Nonlinear Phenomena In Mathematical Sciences V Lakshmikantham

Reviewing **Nonlinear Phenomena In Mathematical Sciences V Lakshmikantham**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Nonlinear Phenomena In Mathematical Sciences V Lakshmikantham**," an enthralling opus penned by a highly acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

Invariant Theory F. Gherardelli 2006-11-15
Nonlinear Functional Analysis Klaus Deimling 2013-11-11 topics. However, only a modest preliminary knowledge is needed. In the first chapter, where we introduce an important topological concept, the so-called topological degree for continuous maps from subsets ofRn into Rn, you need not know anything about functional analysis. Starting with Chapter 2, where infinite dimensions first appear, one should be

familiar with the essential step of consider ing a sequence or a function of some sort as a point in the corresponding vector space of all such sequences or functions, whenever this abstraction is worthwhile. One should also work out the things which are proved in § 7 and accept certain basic principles of linear functional analysis quoted there for easier references, until they are applied in later chapters. In other words, even the 'completely linear' sections which we have included for your convenience serve only as a vehicle for progress in nonlinearity. Another point that makes the text introductory is the use of an essentially uniform mathematical language and way of thinking, one which is no doubt familiar from elementary lectures in analysis that did not worry much about its connections with algebra and topology. Of course we shall use some elementary topological concepts, which may be new, but in fact only a few remarks here and there pertain to algebraic or differential topological concepts and methods.

Almost Periodic Type Functions and Ergodicity Zhang Chuanyi 2003-06-30 The theory of almost periodic functions was first developed by the Danish mathematician H. Bohr during 1925-1926. Then Bohr's work was substantially extended by S. Bochner, H. Weyl, A. Besicovitch, J. Favard, J. von Neumann, V. V. Stepanov, N. N. Bogolyubov, and oth ers. Generalization of the classical theory of almost periodic functions has been taken in several directions. One direction is the broader study of functions of almost periodic type. Related this is the study of ergodic ity. It shows that the ergodicity plays an important part in the theories of function spectrum, semigroup of bounded linear operators, and dynamical systems. The purpose of this book is to develop a theory of almost pe riodic type functions and ergodicity with applications-in particular, to our interest-in the theory of differential

equations, functional differen tial equations and abstract evolution equations. The author selects these topics because there have been many (excellent) books on almost periodic functions and relatively, few books on almost periodic type and ergodicity. The author also wishes to reflect new results in the book during recent years. The book consists of four chapters. In the first chapter, we present a basic theory of four almost periodic type functions. Section 1. 1 is about almost periodic functions. To make the reader easily learn the almost periodicity, we first discuss it in scalar case. After studying a classical theory for this case, we generalize it to finite dimensional vector-valued case, and finally, to Banach-valued (including Hilbert-valued) situation.

Ridge Functions Allan Pinkus 2015-08-07 Presents the state of the art in the theory of ridge functions, providing a solid theoretical foundation.

Handbook of Differential Equations: Ordinary Differential Equations A. Canada 2006-08-21 This handbook is the third volume in a series of volumes devoted to self contained and up-to-date surveys in the tehory of ordinary differential equations, written by leading researchers in the area. All contributors have made an additional effort to achieve readability for mathematicians and scientists from other related fields so that the chapters have been made accessible to a wide audience. These ideas faithfully reflect the spirit of this multi-volume and hopefully it becomes a very useful tool for reseach, learing and teaching. This volumes consists of seven chapters covering a variety of problems in ordinary differential equations. Both pure mathematical research and real word applications are reflected by the contributions to this volume. Covers a variety of problems in ordinary differential equations Pure mathematical and real world applications Written for mathematicians and scientists of many related fields

A Mathematical Treatment of Economic Cooperation and Competition Among Nations, with Nigeria, USA, UK, China, and the Middle East Examples Ethelbert N. Chukwu 2005-09-30 The book presents a careful mathematical study of Economic Cooperation and Competition among Nations. It appropriates the principles of Supply and Demand and of Rational Expectations to build the dynamic model of the Gross Domestic Products of two groups of nations which are linked up together. The first group consists of Nigeria, the US, the UK and China. The second group is made up of Egypt, the US, Jordan and Israel. The link connecting the four nations of each group is mirrored in the net export function which is broadened to include trade, debts and the inflow or the outflow of wealth from the competing and cooperating nations. This realistic models of the four interacting GDP's, a hereditary differential game of pursuit are validated with historical data from International Financial Statistic Year Book. The Mathematical model is then studied for controllability: from a current initial GDPs a better state can be attained using government and private strategies which are carefully identified. We use regression and differential equation methods to test whether the four countries are competing or cooperating. The consequences of competition or cooperation are explored. Cooperation can be realized and the growth of wealth assured because the system is controllable and we can increase the growth of GDP and then increase the coefficient of cooperation. The outcome may be unbounded growth of wealth for all concerned – the triumph of cooperation. With analogous simple examples the book shows that sufficiently cooperating systems grow unbounded and competing ones are either bounded at best, or become extinct in finite time. If competition is small, i.e., limited, or regulated the GDP's need not be extinct even

after a long time. This results are in contrast with popular opinion which advocate competition over cooperation. The detailed policy implication of the cooperation analysis at one time or the other were advocated by Pope John Paul II, President Clinton and President Bush. The mathematical message is clear: the strategy of cooperation is the best way in an Interconnected World: Cooperation triumphs over competition. The same type of analysis allows the book to argue through modeling that prosperity, internal peace and harmony can flourish in Nigeria among the old three regions and the newer six geopolitical regions. The same is true for the four powerful states in the Middle East. Thus the author’s refreshing approach is the "scientific" treatment of cooperation and competition models of the gross-domestic product of two groups of nations – Nigeria, the USA, the UK, and China, and the USA, Egypt, Jordan and Israel. Attempts are made to provide "scientific" answers to broad national policies. It allows predictions of growth to be made with some degree of accuracy for up to 4 years. MATLAB and Maple programs in accompanied CD are provided. The author's individual nations economic models are cited. The dynamics are ordinary and hereditary games of pursuit also cited from the original earlier writings of the author are models of the economic state of each nation – a vector of six things – the gross domestic product (GDP) (y), interest rate R; employment (or unemployment) (L), value of capital stock (k), prices p(t), and therefore inflation and cumulative balance of payment (E). Each economic state is isolated except the impact of export function on aggregate demand. The main difference between this earlier contributions and this book is the link and its apparent policy implications and consequences. Key features:

Differential Models and Neutral Systems for

Controlling the Wealth of Nations Ethelbert N. Chukwu 2001 This monograph derives from familiar economic principles the dynamics of national income, the interest rate, employment, the value of capital stock, prices, and the cumulative balance of payments. This is a Volterra neutral integrodifferential game of pursuit. The quarry control is government intervention in the form of taxation, control of money supply, tariffs, foreign credit, interest equalization tax, preferential trade agreements (which reduce trade barriers and enhance trade flows between nations), transportation and distance between trading partners. The pursuer controls include wages and productivity. The book provides conditions for controllability and then deduces how big government intervention (compared with private firms' contributions) should be to ensure the possibility of growth.The reader is assumed to be familiar with advanced calculus and to have a working knowledge of ordinary differential equations. The required theory of hereditary systems can be obtained from the book itself.

Nonlinear Functional Analysis and Its Applications Felix E. Browder 1986

Shock Waves and Reaction—Diffusion Equations Joel Smoller 2012-12-06 For this edition, a number of typographical errors and minor slip-ups have been corrected. In addition, following the persistent encouragement of Olga Oleinik, I have added a new chapter, Chapter 25, which I titled "Recent Results." This chapter is divided into four sections, and in these I have discussed what I consider to be some of the important developments which have come about since the writing of the first edition. Section I deals with reaction-diffusion equations, and in it are described both the work of C. Jones, on the stability of the travelling wave for the Fitz-Hugh-Nagumo equations, and

symmetry-breaking bifurcations. Section II deals with some recent results in shock-wave theory. The main topics considered are L. Tartar's notion of compensated compactness, together with its application to pairs of conservation laws, and T.-P. Liu's work on the stability of viscous profiles for shock waves. In the next section, Conley's connection index and connection matrix are described; these general notions are useful in con structing travelling waves for systems of nonlinear equations. The final sec tion, Section IV, is devoted to the very recent results of C. Jones and R. Gardner, whereby they construct a general theory enabling them to locate the point spectrum of a wide class of linear operators which arise in stability problems for travelling waves. Their theory is general enough to be applica ble to many interesting reaction-diffusion systems.

Mathematical Approaches for Emerging and Reemerging Infectious Diseases: Models, Methods, and Theory Carlos Castillo-Chavez 2012-12-06 This IMA Volume in Mathematics and its Applications MATHEMATICAL APPROACHES FOR EMERGING AND REEMERGING INFECTIOUS DISEASES: MODELS, AND THEORY METHODS is based on the proceedings of a successful one week workshop. The pro ceedings of the two-day tutorial which preceded the workshop "Introduction to Epidemiology and Immunology" appears as IMA Volume 125: Math ematical Approaches for Emerging and Reemerging Infectious Diseases: An Introduction. The tutorial and the workshop are integral parts of the September 1998 to June 1999 IMA program on "MATHEMATICS IN BI OLOGY. " I would like to thank Carlos Castillo-Chavez (Director of the Math ematical and Theoretical Biology Institute and a member of the Depart ments of Biometrics, Statistics and Theoretical and Applied Mechanics, Cornell University), Sally M. Blower

(Biomathematics, UCLA School of Medicine), Pauline van den Driessche (Mathematics and Statistics, Uni versity of Victoria), and Denise Kirschner (Microbiology and Immunology, University of Michigan Medical School) for their superb roles as organizers of the meetings and editors of the proceedings. Carlos Castillo-Chavez, es pecially, made a major contribution by spearheading the editing process. I am also grateful to Kenneth L. Cooke (Mathematics, Pomona College), for being one of the workshop organizers and to Abdul-Aziz Yakubu (Mathe matics, Howard University) for serving as co-editor of the proceedings. I thank Simon A. Levin (Ecology and Evolutionary Biology, Princeton Uni versity) for providing an introduction.

Volterra and Functional Differential Equations Kenneth B. Hannsgen 2023-05-31 This book contains twenty four papers, presented at the conference on Volterra and Functional Differential Equations held in Virginia in 1981, on various topics, including Liapunov stability, Volterra equations, integral equations, and functional differential equations.

State-Dependent Impulses Irena Rachůnková 2015-09-29 This book offers the reader a new approach to the solvability of boundary value problems with state-dependent impulses and provides recently obtained existence results for state dependent impulsive problems with general linear boundary conditions. It covers fixed-time impulsive boundary value problems both regular and singular and deals with higher order differential equations or with systems that are subject to general linear boundary conditions. We treat state-dependent impulsive boundary value problems, including a new approach giving effective conditions for the solvability of the Dirichlet problem with one state-dependent impulse condition and we show that the depicted approach can be extended to problems with a finite number of state-

dependent impulses. We investigate the Sturm–Liouville boundary value problem for a more general right-hand side of a differential equation. Finally, we offer generalizations to higher order differential equations or differential systems subject to general linear boundary conditions.

Oscillation and Dynamics in Delay Equations John R. Graef 1992 Oscillation theory and dynamical systems have long been rich and active areas of research. Containing frontier contributions by some of the leaders in the field, this book brings together papers based on presentations at the AMS meeting in San Francisco in January, 1991. With special emphasis on delay equations, the papers cover a broad range of topics in ordinary, partial, and difference equations and include applications to problems in commodity prices, biological modeling, and number theory. The book would be of interest to graduate students and researchers in mathematics or those in other fields who have an interest in delay equations and their applications.

Mathematical Approaches for Emerging and Reemerging Infectious Diseases: An Introduction Carlos Castillo-Chavez 2002-05-02 This book grew out of the discussions and presentations that began during the Workshop on Emerging and Reemerging Diseases (May 17-21, 1999) sponsored by the Institute for Mathematics and its Application (IMA) at the University of Minnesota with the support of NIH and NSF. The workshop started with a two-day tutorial session directed at ecologists, epidemiologists, immunologists, mathematicians, and scientists interested in the study of disease dynamics. The core of this first volume, Volume 125, covers tutorial and research contributions on the use of dynamical systems (deterministic discrete, delay, PDEs, and ODEs models) and stochastic models in disease dynamics. The volume includes

the study of cancer, HIV, pertussis, and tuberculosis. Beginning graduate students in applied mathematics, scientists in the natural, social, or health sciences or mathematicians who want to enter the fields of mathematical and theoretical epidemiology will find this book useful.

Almost Periodic and Almost Automorphic Solutions to Integro-Differential Equations Marko Kostić 2019-05-06 This book discusses almost periodic and almost automorphic solutions to abstract integro-differential Volterra equations that are degenerate in time, and in particular equations whose solutions are governed by (degenerate) solution operator families with removable singularities at zero. It particularly covers abstract fractional equations and inclusions with multivalued linear operators as well as abstract fractional semilinear Cauchy problems.

World Congress of Nonlinear Analysts '92 V. Lakshmikantham 1996-01-01

Systems Approaches in Computer Science and Mathematics G.E. Lasker 2014-05-20 Applied Systems and Cybernetics, Volume V: Systems Approaches in Computer Science and Mathematics covers the proceedings of the International Congress on Applied Systems Research and Cybernetics. This book discusses trends and advances in the application of systems science and cybernetics to various fields. This volume reviews the systems approaches in computer science and mathematics and concentrates on several major areas of systems research in computer science and theoretical and applied mathematics. This book will be of great interest to computer scientists interested in the development of the theories and applications of computer science.

Differential Equations I.W. Knowles 2000-04-01 This volume forms a record of the lectures given at this International Conference. Under the general heading of

the equations of mathematical physics, contributions are included on a broad range of topics in the theory and applications of ordinary and partial differential equations, including both linear and non-linear equations. The topics cover a wide variety of methods (spectral, theoretical, variational, topological, semi-group), and a equally wide variety of equations including the Laplace equation, Navier-Stokes equations, Boltzmann's equation, reaction-diffusion equations, Schroedinger equations and certain non-linear wave equations. A number of papers are devoted to multi-particle scattering theory, and to inverse theory. In addition, many of the plenary lectures contain a significant amount of survey material on a wide variety of these topics.

Nonlinear Dynamics of Piecewise Constant Systems and Implementation of Piecewise Constant Arguments Liming Dai 2008 Piecewise constant systems exist in widely expanded areas such as engineering, physics, and mathematics. Extraordinary and complex characteristics of piecewise constant systems have been reported in recent years. This book provides the methodologies for analyzing and assessing nonlinear piecewise constant systems on a theoretically and practically sound basis. Recently developed approaches for theoretically analyzing and numerically solving the nonlinear piecewise constant dynamic systems are reviewed. A new greatest integer argument with a piecewise constant function is utilized for nonlinear dynamic analyses and for establishing a novel criterion in diagnosing irregular and chaotic solutions from the regular solutions of a nonlinear dynamic system. The newly established piecewise constantization methodology and its implementation in analytically solving for nonlinear dynamic problems are also presented.

Differential Equations and Nonlinear Mechanics

Kuppalapalle Vajravelu 2013-12-01 The International Conference on Differential Equations and Nonlinear Mechanics was hosted by the University of Central Florida in Orlando from March 17-19, 1999. One of the conference days was dedicated to Professor V. Lakshmikantham in th honor of his 75 birthday. 50 well established professionals (in differential equations, nonlinear analysis, numerical analysis, and nonlinear mechanics) attended the conference from 13 countries. Twelve of the attendees delivered hour long invited talks and remaining thirty-eight presented invited forty-five minute talks. In each of these talks, the focus was on the recent developments in differential equations and nonlinear mechanics and their applications. This book consists of 29 papers based on the invited lectures, and I believe that it provides a good selection of advanced topics of current interest in differential equations and nonlinear mechanics. I am indebted to the Department of Mathematics, College of Arts and Sciences, Department of Mechanical, Materials and Aerospace Engineering, and the Office of International Studies (of the University of Central Florida) for the financial support of the conference. Also, to the Mathematics Department of the University of Central Florida for providing secretarial and administrative assistance. I would like to thank the members of the local organizing committee, Jeanne Blank, Jackie Callahan, John Cannon, Holly Carley, Brad Pyle, Pete Rautenstrauch, and June Wingler for their assistance. Thanks are also due to the conference organizing committee, F. H. Busse, J. R. Cannon, V. Girault, R. H. J. Grimshaw, P. N. Kaloni, V.

Nonlinear Phenomena in Mathematical Sciences

Vangipuram Lakshmikantham 1982 Nonlinear Phenomena in Mathematical Sciences ...

Equadiff-91 - International Conference On Differential Equations (In 2 Volumes)

Perello C 1993-05-25

Method of Variation of Parameters for Dynamic Systems V. Lakshmikantham 2019-09-10 Method of Variation of Parameters for Dynamic Systems presents a systematic and unified theory of the development of the theory of the method of variation of parameters, its unification with Lyapunov's method and typical applications of these methods. No other attempt has been made to bring all the available literature into one volume. This book is a clear exposition of this important topic in control theory, which is not covered by any other text. Such an exposition finally enables the comparison and contrast of the theory and the applications, thus facilitating further development in this fascinating field.

Nonlinear Evolution Equations Songmu Zheng 2004-07-08 Nonlinear evolution equations arise in many fields of sciences including physics, mechanics, and material science. This book introduces some important methods for dealing with these equations and explains clearly and concisely a wide range of relevant theories and techniques. These include the semigroup method, the compactness and monotone operator methods, the monotone iterative method and invariant regions, the global existence and uniqueness theory for small initial data, and the asymptotic behavior of solutions and global attractors. Many of the results are published in book form for the first time. Bibliographic comments in each chapter provide the reader with references and further reading materials to enable further research and study.

Advances in Nonlinear Dynamics S. Sivasundaram 2023-01-06 Dedicated to Professor S. Leela in recognition of her significant contribution to the field of nonlinear dynamics and differential equations, this text consists of 38 papers contributed by experts from 15 countries, together with a survey of Professor Leela's

work. The first group of papers examines stability, the second process controls, and the third section contains papers on various topics, including solutions for new classes of systems of equations and boundary problems, and proofs of basic theorems. Many of the featured problems are associated with the ideas and methods proposed and developed by Professor Leela.
Stochastic versus Deterministic Systems of Differential Equations G. S. Ladde 2003-12-05 This peerless reference/text unfurls a unified and systematic study of the two types of mathematical models of dynamic processes-stochastic and deterministic-as placed in the context of systems of stochastic differential equations. Using the tools of variational comparison, generalized variation of constants, and probability distribution as its methodological backbone, Stochastic Versus Deterministic Systems of Differential Equations addresses questions relating to the need for a stochastic mathematical model and the between-model contrast that arises in the absence of random disturbances/fluctuations and parameter uncertainties both deterministic and stochastic.
Nonlinear Parabolic and Elliptic Equations C.V. Pao 2012-12-06 In response to the growing use of reaction diffusion problems in many fields, this monograph gives a systematic treatment of a class of nonlinear parabolic and elliptic differential equations and their applications these problems. It is an important reference for mathematicians and engineers, as well as a practical text for graduate students.
Mathematical Approaches to Problems in Resource Management and Epidemiology Carlos Castillo-Chavez 2013-03-08 Increasingly, mathematical methods are being used to advantage in addressing the problems facing humanity in managing its environment. Problems in resource management and

epidemiology especially have demonstrated the utility of quantitative modeling. To explore these approaches, the Center of Applied Mathematics at Cornell University organized a conference in Fall, 1987, with the objective of surveying and assessing the state of the art. This volume records the proceedings of that conference. Underlying virtually all of these studies are models of population growth, from individual cells to large vertebrates. Cell population growth presents the simplest of systems for study, and is of fundamental importance in its own right for a variety of medical and environmental applications. In Part I of this volume, Michael Shuler describes computer models of individual cells and cell populations, and Frank Hoppensteadt discusses the synchronization of bacterial culture growth. Together, these provide a valuable introduction to mathematical cell biology.

Nonlinear Dynamics in Physiology and Medicine Anne Beuter 2013-06-05 Introduces concepts from nonlinear dynamics using an almost exclusively biological setting for motivation, and includes examples of how these concepts are used in experimental investigations of biological and physiological systems. One novel feature of the book is the inclusion of classroom-tested computer exercises. This book will appeal to students and researchers working in the natural and physical sciences wanting to learn about physiological systems from a mathematical perspective.

Mathematical Ecology S.A. Levin 2013-03-13

Topological Degree Approach to Bifurcation Problems Michal Fečkan 2008-06-29 1. 1 Preface Many phenomena from physics, biology, chemistry and economics are modeled by di?erential equations with parameters. When a nonlinear equation is est- lished, its behavior/dynamics should be understood. In general, it is impossible to ?nd a complete

dynamics of a nonlinear di?erential equation. Hence at least, either periodic or irregular/chaotic solutions are tried to be shown. So a pr- erty of a desired solution of a nonlinear equation is given as a parameterized boundary value problem. Consequently, the task is transformed to a solvability of an abstract nonlinear equation with parameters on a certain functional space. When a family of solutions of the abstract equation is known for some para- ters, the persistence or bifurcations of solutions from that family is studied as parameters are changing. There are several approaches to handle such nonl- ear bifurcation problems. One of them is a topological degree method, which is rather powerful in cases when nonlinearities are not enough smooth. The aim of this book is to present several original bifurcation results achieved by the author using the topological degree theory. The scope of the results is rather broad from showing periodic and chaotic behavior of non-smooth mechanical systems through the existence of traveling waves for ordinary di?erential eq- tions on in?nite lattices up to study periodic oscillations of undamped abstract waveequationsonHilbertspaces withapplicationstononlinearbea mandstring partial di?erential equations. 1.

Control and Optimization with PDE Constraints Kristian Bredies 2013-06-12 Many mathematical models of physical, biological and social systems involve partial differential equations (PDEs). The desire to understand and influence these systems naturally leads to considering problems of control and optimization. This book presents important topics in the areas of control of PDEs and of PDE-constrained optimization, covering the full spectrum from analysis to numerical realization and applications. Leading scientists address current topics such as non-smooth optimization, Hamilton–Jacobi–Bellmann

equations, issues in optimization and control of stochastic partial differential equations, reduced-order models and domain decomposition, discretization error estimates for optimal control problems, and control of quantum-dynamical systems. These contributions originate from the “International Workshop on Control and Optimization of PDEs” in Mariatrost in October 2011. This book is an excellent resource for students and researchers in control or optimization of differential equations. Readers interested in theory or in numerical algorithms will find this book equally useful.

Vector Lyapunov Functions and Stability Analysis of Nonlinear Systems V. Lakshmikantham 2013-03-09 One service mathematics has rendered the 'Et moi, "', si j'avait su comment en revenir, je n'y serais point all".' human race. It has put common sense back where it belongs, on the topmost shelf next Jules Verne to the dusty canister labelled 'discarded non sense'. The series is divergent; therefore we may be able to do something with it. Eric T. Bell O. Heaviside Mathematics is a tool for thought. A highly necessary tool in a world where both feedback and non linearities abound. Similarly, all kinds of parts of mathematics serve as tools for other parts and for other sciences. Applying a simple rewriting rule to the quote on the right above one finds such statements as: 'One service topology has rendered mathematical physics . .'; 'One service logic has rendered com puter science . .'; 'One service category theory has rendered mathematics . .'. All arguably true. And all statements obtainable this way form part of the raison d'etre of this series.

Nonlinear Parabolic Equations and Hyperbolic-Parabolic Coupled Systems Songmu Zheng 2020-05-05 This monograph is devoted to the global existence, uniqueness and asymptotic behaviour of smooth solutions to both initial

value problems and initial boundary value problems for nonlinear parabolic equations and hyperbolic parabolic coupled systems. Most of the material is based on recent research carried out by the author and his collaborators. The book can be divided into two parts. In the first part, the results on decay of solutions to nonlinear parabolic equations and hyperbolic parabolic coupled systems are obtained, and a chapter is devoted to the global existence of small smooth solutions to fully nonlinear parabolic equations and quasilinear hyperbolic parabolic coupled systems. Applications of the results to nonlinear thermoelasticity and fluid dynamics are also shown. Some nonlinear parabolic equations and coupled systems arising from the study of phase transitions are investigated in the second part of the book. The global existence, uniqueness and asymptotic behaviour of smooth solutions with arbitrary initial data are obtained. The final chapter is further devoted to related topics: multiplicity of equilibria and the existence of a global attractor, inertial manifold and inertial set. A knowledge of partial differential equations and Sobolev spaces is assumed. As an aid to the reader, the related concepts and results are collected and the relevant references given in the first chapter. The work will be of interest to researchers and graduate students in pure and applied mathematics, mathematical physics and applied sciences.

Handbook of Multivalued Analysis Shouchuan Hu 2013-11-21 In volume I we developed the tools of "Multivalued Analysis. " In this volume we examine the applications. After all, the initial impetus for the development of the theory of set-valued functions came from its applications in areas such as control theory and mathematical economics. In fact, the needs of control theory, in particular the study of systems with a priori feedback, led to the systematic investigation of differential

equations with a multi valued vector field (differential inclusions). For this reason, we start this volume with three chapters devoted to set-valued differential equations. However, in contrast to the existing books on the subject (i. e. J. -P. Aubin - A. Cellina: "Differential Inclusions," Springer-Verlag, 1983, and Deimling: "Multivalued Differential Equations," W. De Gruyter, 1992), here we focus on "Evolution Inclusions," which are evolution equations with multi valued terms. Evolution equations were raised to prominence with the development of the linear semigroup theory by Hille and Yosida initially, with subsequent im portant contributions by Kato, Phillips and Lions. This theory allowed a successful unified treatment of some apparently different classes of nonstationary linear par tial differential equations and linear functional equations. The needs of dealing with applied problems and the natural tendency to extend the linear theory to the nonlinear case led to the development of the nonlinear semigroup theory, which became a very effective tool in the analysis of broad classes of nonlinear evolution equations.

Nonlinear Phenomena in Mathematical Sciences V. Lakshmikantham 2014-05-12 Nonlinear Phenomena in Mathematical Sciences contains the proceedings of an International Conference on Nonlinear Phenomena in Mathematical Sciences, held at the University of Texas at Arlington, on June 16-20,1980. The papers explore trends in nonlinear phenomena in mathematical sciences, with emphasis on nonlinear functional analytic methods and their applications; nonlinear wave theory; and applications to medical and life sciences. In the area of nonlinear functional analytic methods and their applications, the following subjects are discussed: optimal control theory; periodic oscillations of nonlinear mechanical systems; Leray-Schauder degree theory; differential inequalities applied

to parabolic and elliptic partial differential equations; bifurcation theory, stability theory in analytical mechanics; singular and ordinary boundary value problems, etc. The following topics in nonlinear wave theory are considered: nonlinear wave propagation in a randomly homogeneous media; periodic solutions of a semilinear wave equation; asymptotic behavior of solutions of strongly damped nonlinear wave equations; shock waves and dissipation theoretical methods for a nonlinear Schr?dinger equation; and nonlinear hyperbolic Volterra equations occurring in viscoelasticity. Applications to medical and life sciences include mathematical modeling in physiology, pharmacokinetics, and neuro-mathematics, along with epidemic modeling and parameter estimation techniques. This book will be helpful to students, practitioners, and researchers in the field of mathematics.

Trends in Theory and Practice of Nonlinear Differential Equations V. Lakshmikantham 2020-12-18 This book is based on an International Conference on Trends in Theory and Practice of Nonlinear Differential Equations held at The University of Texas at Arlington. It aims to feature recent trends in theory and practice of nonlinear differential equations.

A Functional Analysis Framework for Modeling, Estimation and Control in Science and Engineering H.T. Banks 2012-06-18 A Modern Framework Based on Time-Tested Material A Functional Analysis Framework for Modeling, Estimation and Control in Science and Engineering presents functional analysis as a tool for understanding and treating distributed parameter systems. Drawing on his extensive research and teaching from the past 20 years, the author explains how functional analysis can be the basis of modern partial differential equation (PDE) and delay differential equation (DDE)

techniques. Recent Examples of Functional Analysis in Biology, Electromagnetics, Materials, and Mechanics Through numerous application examples, the book illustrates the role that functional analysis—a classical subject—continues to play in the rigorous formulation of modern applied areas. The text covers common examples, such as thermal diffusion, transport in tissue, and beam vibration, as well as less traditional ones, including HIV models, uncertainty in noncooperative games, structured population models, electromagnetics in materials, delay systems, and PDEs in control and inverse problems. For some applications, computational aspects are discussed since many problems necessitate a numerical approach.

Vertically Transmitted Diseases Stavros Busenberg 2012-12-06 Infectious diseases are transmitted through various different mechanisms including person to person interactions, by insect vectors and via vertical transmission from a parent to an unborn offspring. The population dynamics of such disease transmission can be very complicated and the development of rational strategies for controlling and preventing the spread of these diseases requires careful modeling and analysis. The book describes current methods for formulating models and analyzing the dynamics of the propagation of diseases which include vertical transmission as one of the mechanisms for their spread. Generic models that describe broad classes of diseases as well as models that are tailored to the dynamics of a specific infection are formulated and analyzed. The effects of incubation periods, maturation delays, and age-structure, interactions between disease transmission and demographic changes, population crowding, spatial spread, chaotic dynamic behavior, seasonal periodicities and discrete time interval events are studied within the context of specific disease transmission models. No

previous background in disease transmission modeling and analysis is assumedand the required biological concepts and mathematical methods are gradually introduced within the context of specific disease transmission models. Graphs are widely used to illustrate and explain the modeling assumptions and results. REMARKS: NOTE: the authors have supplied variants on the promotion text that are more suitable for promotionin different fields (by virtue of different emphasis in the content). They are not enclosed, but in the mathematics editorial.

Differential Equations Models in Biology, Epidemiology and Ecology

Stavros Busenberg 2013-03-08 The past forty years have been the stage for the maturation of mathematical biolo~ as a scientific field. The foundations laid by the pioneers of the field during the first half of this century have been combined with advances in ap plied mathematics and the computational sciences to create a vibrant area of scientific research with established research journals, professional societies, deep subspecialty areas, and graduate education programs. Mathematical biology is by its very nature cross-disciplinary, and research papers appear in mathemat ics, biology and other scientific journals, as well as in the specialty journals devoted to mathematical and theoretical biology. Multiple author papers are common, and so are collaborations between individuals who have academic bases in different traditional departments. Those who seek to keep abreast of current trends and problems need to interact with research workers from a much broader spectrum of fields than is common in the traditional mono-culture disciplines. Consequently, it is beneficial to have occasions which bring together significant numbers of workers in this field in a forum that encourages the exchange of ideas and which leads to a timely publication of the work that is presented. Such an

occasion occurred during January 13 to 16, 1990 when almost two hun dred research workers participated in an international conference on Differential Equations and Applications to Biology and Population Dynamics which was held in Claremont.

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