Operator Approach to Linear Problems of Hydrodynamics

Volume 1: Self-adjoint Problems for an Ideal Fluid

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Operator Approach To Problems Of Stabili

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<u>Operator Approach to Linear Problems of Hydrodynamics</u> Nikolay D. Kopachevskii,Selim G. Krein,2012-12-06 This is the first volume of a set of two devoted to the operator approach to linear problems in hydrodynamics It presents functional analytical methods applied to the study of small movements and normal oscillations of hydromechanical systems having cavities filled with either ideal or viscous fluids The work is a sequel to and at the same time substantially extends the volume Operator Methods in Linear Hydrodynamics Evolution and Spectral Problems by N D Kopachevsky S G Krein and Ngo Zuy Kan published in 1989 by Nauka in Moscow It includes several new problems on the oscillations of partially dissipative hydrosystems and the oscillations of visco elastic or relaxing fluids The work relies on the authors and their students works of the last 30 40 years The readers are not supposed to be familiar with the methods of functional analysis In the first part of the present volume the main facts of linear operator theory relevant to linearized problems of hydrodynamics are summarized including elements of the theories of distributions self adjoint operators in Hilbert spaces and in spaces with an indefinite metric evolution equations and asymptotic methods for their solutions the spectral theory of operator pencils The book is particularly useful for researchers engineers and students in fluid mechanics and mathematics interested in operator theoretical methods for the analysis of hydrodynamical problems **Operator Approach to Linear Problems of Hydrodynamics** Nikolay D. Kopachevsky,Selim Krein,2012-12-06 As mentioned in the Introduction to Volume I the present monograph is intended both for mathematicians interested in applications of the theory of linear operators and operator functions to problems of hydrodynamics and for researchers of applied hydrodynamic problems who want to study these problems by means of the most recent achievements in operator theory The second volume considers nonself adjoint problems describing motions and normal oscillations of a homogeneous viscous incompressible fluid These ini tial boundary value problems of mathematical physics include as a rule derivatives in time of the unknown functions not only in the equation but in the boundary conditions too Therefore the spectral problems corresponding to such boundary value problems include the spectral parameter in the equation and in the bound ary conditions and are nonself adjoint In their study we widely used the theory of nonself adjoint operators acting in a Hilbert space and also the theory of operator pencils In particular the methods of operator pencil factorization and methods of operator theory in a space with indefinite metric find here a wide application We note also that this volume presents both the now classical problems on oscillations of a homogeneous viscous fluid in an open container in an ordinary state and in weightlessness and a new set of problems on oscillations of partially dissipative hydrodynamic systems and problems on oscillations of a visco elastic or relaxing fluid Some of these problems need a more careful additional investigation and are rather complicated *Operator Approach to Linear Control Systems* A. Cheremensky,V.N. Fomin,2013-11-11 The idea of optimization runs through most parts of control theory The simplest optimal controls are preplanned programmed ones The problem of constructing optimal preplanned

controls has been extensively worked out in literature see e g the Pontrjagin maximum principle giving necessary conditions of preplanned control optimality However the concept of op timality itself has a restrictive character it is limited by what one means under optimality in each separate case The internal contradictoriness of the preplanned control optimality the better is the enemy of the good yields that the practical significance of optimal preplanned controls proves to be not great such controls are usually sensitive to unregistered disturbances includ ing the round off errors which are inevitable when computer devices are used for forming controls as there is the effect of disturbance accumulation in the control process which makes controls to be of little use on large time inter vals This gap is mainly provoked by oversimplified settings of optimization problems The outstanding result of control theory established in the end of the first half of our century is that controls in feedback form ensure the weak sensitivity of closed loop systems with respect to small unregistered internal and external disturbances acting in them here we do not need to discuss performance indexes since the considered phenomenon is of general nature But by far not all optimal preplanned controls can be represented in a feedback form **Nuclear Science Abstracts** ,1976-05 *The Linearization Method in Hydrodynamical Stability Theory* Viktor Iosifovich I_Udovich,1989-12-31 This book presents the theory of the linearization method as applied to the problem of steady state and periodic motions of continuous media The author proves infinite dimensional analogues of Lyapunov s theorems on stability instability and conditional stability for a large class of continuous media In addition semigroup properties for the linearized Navier Stokes equations in the case of an incompressible fluid are studied and coercivity inequalities and completeness of a system of small oscillations are proved An Introduction to Non-Harmonic Fourier Series, Revised Edition, 93 Robert M. Young,2001-05-16 An Introduction to Non Harmonic Fourier Series Revised Edition is an update of a widely known and highly respected classic textbook Throughout the book material has also been added on recent developments including stability theory the frame radius and applications to signal analysis and the control of partial differential equations

Asymptotic Stability of Steady Compressible Fluids Mariarosaria Padula,2011-07-30 This volume introduces a systematic approach to mathematical problems involved with thermodynamic fluids The book is written for theoretical and applied mathematicians with an interest in compressible flow capillarity theory and control theory *Building Bridges: Connections and Challenges in Modern Approaches to Numerical Partial Differential Equations* Gabriel R. Barrenechea,Franco Brezzi,Andrea Cangiani,Emmanuil H. Georgoulis,2016-10-03 This volume contains contributed survey papers from the main speakers at the LMS EPSRC Symposium Building bridges connections and challenges in modern approaches to numerical partial differential equations This meeting took place in July 8 16 2014 and its main purpose was to gather specialists in emerging areas of numerical PDEs and explore the connections between the different approaches The type of contributions ranges from the theoretical foundations of these new techniques to the applications of them to new general frameworks and unified approaches that can cover one or more than one of these emerging techniques *Advances*

in Control Systems C. T. Leondes,2014-11-30 Advances in Control Systems Theory and Applications Volume 2 provides information pertinent to the significant progress in the field of automatic control This book presents different methods for generating Liapunov functions which is important in the analysis of nonlinear systems Organized into five chapters this volume begins with an overview of the reduction of the important method of Liapunov to a practical working tool for the analysis of complex nonlinear systems This text then discusses applications of the rather powerful method of dynamic programming to a complex class of problems Other chapters consider the mathematical theory of optimal control which is often confronted with the task of solving a system of first order ordinary differential equations This book discusses as well the input output relationship of multivariable linear systems or plants The final chapter deals with a powerful technique for design by analysis of nonlinear systems This book is a valuable resource for mathematicians and engineers **Waves And Stability In Continuous Media - Proceedings Of The 11th Conference On Wascom 2001** Miriam Pandolfi Bianchi,Roberto Monaco,Salvatore Rionero,2002-06-19 First organized in 1981 the WASCOM conference to bring together researchers and scientists from all over the world to discuss problems promote collaborations and shape future directions for research in the field of stability and wave propagation in continuous media This book constitutes the proceedings of the 11th edition of the conference the first of the third millennium The main topics are 1 Linear and nonlinear hyperbolic equations conservation laws and specific aspects of wave propagation 2 stability of systems of PDEs with particular reference to those of fluid and solid mechanics 3 extended thermodynamics and passage from microscopic to macroscopic description of the medium for systems characterized also by inelastic interactions at the kinetic scale The proceedings have been selected for coverage in Index to Scientific Technical Proceedings ISTP CDROM version ISI Proceedings **Logarithmic Norms** Gustaf Söderlind,2024-11-11 This book offers the first comprehensive account of how the logarithmic norm is used for matrices nonlinear maps and linear differential operators with a focus on initial and boundary value problems Complementing the usual operator norm the logarithmic norm is a versatile tool which provides unique additional information on the magnitude of an operator It is instrumental in the stability theory of dynamical systems and in the theory of elliptic operator equations The text adopts a unified approach to address a wide range of themes in applied mathematics It explores the role of the logarithmic norm in scientific computing compares the operator bounds with those of spectral theory and illustrates the theory with classical models from science and engineering Many previously unpublished results are presented alongside established material supporting researchers in applied mathematics and computational engineering who seek a systematic approach to stability and perturbation bounds in initial value problems boundary value problems and partial differential equations Primarily intended as a reference text the book can also serve as a graduate text for PhD students *Numerical Methods for Nonlinear Elliptic Differential Equations* Klaus Böhmer,2010-10-07 Boehmer systmatically handles the different numerical methods for nonlinear elliptic problems *Stability Criteria for Fluid Flows* Adelina Georgescu,Lidia Palese,2010

This is a comprehensive and self contained introduction to the mathematical problems of thermal convection The book delineates the main ideas leading to the authors variant of the energy method These can be also applied to other variants of the energy method The importance of the book lies in its focussing on the best concrete results known in the domain of fluid flows stability and in the systematic treatment of mathematical instruments used in order to reach them   Stability Criteria For Fluid Flows Lidia Palese,Adelina Georgescu,2009-12-18 This is a comprehensive and self contained introduction to the mathematical problems of thermal convection The book delineates the main ideas leading to the authors variant of the energy method These can be also applied to other variants of the energy method The importance of the book lies in its focussing on the best concrete results known in the domain of fluid flows stability and in the systematic treatment of mathematical instruments used in order to reach them   Singular Perturbations of Differential Operators Sergio Albeverio,P. Kurasov,2000-03-13 Differential and more general self adjoint operators involving singular interactions arise naturally in a range of topics such as classical and quantum physics chemistry and electronics This book presents a systematic mathematical study of these operators with particular emphasis on spectral and scattering problems Suitable for researchers in analysis or mathematical physics this book could also be used as a text for an advanced course on the applications of analysis   **Mathematical Reviews** ,2006   **Pricing Derivatives Under Lévy Models** Andrey Itkin,2017-02-27 This monograph presents a novel numerical approach to solving partial integro differential equations arising in asset pricing models with jumps which greatly exceeds the efficiency of existing approaches The method based on pseudo differential operators and several original contributions to the theory of finite difference schemes is new as applied to the L vy processes in finance and is herein presented for the first time in a single volume The results within developed in a series of research papers are collected and arranged together with the necessary background material from L vy processes the modern theory of finite difference schemes the theory of M matrices and EM matrices etc thus forming a self contained work that gives the reader a smooth introduction to the subject For readers with no knowledge of finance a short explanation of the main financial terms and notions used in the book is given in the glossary The latter part of the book demonstrates the efficacy of the method by solving some typical problems encountered in computational finance including structural default models with jumps and local stochastic volatility models with stochastic interest rates and jumps The author also adds extra complexity to the traditional statements of these problems by taking into account jumps in each stochastic component while all jumps are fully correlated and shows how this setting can be efficiently addressed within the framework of the new method Written for non mathematicians this book will appeal to financial engineers and analysts econophysicists and researchers in applied numerical analysis It can also be used as an advance course on modern finite difference methods or computational finance   Stability Estimates for Hybrid Coupled Domain Decomposition Methods Olaf Steinbach,2003-01-01 Domain decomposition methods are a well established tool for an efficient numerical solution of partial differential equations

in particular for the coupling of different model equations and of different discretization methods Based on the approximate solution of local boundary value problems either by finite or boundary element methods the global problem is reduced to an operator equation on the skeleton of the domain decomposition Different variational formulations then lead to hybrid domain decomposition methods   <u>Parabolic Problems</u> Joachim Escher,Patrick Guidotti,Matthias Hieber,Piotr Mucha,Jan W. Prüss,Yoshihiro Shibata,Gieri Simonett,Christoph Walker,Wojciech Zajaczkowski,2011-07-20 The volume originates from the Conference on Nonlinear Parabolic Problems held in celebration of Herbert Amann s 70th birthday at the Banach Center in Bedlewo Poland It features a collection of peer reviewed research papers by recognized experts highlighting recent advances in fields of Herbert Amann s interest such as nonlinear evolution equations fluid dynamics quasi linear parabolic equations and systems functional analysis and more   **Transmutation Operators and Applications** Vladislav V. Kravchenko,Sergei M. Sitnik,2020-04-11 Transmutation operators in differential equations and spectral theory can be used to reveal the relations between different problems and often make it possible to transform difficult problems into easier ones Accordingly they represent an important mathematical tool in the theory of inverse and scattering problems of ordinary and partial differential equations integral transforms and equations special functions harmonic analysis potential theory and generalized analytic functions This volume explores recent advances in the construction and applications of transmutation operators while also sharing some interesting historical notes on the subject

Reviewing **Operator Approach To Problems Of Stabili**: Unlocking the Spellbinding Force of Linguistics

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