Basic Theory of

Fractional Differential Equations

Edited by: **Olga Moreira**

Basic Theory Of Fractional Differential Equations

Alberto Carpinteri,Francesco Mainardi

Basic Theory Of Fractional Differential Equations:

Basic Theory Of Fractional Differential Equations (Second Edition) Yong Zhou,Jinrong Wang,Lu Zhang,2016-10-20 This invaluable monograph is devoted to a rapidly developing area on the research of qualitative theory of fractional ordinary and partial differential equations It 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 the technique of Picard operators critical point theory and semigroup theory Based on the research work carried out by the authors and other experts during the past seven years the contents are very recent and comprehensive In this edition two new topics have been added that is fractional impulsive differential equations and fractional partial differential equations including fractional Navier Stokes equations and fractional diffusion equations   **Basic Theory of Fractional Differential Equations** 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   Basic Theory of Fractional Differential Equations Yong Zhou,2024   Basic Theory of Fractional Differential Equations Giovanni C. Gentry,2014-05-14 This invaluable book is devoted to a rapidly developing area on the research of the qualitative theory of fractional differential equations It is self contained and unified in presentation and provides 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 the Picard operators technique critical point theory and semigroups theory Based on research work carried out by the author and other experts during the past four years the contents are very new and comprehensive   **Basic Theory of Fractional Differential Equations** Yong Zhou,2016 This invaluable monograph is devoted to a rapidly developing area on the research of qualitative theory of fractional ordinary and partial differential equations It provides the readers the necessary background material required to go further into the subject and explore the rich research literature

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Theory And Applications of Fractional Differential Equations A. Anatolii Aleksandrovich Kilbas,Hari Mohan Srivastava,Juan J. Trujillo,2006 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   **Fractional Differential Equations** Anatoly Kochubei,Yuri Luchko,2019-02-19 This multi volume handbook is the most up to date and comprehensive reference work in the field of fractional calculus and its numerous applications This second volume collects authoritative chapters covering the mathematical theory of fractional calculus including ordinary and partial differential equations of fractional order inverse problems and evolution equations   **The Theory of Fractional Powers of Operators** Celso Martínez Carracedo,Miguel Sanz Alix,2001-01-17 This book makes available to researchers and advanced graduates a simple and direct presentation of the fundamental aspects of the theory of fractional powers of non negative operators which have important links with partial differential equations and harmonic analysis For the first time ever a book deals with this subject monographically despite the large number of papers written on it during the second half of the century The first chapters are concerned with the construction of a basic theory of fractional powers and study the classic questions in that respect A new and distinct feature is that the approach adopted has allowed the extension of this theory to locally convex spaces thereby including certain differential operators which appear naturally in distribution spaces The bulk of the second part of the book is dedicated to

powers with pure imaginary exponents which have been the focus of research in recent years ever since the publication in 1987 of the now classic paper by G Dore and A Venni Special care has been taken to give versions of the results with more accurate hypotheses particularly with respect to the density of the domain or the range of the operator The authors have made a point of making the text clear and self contained Accordingly an extensive appendix contains the material on real and functional analysis used and at the end of each chapter there are detailed historical and bibliographical notes in order to understand the development and current state of research into the questions dealt with   **Proceedings of A. Razmadze Mathematical Institute** ,2008   **Theory of Fractional Evolution Equations** Yong Zhou,Bashir Ahmad,Ahmed Alsaedi,2022-03-21 Fractional evolution equations provide a unifying framework to investigate wellposedness of complex systems with fractional order derivatives This monograph presents the existence attractivity stability periodic solutions and control theory for time fractional evolution equations The book contains an up to date and comprehensive stuff on the topic
     The Journal of Integral Equations and Applications ,2018   **Annales Polonici Mathematici** ,2011   **Fractals and Fractional Calculus in Continuum Mechanics** Alberto Carpinteri,Francesco Mainardi,1997-12-11 The book is characterized by the illustration of cases of fractal self similar and multi scale structures taken from the mechanics of solid and porous materials which have a technical interest In addition an accessible and self consistent treatment of the mathematical technique of fractional calculus is provided avoiding useless complications   **Communications in Applied Analysis** ,2008   *Fractional Differential Equations* Bangti Jin,2021-07-22 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

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