Volterra Integral Equations And Fractional Calculus Do

Unparalleled in scope compared to the literature currently available, the Handbook of Integral Equations, Second Edition contains over 2,500 integral equations with solutions as well as analytical and numerical methods for solving linear and nonlinear equations. It explores Volterra, Fredholm, Wiener–Hopf, Hammerstein, Uryson, and other equations that arise in mathematics, physics, engineering, the sciences, and economics. With 300 additional pages, this edition covers much more material than its predecessor. New to the Second Edition • New material on Volterra, Fredholm, singular, hypersingular, dual, and nonlinear integral equations, integral transforms, and special functions • More than 400 new equations with exact solutions • New chapters on mixed multidimensional equations and methods of integral equations for ODEs and PDEs • Additional examples for illustrative purposes To accommodate different mathematical backgrounds, the authors avoid wherever possible the use of special terminology, outline some of the methods in a schematic, simplified manner, and arrange the material in increasing order of complexity. The book can be used as a database of test problems for numerical and approximate methods for solving linear and nonlinear integral equations.

The use of scientific computing tools is currently customary for solving problems at several complexity levels in Applied Sciences. The great need for reliable software in the scientific community conveys a continuous stimulus to develop new and better performing numerical methods that are able to grasp the particular features of the problem at hand. This has been the case for many different settings of numerical analysis, and this Special Issue aims at covering some important developments in various areas of application.

This book offers a comprehensive treatment of the theory of measures of noncompactness. It discusses various applications of the theory of measures of noncompactness, in particular, by addressing the results and methods of fixed-point theory. The concept of a measure of noncompactness is very useful for the mathematical community working in nonlinear analysis. Both these theories are especially useful in investigations connected with differential equations, integral equations, functional integral equations and optimization theory. Thus, one of the book’s central goals is to collect and present sufficient conditions for the solvability of such equations. The results are established in miscellaneous function spaces, and particular attention is paid to fractional calculus.

This volume presents a state-of-the-art account of the theory and applications of integral equations of convolution type, and of certain classes of integro-differential and non-linear integral equations. An extensive and well-motivated discussion of some open questions and of various important directions for further research is also presented. The book has been written so as to be self-contained, and includes a list of symbols with their definitions. For users of convolution integral equations, the volume contains numerous, well-classified inversion tables which correspond to the various convolutions and intervals of integration. It also has an extensive, up-to-date bibliography. The convolution integral equations which are considered arise naturally from a large variety of physical situations and it is felt that the types of solutions discussed will be usefull in many diverse disciplines of applied mathematics and mathematical physical. For researchers and graduate students in the mathematical and physical sciences whose work involves the solution of integral equations.

This book includes different topics associated with integral and integro-differential equations and their relevance and significance in various scientific areas of study and research. Integral and integro-differential equations are capable of modelling many situations from science and engineering. Readers should find several useful and advanced methods for solving various types of integral and integro-differential equations in this book. The book is useful for graduate students, Ph.D. students, researchers and educators interested in mathematical modelling, applied mathematics, applied sciences, engineering, etc. Key Features • New and advanced methods for solving integral and integro-differential equations • Contains comparison of various methods for accuracy • Demonstrates the applicability of integral and integro-differential equations in other scientific areas • Examines qualitative as well as quantitative properties of solutions of various types of integral and integro-differential equations

This book is a printed edition of the Special Issue "Mathematical Analysis and Applications" that was published in Axioms

This book deals with the existence and stability of solutions to initial and boundary value problems for functional differential and integral equations and inclusions involving the Riemann-Liouville, Caputo, and Hadamard fractional derivatives and integrals. A wide variety of topics is covered in a mathematically rigorous manner making this work a valuable source of information for graduate students and researchers working with problems in fractional calculus.

Contents Preliminary Background Nonlinear Implicit Fractional Differential Equations Impulsive Nonlinear Implicit Fractional Differential Equations Boundary Value Problems for Nonlinear Implicit Fractional

Differential Equations Boundary Value Problems for Impulsive NIFDE Integrable Solutions for Implicit Fractional Differential Equations Partial Hadamard Fractional Integral Equations and Inclusions Stability Results for Partial Hadamard Fractional Integral Equations and Inclusions Hadamard–Stieltjes Fractional Integral Equations Ulam Stabilities for Random Hadamard Fractional Integral Equations

In the last two decades, fractional (or non integer) differentiation has played a very important role in various fields such as mechanics, electricity, chemistry, biology, economics, control theory and signal and image processing. For example, in the last three fields, some important considerations such as modelling, curve fitting, filtering, pattern recognition, edge detection, identification, stability, controllability, observability and robustness are now linked to long-range dependence phenomena. Similar progress has been made in other fields listed here. The scope of the book is thus to present the state of the art in the study of fractional systems and the application of fractional differentiation. As this volume covers recent applications of fractional calculus, it will be of interest to engineers, scientists, and applied mathematicians.

This is the first book to present a systematic review of applications of the Haar wavelet method for solving Calculus and Structural Mechanics problems. Haar wavelet-based solutions for a wide range of problems, such as various differential and integral equations, fractional equations, optimal control theory, buckling, bending and vibrations of elastic beams are considered. Numerical examples demonstrating the efficiency and accuracy of the Haar method are provided for all solutions.

This graduate textbook provides a self-contained introduction to modern mathematical theory on fractional differential equations. It addresses both ordinary and partial differential equations with a focus on detailed solution theory, especially regularity theory under realistic assumptions on the problem data. The text includes an extensive bibliography, application-driven modeling, extensive exercises, and graphic illustrations throughout to complement its comprehensive presentation of the field. It is recommended for graduate students and researchers in applied and computational mathematics, particularly applied analysis, numerical analysis and inverse problems.

Numerical analysis has witnessed many significant developments in the 20th century. This book brings together 16 papers dealing with historical developments, survey papers and papers on recent trends in selected areas of numerical analysis, such as: approximation and interpolation, solution of linear systems and eigenvalue problems, iterative methods, quadrature rules, solution of ordinary-, partial- and integral equations. The papers are reprinted from the 7-volume project of the Journal of Computational and Applied Mathematics on '/homepage/sac/cam/na2000/index.htmlNumerical Analysis 2000'. An introductory survey paper deals with the history of the first courses on numerical analysis in several countries and with the landmarks in the development of important algorithms and concepts in the field.

This volume is dedicated to Professor Stefan Samko on the occasion of his seventieth birthday. The contributions display the range of his scientific interests in harmonic analysis and operator theory. Particular attention is paid to fractional integrals and derivatives, singular, hypersingular and potential operators in variable exponent spaces, pseudodifferential operators in various modern function and distribution spaces, as well as related applications, to mention but a few. Most contributions were firstly presented in two conferences at Lisbon and Aveiro, Portugal, in June?July 2011.

In recent decades, significant interest, based on physics and engineering applications, has developed on so-called anomalous diffusion processes that possess different spread functions with classical ones. The resulting differential equation whose fundamental solution matches this decay process is best modeled by an equation containing a fractional order derivative. This dissertation mainly focuses on some inverse problems for fractional diffusion equations. After some background introductions and preliminaries in Section 1 and 2, in the third section we consider our first inverse boundary problem. This is where an unknown boundary condition is to be determined from overposed data in a time-fractional diffusion equation. Based upon the fundamental solution in free space, we derive a representation for the unknown parameters as the solution of a nonlinear Volterra integral equation of second kind with a weakly singular kernel. We are able to make physically reasonable assumptions on our constraining functions (initial and given boundary values) to be able to prove a uniqueness and reconstruction result. This is achieved by an iterative process and is an immediate result of applying a certain fixed point theorem. Numerical examples are presented to illustrate the validity and effectiveness of the proposed method. In the fourth section a reaction-diffusion problem with an unknown nonlinear source function, which has to be determined from overposed data, is considered. A uniqueness result is proved and a numerical algorithm including convergence analysis under some physically reasonable assumptions is presented in the one-dimensional case. To show effectiveness of the proposed method, some results of numerical simulations are presented. In Section 5, we also attempted to reconstruct a nonlinear source in a heat equation from a number of known input sources. This represents a new research even for the case of classical diffusion and would be the first step in a solution method for the fractional diffusion case. While analytic work is still in progress on this problem, Newton and Quasi-Newton method are applied to show the feasibility of numerical reconstructions. In conclusion, the fractional diffusion equations have some different properties with the classical ones but there are some similarities between them. The classical tools like integral equations and fixed point theory still hold under slightly different assumptions. Inverse problems for fractional diffusion equations have applications in many engineering and physics areas such as material design, porous media. They are trickier than classical ones but there are also some advantages due to the mildly ill-conditioned singularity caused by the new kernel functions. The electronic version of this dissertation is accessible from http://hdl.handle.net/1969.1/151079

The theory of integral equations has been an active research field for many years and is based on analysis, function theory, and functional analysis. On the other hand, integral equations are of practical interest because of the «boundary integral equation method», which transforms partial differential equations on a domain into integral equations over its boundary. This book grew out of a series of lectures given by the author at the Ruhr-Universitat Bochum and the Christian-Albrecht-Universitat zu Kiel to students of mathematics. The contents of the first six chapters correspond to an intensive lecture course of four hours per week for a semester. Readers of the book require background from analysis and the foundations of numeri cal mathematics. Knowledge of functional analysis is helpful, but to begin with some basic facts about Banach and Hilbert spaces are sufficient. The theoretical part of this book is reduced to a minimum; in Chapters 2, 4, and 5 more importance is attached to the numerical treatment of the integral equations than to their theory. Important parts of functional analysis (e. g. , the Riesz-Schauder theory) are presented without proof. We expect the reader either to be already familiar with functional analysis or to become motivated by the practical examples given here to read a book about this topic. We recall that also from a historical point of view, functional analysis was initially stimulated by the investigation of integral equations. This thesis presents three new numerical schemes for a class of fractional differential equations. The presented schemes are a Quadratic, a Cubic, and a Slope method. In these approaches, the differential equations are expressed in terms of Caputo type fractional derivatives. Properties of the Caputo derivative allow one to reduce the fractional differential equation into a Volterra type integral equation. Once this is done, a number of numerical schemes for the Volterra type integral equations can be applied to find the numerical solution of fractional differential equations. In all schemes, the entire domain is divided into several equal small domains. In the quadratic and the cubic methods, the distribution of the unknown function over the domain is expressed in terms of the function values at the node points. The slopes between the node points are not constant for the quadratic and the cubic methods. In the slope method, the distribution of the unknown function over the domain is expressed in terms of the function values and its slopes at the node points. The slope method explicitly imposes continuity of the slopes at the node points. These approximations are then substituted into the Volterra type integral equation to reduce it to a set of algebraic equations. These methods are used to solve linear and nonlinear problems. The Slope method uses two different types of polynomials, cubic order and fractional order, to develop two algorithms. Results obtained using quadratic, cubic, and slope methods agree with the analytical results and the numerical results obtained using other schemes. It is shown that the numerical solutions of fractional differential equations using fractional order polynomials for slope method may be more suitable than the integer order polynomials for slope method. In addition, the thesis presents a comparative study of the performance of five different numerical schemes for the solution of fractional differential equations to examine the stability, accuracy, and computational speed of the algorithms. The schemes considered for comparative study, are a Linear, a Quadratic, a Cubic, a State-space non-integer integrator, and a Direct discretization method.

In this work, the Haar wavelet operational matrix of fractional integration is first obtained. Haar wavelet approximating method is then utilized to reduce the fractional Volterra integral equations (which are also called the weakly-singular linear Volterra integral equations) and in particular the Abel integral equations, to a system of algebraic equations. An error bound is estimated and some numerical examples are included to demonstrate the validity and applicability of the method.

The book presents efficient numerical methods for simulation and analysis of physical processes exhibiting fractional order (FO) dynamics. The book introduces FO system identification method to estimate parameters of a mathematical model under consideration from experimental or simulated data. A simple tuning technique, which aims to produce a robust FO PID controller exhibiting iso-damping property during re-parameterization of a plant, is devised in the book. A new numerical method to find an equivalent finite dimensional integer order system for an infinite dimensional FO system is

developed in the book. The book also introduces a numerical method to solve FO optimal control problems. Key features Proposes generalized triangular function operational matrices. Shows significant applications of triangular orthogonal functions as well as triangular strip operational matrices in simulation, identification and control of fractional order processes. Provides numerical methods for simulation of physical problems involving different types of weakly singular integral equations, Abel's integral equation, fractional order integro-differential equations, fractional order differential and differential-algebraic equations, and fractional order partial differential equations. Suggests alternative way to do numerical computation of fractional order signals and systems and control. Provides source codes developed in MATLAB for each chapter, allowing the interested reader to take advantage of these codes for broadening and enhancing the scope of the book itself and developing new results.
This book looks at the theories of Volterra integral and functional equations.

This book is a printed edition of the Special Issue "Operators of Fractional Calculus and Their Applications" that was published in Mathematics

The theory of integral equations has a close contact with many different areas of mathematics. This is sufficient to say that there is almost no area of applied sciences and physics where integral equations do not play an important role. This books intended primarily to study the existence of solution, analytically and numerically, of nonlinear integral equations of the second kind of types Hammerstein, Hammerstein-Volterra and Volterra-Hammerstein. Also, it is used for proving the existence and uniqueness solution, analytically, of linear integro-differential and integral equations of type Fredholm-Volterra in three dimensional. Finally, it is very useful in establishing the existence and uniqueness solution of linear and nonlinear partial differential equations of fractional order, analytically and numerically.

Researches and investigations involving the theory and applications of integral transforms and operational calculus are remarkably wide-spread in many diverse areas of the mathematical, physical, chemical, engineering and statistical sciences. This Special Issue contains a total of 36 carefully-selected and peer-reviewed articles which are authored by established researchers from many countries. Included in this Special Issue are review, expository and original research articles dealing with the recent advances on the topics of integral transforms and operational calculus as well as their multidisciplinary applications

Very Good,No Highlights or Markup,all pages are intact.

This nine-chapter monograph introduces a rigorous investigation of q-difference operators in standard and fractional settings. It starts with elementary calculus of q-differences and integration of Jackson’s type before turning to q-difference equations. The existence and uniqueness theorems are derived using successive approximations, leading to systems of equations with retarded arguments. Regular q-Sturm–Liouville theory is also introduced; Green’s function is constructed and the eigenfunction expansion theorem is given. The monograph also discusses some integral equations of Volterra and Abel type, as introductory material for the study of fractional q-calculi. Hence fractional q-calculi of the types Riemann–Liouville; Grünwald–Letnikov; Caputo; Erdélyi–Kober and Weyl are defined analytically. Fractional q-Leibniz rules with applications in q-series are also obtained with rigorous proofs of the formal results of Al-Salam-Verma, which remained unproved for decades. In working towards the investigation of q-fractional difference equations; families of q-Mittag-Leffler functions are defined and their properties are investigated, especially the q-

Mellin–Barnes integral and Hankel contour integral representation of the q-Mittag-Leffler functions under consideration, the distribution, asymptotic and reality of their zeros, establishing q-counterparts of Wiman's results. Fractional q-difference equations are studied; existence and uniqueness theorems are given and classes of Cauchy-type problems are completely solved in terms of families of q-Mittag-Leffler functions. Among many q-analogs of classical results and concepts, q-Laplace, q-Mellin and q2-Fourier transforms are studied and their applications are investigated. This work aims to present, in a systematic manner, results including the existence and uniqueness of solutions for the Cauchy Type and Cauchy problems involving nonlinear ordinary fractional differential equations. /homepage/sac/cam/na2000/index.html7-Volume Set now available at special set price ! This volume contains contributions in the area of differential equations and integral equations. Many numerical methods have arisen in response to the need to solve "real-life" problems in applied mathematics, in particular problems that do not have a closed-form solution. Contributions on both initial-value problems and boundary-value problems in ordinary differential equations appear in this volume. Numerical methods for initial-value problems in ordinary differential equations fall naturally into two classes: those which use one starting value at each step (one-step methods) and those which are based on several values of the solution (multistep methods). John Butcher has supplied an expert's perspective of the development of numerical methods for ordinary differential equations in the 20th century. Rob Corless and Lawrence Shampine talk about established technology, namely software for initial-value problems using Runge-Kutta and Rosenbrock methods, with interpolants to fill in the solution between mesh-points, but the 'slant' is new - based on the question, "How should such software integrate into the current generation of Problem Solving Environments?" Natalia Borovykh and Marc Spijker study the problem of establishing upper bounds for the norm of the nth power of square matrices. The dynamical system viewpoint has been of great benefit to ODE theory and numerical methods. Related is the study of chaotic behaviour. Willy Govaerts discusses the numerical methods for the computation and continuation of equilibria and bifurcation points of equilibria of dynamical systems. Arieh Iserles and Antonella Zanna survey the construction of Runge-Kutta methods which preserve algebraic invariant functions. Valeria Antohe and Ian Gladwell present numerical experiments on solving a Hamiltonian system of Hénon and Heiles with a symplectic and a nonsymplectic method with a variety of precisions and initial conditions. Stiff differential equations first became recognized as special during the 1950s. In 1963 two seminal publications laid to the foundations for later development: Dahlquist's paper on A-stable multistep methods and Butcher's first paper on implicit Runge-Kutta methods. Ernst Hairer and Gerhard Wanner deliver a survey which retraces the discovery of the order stars as well as the principal achievements obtained by that theory. Guido Vanden Berghe, Hans De Meyer, Marnix Van Daele and Tanja Van Hecke construct exponentially fitted Runge-Kutta methods with s stages. Differential-algebraic equations arise in control, in modelling of mechanical systems and in many other fields. Jeff Cash describes a fairly recent class of formulae for the numerical solution of initial-value problems for stiff and differential-algebraic systems. Shengtai Li and Linda Petzold describe methods and software for sensitivity analysis of solutions of DAE initial-value problems. Again in the area of differential-algebraic systems, Neil Biehn, John Betts, Stephen Campbell and William Huffman present current work on mesh adaptation for DAE two-point boundary-value problems. Contrasting approaches to the question of how good an approximation is as a solution of a given equation involve (i) attempting to estimate the actual error (i.e., the difference between the true and the approximate solutions) and (ii) attempting to estimate the defect - the amount by which the approximation fails to satisfy the given equation and any side-conditions. The paper by Wayne Enright on defect control relates to carefully analyzed techniques that have been proposed both for ordinary differential equations and for delay differential equations in which an attempt is made to control an estimate of the size of the defect. Many phenomena incorporate noise, and the numerical solution of stochastic differential equations has developed as a relatively new item of study in the area. Keven Burrage, Pamela Burrage and Taketomo Mitsui review the way numerical methods for solving stochastic differential equations (SDE's) are constructed. One of the more recent areas to attract scrutiny has been the area of differential equations with after-effect (retarded, delay, or neutral delay differential equations) and in this volume we include a number of papers on evolutionary problems in this area. The paper of Genna Bocharov and Fathalla Rihan conveys the importance in mathematical biology of models using retarded differential equations. The contribution by Christopher Baker is intended to convey much of the background necessary for the application of numerical methods and includes some original results on stability and on the solution of approximating equations. Alfredo Bellen, Nicola Guglielmi and Marino Zennaro contribute to the analysis of stability of numerical solutions of nonlinear neutral differential equations. Koen Engelborghs, Tatyana Luzyanina, Dirk Roose, Neville Ford and Volker Wulf consider the numerics of bifurcation in delay differential equations. Evelyn Buckwar contributes a paper indicating the construction and analysis of a numerical strategy for stochastic delay differential equations (SDDEs). This volume contains contributions on both Volterra and Fredholm-type integral equations. Christopher Baker responded to a late challenge to craft a review of the theory of the basic numerics of Volterra integral and integro-differential equations. Simon Shaw and John Whiteman discuss Galerkin methods for a type of Volterra integral equation that arises in modelling viscoelasticity. A subclass of boundary-value problems for ordinary differential equation comprises eigenvalue problems such as Sturm-Liouville problems (SLP) and Schrödinger equations. Liviu Ixaru describes the advances made over the last three decades in the field of piecewise perturbation methods for the numerical solution of Sturm-Liouville problems in general and systems of Schrödinger equations in particular. Alan Andrew surveys the asymptotic correction method for regular Sturm-Liouville problems. Leon Greenberg and Marco Marletta survey methods for higher-order Sturm-Liouville problems. R. Moore in the 1960s first showed the feasibility of validated solutions of differential equations, that is, of computing guaranteed enclosures of solutions. Boundary integral equations. Numerical solution of integral equations associated with boundary-value problems has experienced continuing interest. Peter Junghanns and Bernd Silbermann present a selection of modern results concerning the numerical analysis of one-dimensional Cauchy singular integral equations, in particular the stability of operator sequences associated with different projection methods. Johannes Elschner and Ivan Graham summarize the most important results achieved in the last years about the numerical solution of one-dimensional integral equations of Mellin type of means of projection methods and, in particular, by collocation methods. A survey of results on quadrature methods for solving boundary integral equations is presented by Andreas

Rathsfeld. Wolfgang Hackbusch and Boris Khoromski present a novel approach for a very efficient treatment of integral operators. Ernst Stephan examines multilevel methods for the h-, p- and hp- versions of the boundary element method, including pre-conditioning techniques. George Hsiao, Olaf Steinbach and Wolfgang Wendland analyze various boundary element methods employed in local discretization schemes.
The late Professor Ming-Po Chen was instrumental in making the Third International Conference on Difference Equations a great success. Dedicated to his memory, these proceedings feature papers presented by many of the most prominent mathematicians in the field. It is a comprehensive collection of the latest developments in topics including stability theory, combinatorics, asymptotics, partial difference equations, as well as applications to biological, social, and natural sciences. This volume is an indispensable reference for academic and applied mathematicians, theoretical physicists, systems engineers, and computer and information scientists.
This book presents a system view of the digital scientific and technological revolution, including its genesis and prerequisites, current trends, as well as current and potential issues and future prospects. It gathers selected research papers presented at the 12th International Scientific and Practical Conference, organized by the Institute of Scientific Communications. The conference “Artificial Intelligence: Anthropogenic Nature vs. Social Origin” took place on December 5–7, 2019 in Krasnoyarsk, Russia. The book is intended for academic researchers and independent experts studying the social and human aspects of the Fourth Industrial Revolution and the associated transition to the digital economy and Industry 4.0, as well as the creators of the legal framework for this process and its participants – entrepreneurs, managers, employees and consumers. It covers a variety of topics, including “intelligent” technologies

and artificial intelligence, the digital economy, the social environment of the Fourth Industrial Revolution and its consequences for humans, the regulatory framework of the Fourth Industrial Revolution, and the “green” consequences, prospects and financing of the Fourth Industrial Revolution.
Publisher Description
An Operational Haar Wavelet Method for Solving Fractional Volterra Integral Equations
This monograph provides the most recent and up-to-date developments on fractional differential and fractional integro-differential equations involving many different potentially useful operators of fractional calculus. The subject of fractional calculus and its applications (that is, calculus of integrals and derivatives of any arbitrary real or complex order) has gained considerable popularity and importance during the past three decades or so, due mainly to its demonstrated applications in numerous seemingly diverse and widespread fields of science and engineering. Some of the areas of present-day applications of fractional models include Fluid Flow, Solute Transport or Dynamical Processes in Self-Similar and Porous Structures, Diffusive Transport akin to Diffusion, Material Viscoelastic Theory, Electromagnetic Theory, Dynamics of Earthquakes, Control Theory of Dynamical Systems, Optics and Signal Processing, Bio-Sciences, Economics, Geology, Astrophysics, Probability and Statistics, Chemical Physics, and so on. In the above-mentioned areas, there are phenomena with estrange kinetics which have a microscopic complex behaviour, and their macroscopic dynamics can not be characterized by classical derivative models. The fractional modelling is an emergent tool which use fractional differential equations including derivatives of fractional order, that is, we can speak about a derivative of order 1/3, or square root of 2, and so on. Some of such fractional models can have solutions which are

non-differentiable but continuous functions, such as Weierstrass type functions. Such kinds of properties are, obviously, impossible for the ordinary models. What are the useful properties of these fractional operators which help in the modelling of so many anomalous processes? From the point of view of the authors and from known experimental results, most of the processes associated with complex systems have non-local dynamics involving long-memory in time, and the fractional integral and fractional derivative operators do have some of those characteristics. This book is written primarily for the graduate students and researchers in many different disciplines in the mathematical, physical, engineering and so many others sciences, who are interested not only in learning about the various mathematical tools and techniques used in the theory and widespread applications of fractional differential equations, but also in further investigations which emerge naturally from (or which are motivated substantially by) the physical situations modelled mathematically in the book. This monograph consists of a total of eight chapters and a very extensive bibliography. The main objective of it is to complement the contents of the other books dedicated to the study and the applications of fractional differential equations. The aim of the book is to present, in a systematic manner, results including the existence and uniqueness of solutions for the Cauchy type problems involving nonlinear ordinary fractional differential equations, explicit solutions of linear differential equations and of the corresponding initial-value problems through different methods, closed-form solutions of ordinary and partial differential equations, and a theory of the so-called sequential linear fractional differential equations including a generalization of the classical Frobenius method, and also to include an interesting set of applications of the developed theory. Key features: - It is mainly application oriented. - It contains a complete theory of Fractional Differential Equations. - It can be used as a postgraduate-level textbook in many different disciplines within science and engineering. - It contains an up-to-date bibliography. - It provides problems and directions for further investigations. - Fractional Modelling is an emergent tool with demonstrated applications in numerous seemingly diverse and widespread fields of science and engineering. - It contains many examples. - and so on!

Launched in 2013, Frontiers in Physics consists of 18 specialties covering all areas of research in physics. With over 500 published manuscripts, the journal is now indexed in SCIE with the first impact factor coming in 2019. Frontiers in Physics aims to become the largest and most cited open access multidisciplinary physics journal. This eBook collects what the Specialty Chief Editors of the journal believed were the most interesting manuscripts published over the past two years. It is a nice collection, which will offer the reader the chance to have a quick overview of the specialties of the journal and offer a glimpse into the state of the art of physics. We must confess that it has been quite challenging to select only one article per specialty section given the many important manuscripts published by the journal in 2017 and 2018. We invite our reader to have a look at the journal homepage and browse what we have published so far. It includes articles on topics very different from each other, written by both early career scientists and well-known researchers, ranging from the indisputable advance of the field to the more bold. We hope you enjoy reading our first edition of the Frontiers in Physics Editor's Choice eBook! Professor Alex Hansen (Field Chief Editor) and Dr Claudio Bogazzi (Journal Manager)

These proceedings comprise a large part of the papers presented at the In ternational Conference Factorization, Singular Operators and related problems, which was held from January 28 to February 1, 2002, at the University of th Madeira, Funchal, Portugal, to mark Professor Georgii Litvinchuk's 70 birth day. Experts in a variety of fields came to this conference to pay tribute to the great achievements of Professor Georgii Litvinchuk in the development of vari ous areas of operator theory. The main themes of the conference were focussed around the theory of singular type operators and factorization problems, but other topics such as potential theory and fractional calculus, to name but a couple, were also presented. The goal of the conference was to bring together mathematicians from var ious fields within operator theory and function theory in order to highlight recent advances in problems many of which were originally studied by Profes sor Litvinchuk and his scientific school. A second aim was to stimulate in ternational collaboration even further and promote the interaction of different approaches in current research in these areas. The Proceedings will be of great interest to researchers in Operator The ory, Real and Complex Analysis, Functional and Harmonic Analysis, Potential Theory, Fractional Calculus and other areas, as well as to graduate students looking for the latest results.

This proceedings gather a selection of peer-reviewed papers presented at the 8th International Conference on Fracture Fatigue and Wear (FFW 2020), held as a virtual conference on 26-27 August 2020. The contributions, prepared by international scientists and engineers, cover the latest advances in and innovative applications of fracture mechanics, fatigue of materials, tribology, and wear of materials. In addition, they discuss industrial applications and cover theoretical and analytical methods, numerical simulations and experimental techniques. The book is intended for academics, including graduate students and researchers, as well as industrial practitioners working in the areas of fracture fatigue and wear.

In this volume, we report new results about various theories and methods of integral equation, boundary value problems for partial differential equations and functional equations, and integral operators including singular integral equations, applications of boundary value problems and integral equations to mechanics and physics, numerical methods of integral equations and boundary value problems, theories and methods for inverse problems of mathematical physics, Clifford analysis and related problems. Contents:Some Properties of a Kind of Singular Integral Operator for K-Monogenic Function in Clifford Analysis (L P Wang, Z L Xu and Y Y Qiao)Some Results Related with Möbius Transformation in Clifford Analysis (Z X Zhang)The Scattering of SH Wave on the Array of Periodic Cracks in a Piezoelectric Substrate Bonded a Half-Plane of Functionally Graded Materials (J Q Liu, X Li, S Z Dong, X Y Yao and C F Wang)Anti-Plane Problem of Two Collinear Cracks in a Functionally Graded Coating–Substrate Structure (S H Ding and X Li)A Kind of Riemann Boundary Value Problem for Triharmonic Functions in Clifford Analysis (L F Gu)A New Dynamical Systems Method for Nonlinear

Operator Equations (X J Luo, F C Li and S H Yang)A Class of Integral Inequality and Application (W S Wang)An Efficient Spectral Boundary Integral Equation Method for the Simulation of Earthquake Rupture Problems (W S Wang and B W Zhang)High-Frequency Asymptotics for the Modified Helmholtz Equation in a Half-Plane (H M Huang)An Inverse Boundary Value Problem Involving Filtration for Elliptic Systems of Equations (Z L Xu and L Yan)Fixed Point Theorems of Contractive Mappings in Extended Cone Metric Spaces (H P Huang and X Li)Positive Solutions of Singular Third-Order Three-Point Boundary Value Problems (B Q Yan and X Liu)Modified Neumann Integral and Asymptotic Behavior in the Half-Space (Y H Zhang, G T Deng and Z Z Wei)Piecewise Tikhonov Regularization Scheme to Reconstruct Discontinuous Density in Computerized Tomography (J Cheng, Y Jiang, K Lin and J W Yan)About the Quaternionic Jacobian Conjecture (H Liu)Interaction Between Antiplane Circular Inclusion and Circular Hole of Piezoelectric Materials (L H Chang and X Li)Convergence of Numerical Algorithm for Coupled Heat and Mass Transfer in Textile Materials (M B Ge, J X Cheng and D H Xu)Haversian Cortical Bone with a Radial Microcrack (X Wang)Spectra of Unitary Integral Operators on L2(?) with Kernels k(xy) (D W Ma and G Chen)The Numerical Simulation of Long-Period Ground Motion on Basin Effects (Y Q Li and X

Li)Complete Plane Strain Problem of a One-Dimensional Hexagonal Quasicrystals with a Doubly-Periodic Set of Cracks (X Li and P P Shi)The Problem About an Elliptic Hole with III Asymmetry Cracks in One-Dimensional Hexagonal Piezoelectric Quasicrystals (H S Huo and X Li)The Second Fundamental Problem of Periodic Plane Elasticity of a One-Dimensional Hexagonal Quasicrystals (J Y Cui, P P Shi and X Li)The Optimal Convex Combination Bounds for the Centroidal Mean (H Liu and X J Meng)The Method of Fundamental Solution for a Class of Elliptical Partial Differential Equations with Coordinate Transformation and Image Technique (L N Wu and Q Jiang)Various Wavelet Methods for Solving Fractional Fredholm–Volterra Integral Equations (P P Shi, X Li and X Li) Readership: Researchers in analysis and differential equations. Keywords:Integral Equations;Boundary Value ProblemsKey Features:Provides new research progress on these topics

This book offers a comprehensive introduction to the theory of linear and nonlinear Volterra integral equations. It includes applications and an extensive bibliography.

This book deals with the study of sequence spaces, matrix transformations, measures of noncompactness and their various applications. The notion of measure of noncompactness is one of the most useful ones available and has many applications. The book discusses some of the existence results for various types of differential and integral equations with the help of measures of noncompactness; in particular, the Hausdorff measure of noncompactness has been applied to obtain necessary and sufficient conditions for matrix operators between BK spaces to be compact operators. The book consists of eight self-contained chapters. Chapter 1 discusses the theory of FK spaces and Chapter 2 various duals of sequence spaces, which are used to characterize the matrix classes between these sequence spaces (FK and BK spaces) in Chapters 3 and 4. Chapter 5 studies the notion of a measure of noncompactness and its properties. The techniques associated with measures of noncompactness are applied to characterize the compact matrix operators in Chapters 6. In Chapters 7 and 8, some of the existence results are discussed for various types of differential and integral equations, which are obtained with the help of argumentations based on compactness conditions.

This book deals with the numerical solution of integral equations based on approximation of functions and the authors apply wavelet approximation to the unknown function of integral equations. The book's goal is to categorize the selected methods and assess their accuracy and efficiency.

The Proceedings volume contains 16 contributions to the IMPA conference “New Trends in Parameter Identification for Mathematical Models”, Rio de Janeiro, Oct 30 – Nov 3, 2017, integrating the “Chemnitz Symposium on Inverse Problems on Tour”. This conference is part of the “Thematic Program on Parameter Identification in Mathematical Models” organized at IMPA in October and November 2017. One goal is to foster the scientific collaboration between mathematicians and engineers from the Brazialian, European and Asian communities. Main topics are iterative and variational regularization methods in Hilbert and Banach spaces for the stable approximate solution of ill-posed inverse problems, novel methods for parameter identification in partial differential equations, problems of tomography , solution of coupled conduction-radiation problems at high temperatures, and the statistical solution of inverse problems with applications in physics.