basis appeared A hypercomplex system is a normed algebra of functions on a locally compact space Q the basis of this hypercomplex system Later similar objects hypergroups were introduced which have complex valued measures on Q as elements and convolution defined to be essentially the convolution of functionals and dual to the original convolution if measures are regarded as functionals on the space of continuous functions on Q However until 1991 the time when this book was written in Russian there were no monographs containing fundamentals of the theory with an exception of a short section in the book by Yu M Berezansky and Yu G Kondratiev BeKo The authors wanted to give an introduction to the theory and cover the most important subsequent results and examples

Research in Progress ,1964

Almost Periodicity and Almost Automorphy Abdallah Afoukal,Brahim Es-sebbar,Khalil Ezzinbi,Gaston Mandata N'Guérékata,2025-03-03 When we study differential equations in Banach spaces whose coefficients are linear unbounded operators we feel that we are working in ordinary differential equations however the fact that the operator coefficients are unbounded makes things quite different from what is known in the classical case Examples or applications for such equations are naturally found in the theory of partial differential equations More specifically if we give importance to the time variable at the expense of the spatial variables we obtain an ordinary differential equation with respect to the variable which was put in evidence Thus for example the heat or the wave equation gives rise to ordinary differential equations of this kind Adding boundary conditions can often be

translated in terms of considering solutions in some convenient functional Banach space The theory of semigroups of operators provides an elegant approach to study this kind of systems Therefore we can frequently guess or even prove theorems on differential equations in Banach spaces looking at a corresponding pattern in finite dimensional ordinary differential equations

Attractors and Inertial Manifolds Boling Guo, Liming Ling, Yansheng Ma, Hui Yang, 2018-07-09 This two volume work presents state of the art mathematical theories and results on infinite dimensional dynamical systems Inertial manifolds approximate inertial manifolds discrete attractors and the dynamics of small dissipation are discussed in detail The unique combination of mathematical rigor and physical background makes this work an essential reference for researchers and graduate students in applied mathematics and physics The main emphasis in the first volume is on the mathematical analysis of attractors and inertial manifolds This volume deals with the existence of global attractors inertial manifolds and with the estimation of Hausdorff fractal dimension for some dissipative nonlinear evolution equations in modern physics Known as well as many new results about the existence regularity and properties of inertial manifolds and approximate inertial manifolds are also presented in the first volume The second volume will be devoted to modern analytical tools and methods in infinite dimensional dynamical systems Contents Attractor and its dimension estimation Inertial manifold The approximate inertial manifold

Degree Theory for Discontinuous Operators Rubén Figueroa Sestelo, Rodrigo López Pouso, Jorge Rodríguez López, 2021-09-21 This unique book contains a generalization of the Leray Schauder degree theory which applies for wide and meaningful types of discontinuous operators The discontinuous degree theory introduced in the first section is subsequently used to prove new applicable discontinuous versions of many classical fixed point theorems such as Schauder's Finally readers will find in this book several applications of those discontinuous fixed point theorems in the proofs of new existence results for discontinuous differential problems Written in a clear expository style with the inclusion of many examples in each chapter this book aims to be useful not only as a self contained reference for mature researchers in nonlinear analysis but also for graduate students looking for a quick accessible introduction to degree theory techniques for discontinuous differential equations

Scientific and Technical Aerospace Reports, 1982-10

Advanced Integration Theory Corneliu Constantinescu, Wolfgang Filler, K. Weber, 1998-10-31 Since about 1915 integration theory has consisted of two separate branches the abstract theory required by probabilists and the theory preferred by analysts that combines integration and topology As long as the underlying topological space is reasonably nice e g locally compact with countable basis the abstract theory and the topological theory yield the same results but for more complicated spaces the topological theory gives stronger results than those provided by the abstract theory The possibility of resolving this split fascinated us and it was one of the reasons for writing this book The unification of the abstract theory and the topological theory is achieved by using new definitions in the abstract theory The integral in this book is defined in such a way that it coincides in the case of Radon measures on Hausdorff spaces with the usual definition in the literature As a

consequence our integral can differ in the classical case Our integral however is more inclusive It was defined in the book C Constantinescu and K Weber in collaboration with A *Applied Mechanics Reviews* ,1973 **Basic Theory Of Fractional Differential Equations (Third Edition)** Yong Zhou,2023-10-06 This accessible monograph is devoted to a rapidly developing area on the research of qualitative theory of fractional ordinary differential equations and evolution equations It is self contained and unified in presentation and provides the readers the necessary background material required to go further into the subject and explore the rich research literature The tools used include many classical and modern nonlinear analysis methods such as fixed point theory measure of noncompactness method topological degree method Picard operators technique critical point theory and semigroups theory This book is based on the research work done so far by the author and other experts and contains comprehensive up to date materials on the topic In this third edition four new topics have been added Hilfer fractional evolution equations and infinite interval problems oscillations and nonoscillations fractional Hamiltonian systems fractional Rayleigh Stokes equations and wave equations The bibliography has also been updated and expanded This book is useful to researchers graduate or PhD students dealing with fractional calculus and applied analysis differential equations and related areas of research

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