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Partially Specified Matrices and Operators: Classification, Completion, Applications

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Partially Specified Matrices and Operators: Classification, Completion, Applications Israel Gohberg,Marinus Kaashoek,Frederik Van Schagen,2012-12-06 This book is devoted to a new direction in linear algebra and operator theory that deals with the invariants of partially specified matrices and operators and with the spectral analysis of their completions The theory developed centers around two major problems concerning matrices of which part of the entries are given and the others are unspecified The first is a classification problem and aims at a simplification of the given part with the help of admissible similarities The results here may be seen as a far reaching generalization of the Jordan canonical form The second problem is called the eigenvalue completion problem and asks to describe all possible eigenvalues and their multiplicities of the matrices which one obtains by filling in the unspecified entries Both problems are also considered in an infinite dimensional operator framework A large part of the book deals with applications to matrix theory and analysis namely to stabilization problems in mathematical system theory to problems of Wiener Hopf factorization and interpolation for matrix polynomials and rational matrix functions to the Kronecker structure theory of linear pencils and to non everywhere defined operators The eigenvalue completion problem has a natural associated inverse which appears as a restriction problem The analysis of these two problems is often simpler when a solution of the corresponding classification problem is available

Partially Specified Matrices and Operators: Classification, Completion, Applications Israel Gohberg,Marinus Kaashoek,Frederik Van Schagen,1995-08-28 This book is devoted to a new direction in linear algebra and operator theory that deals with the invariants of partially specified matrices and operators and with the spectral analysis of their completions The theory developed centers around two major problems concerning matrices of which part of the entries are given and the others are unspecified The first is a classification problem and aims at a simplification of the given part with the help of admissible similarities The results here may be seen as a far reaching generalization of the Jordan canonical form The second problem is called the eigenvalue completion problem and asks to describe all possible eigenvalues and their multiplicities of the matrices which one obtains by filling in the unspecified entries Both problems are also considered in an infinite dimensional operator framework A large part of the book deals with applications to matrix theory and analysis namely to stabilization problems in mathematical system theory to problems of Wiener Hopf factorization and interpolation for matrix polynomials and rational matrix functions to the Kronecker structure theory of linear pencils and to non everywhere defined operators The eigenvalue completion problem has a natural associated inverse which appears as a restriction problem The analysis of these two problems is often simpler when a solution of the corresponding classification problem is available

Operator Theory, Analysis and the State Space Approach Harm Bart,Sanne ter Horst,André C.M. Ran,Hugo J. Woerdeman,2018-12-30 This volume is dedicated to Rien Kaashoek on the occasion of his 80th birthday and celebrates his many contributions to the field of operator theory during more than fifty years In the first part of the volume biographical

information and personal accounts on the life of Rien Kaashoek are presented Eighteen research papers by friends and colleagues of Rien Kaashoek are included in the second part Contributions by J Agler Z A Lykova N J Young J A Ball G J Groenewald S ter Horst H Bart T Ehrhardt B Silbermann J M Bogoya S M Grudsky I S Malysheva A B ttcher E Wegert Z Zhou Y Eidelman I Haimovici A E Frazho A C M Ran B Fritzsche B Kirstein C Madler J J Jaftha D B Janse van Rensburg P Junghanns R Kaiser J Nemcova M Petreczky J H van Schuppen L Plevnik P Semrl A Sakhnovich F O Speck S Sremac H J Woerdeman H Wolkowicz and N Vasilevski *Israel Gohberg and Friends* Harm Bart,Thomas Hempfling,Marinus A. Kaashoek,2008-09-25 Mathematicians do not work in isolation They stand in a long and time honored tradition They write papers and sometimes books they read the publications of fellow workers in the eld and they meet other mathematicians at conferences all over the world In this way in contact with colleagues far away and nearby from the past via their writings and from the present scienti c results are obtained whicharerecognizedasvalid Andthat remarkablyenough regardlessofethnic background political inclination or religion In this process some distinguished individuals play a special and striking role They assume a position of leadership They guide the people working with them through uncharted territory thereby making a lasting imprint on the eld So thing which can only be accomplished through a combination of rare talents usually broad knowledge unfailing intuition and a certain kind of charisma that binds people together AllofthisispresentinIsraelGohberg themantowhomthisbookisdedicated on theoccasionof his 80thbirthday This comes to the foregroundunmistakably from the contributions from those who worked with him or whose life was a ected by him Gohberg sexceptionalqualitiesarealsoapparentfromthe articleswritten by himself sometimes jointly with others that are reproduced in this book Among these are stories of his life some dealing with mathematical aspects others of a more general nature Also included are reminiscences paying tribute to a close colleaguewho isnotamongusanymore speechesorreviewshighlightingthework and personality of a friend or esteemed colleague and responses to the laudatio s connected with the several honorary degrees that were bestowed upon him Handbook of Linear Algebra Leslie Hogben,2006-11-02 The Handbook of Linear Algebra provides comprehensive coverage of linear algebra concepts applications and computational software packages in an easy to use handbook format The esteemed international contributors guide you from the very elementary aspects of the subject to the frontiers of current research The book features an accessibl *Inverse Eigenvalue Problems* Moody Chu,Gene Golub,2005-06-16 Inverse eigenvalue problems arise in a remarkable variety of applications and associated with any inverse eigenvalue problem are two fundamental questions the theoretical issue of solvability and the practical issue of computability Both questions are difficult and challenging In this text the authors discuss the fundamental questions some known results many applications mathematical properties a variety of numerical techniques as well as several open problems This is the first book in the authoritative Numerical Mathematics and Scientific Computation series to cover numerical linear algebra a broad area of numerical analysis Authored by two world

renowned researchers the book is aimed at graduates and researchers in applied mathematics engineering and computer science and makes an ideal graduate text *Handbook of Linear Algebra, Second Edition* Leslie Hogben,2013-11-26 With a substantial amount of new material the Handbook of Linear Algebra Second Edition provides comprehensive coverage of linear algebra concepts applications and computational software packages in an easy to use format It guides you from the very elementary aspects of the subject to the frontiers of current research Along with revisions and updates throughout the second edition of this bestseller includes 20 new chapters New to the Second Edition Separate chapters on Schur complements additional types of canonical forms tensors matrix polynomials matrix equations special types of matrices generalized inverses matrices over finite fields invariant subspaces representations of quivers and spectral sets New chapters on combinatorial matrix theory topics such as tournaments the minimum rank problem and spectral graph theory as well as numerical linear algebra topics including algorithms for structured matrix computations stability of structured matrix computations and nonlinear eigenvalue problems More chapters on applications of linear algebra including epidemiology and quantum error correction New chapter on using the free and open source software system Sage for linear algebra Additional sections in the chapters on sign pattern matrices and applications to geometry Conjectures and open problems in most chapters on advanced topics Highly praised as a valuable resource for anyone who uses linear algebra the first edition covered virtually all aspects of linear algebra and its applications This edition continues to encompass the fundamentals of linear algebra combinatorial and numerical linear algebra and applications of linear algebra to various disciplines while also covering up to date software packages for linear algebra computations Topics in Interpolation Theory Bernd Fritzsche,Victor Katsnelson,Bernd Kirstein,2012-12-06 About one half of the papers in this volume are based on lectures which were pre sented at a conference at Leipzig University in August 1994 which was dedicated to Vladimir Petrovich Potapov He would have been eighty years old These have been supplemented by 1 Historical material based on reminiscences of former colleagues students and associates of V P Potapov 2 Translations of a number of important papers which serve to clarify the Potapov approach to problems of interpolation and extension as well as a number of related problems and methods and are relatively unknown in the West 3 Two expository papers which have been especially written for this volume For purposes of discussion it is convenient to group the technical papers in this volume into six categories We will now run through them lightly first listing the major theme then in parentheses the authors of the relevant papers followed by discussion Some supplementary references are listed at the end OT72 which appears frequently in this volume refers to Volume 72 in the series Operator Theory Advances and Applications It was dedicated to V P Potapov 1 Multiplicative decompositions Yu P Ginzburg M S Livsic I V Mikhailova V I Smirnov *Matrix Partial Orders, Shorted Operators and Applications* Sujit Kumar Mitra,P. Bhimasankaram,Saroj B. Malik,2010 1 Introduction 1 1 Matrix orders 1 2 Parallel sum and shorted operator 1 3 A tour through the rest of the monograph 2 Matrix decompositions and generalized inverses 2 1

Introduction 2 2 Matrix decompositions 2 3 Generalized inverse of a matrix 2 4 The group inverse 2 5 Moore Penrose inverse 2 6 Generalized inverses of modified matrices 2 7 Simultaneous diagonalization 2 8 Exercises 3 The minus order 3 1 Introduction 3 2 Space pre order 3 3 Minus order some characterizations 3 4 Matrices above below a given matrix under the minus order 3 5 Subclass of g inverses A symbol of A such that symbol A A symbol B and AA symbol BA symbol when A

Completion Problems on Operator Matrices Dragana S. Cvetković Ilić,2022-06-07 Completion problems for operator matrices are concerned with the question of whether a partially specified operator matrix can be completed to form an operator of a desired type The research devoted to this topic provides an excellent means to investigate the structure of operators This book provides an overview of completion problems dealing with completions to different types of operators and can be considered as a natural extension of classical results concerned with matrix completions The book assumes some basic familiarity with functional analysis and operator theory It will be useful for graduate students and researchers interested in operator theory and the problem of matrix completions **Recent Advances in Operator Theory** A. Dijksma,Marinus A. Kaashoek,A.C.M. Ran,2012-12-06 This volume contains a selection of papers in modern operator theory and its applications Most of them are directly related to lectures presented at the Inter national Workshop on Operator Theory and its Applications held at the University of Groningen IWOTA 98 in Groningen the Netherlands from June 30 July 3 1998 The workshop was attended by 97 mathematicians of which 12 were PhD or postdoctoral students from 19 countries The program consisted of 19 plenary lectures of 40 minutes and 72 lectures of 30 minutes in 4 parallell sessions The present volume reflects the wide range and rich variety of topics presented and discussed at the workshop The papers deal with operator polynomials and analytic operator functions with spectral problems of partial differential oper ators and related operator matrices with interpolation completion and extension problems with commutant lifting and dilation with Ricatti equations and real ization problems with scattering theory with problems from harmonic analysis and with topics in the theory of reproducing kernel spaces and of spaces with an indefinite metric All papers underwent the usual refereeing process *Schur Functions, Operator Colligations, and Reproducing Kernel Pontryagin Spaces* Daniel Alpay,Aad Dijksma,James Rovnyak,Hendrik de Snoo,2012-12-06 Generalized Schur functions are scalar or operator valued holomorphic functions such that certain associated kernels have a finite number of negative squares This book develops the realization theory of such functions as characteristic functions of coisometric isometric and unitary colligations whose state spaces are reproducing kernel Pontryagin spaces This provides a modern system theory setting for the relationship between invariant subspaces and factorization operator models Krein Langer factorizations and other topics The book is intended for students and researchers in mathematics and engineering An introductory chapter supplies background material including reproducing kernel Pontryagin spaces complementary spaces in the sense of de Branges and a key result on defining operators as closures of linear relations The presentation is self contained and streamlined so that the indefinite case is

handled completely parallel to the definite case **Convolution Operators and Factorization of Almost Periodic Matrix Functions** Albrecht Böttcher,Yuri I. Karlovich,Ilya M. Spitkovsky,2012-12-06 Many problems of the engineering sciences physics and mathematics lead to con volution equations and their various modifications Convolution equations on a half line can be studied by having recourse to the methods and results of the theory of Toeplitz and Wiener Hopf operators Convolutions by integrable kernels have continuous symbols and the Cauchy singular integral operator is the most prominent example of a convolution operator with a piecewise continuous symbol The Fredholm theory of Toeplitz and Wiener Hopf operators with continuous and piecewise continuous matrix symbols is well presented in a series of classical and recent monographs Symbols beyond piecewise continuous symbols have discontinuities of oscillating type Such symbols emerge very naturally For example difference operators are nothing but convolution operators with almost periodic symbols the operator defined by A *Series in Banach Spaces* Vladimir Kadets,2012-12-06 Series of scalars vectors or functions are among the fundamental objects of mathematical analysis When the arrangement of the terms is fixed investigating a series amounts to investigating the sequence of its partial sums In this case the theory of series is a part of the theory of sequences which deals with their convergence asymptotic behavior etc The specific character of the theory of series manifests itself when one considers rearrangements permutations of the terms of a series which brings combinatorial considerations into the problems studied The phenomenon that a numerical series can change its sum when the order of its terms is changed is one of the most impressive facts encountered in a university analysis course The present book is devoted precisely to this aspect of the theory of series whose terms are elements of Banach as well as other topological linear spaces The exposition focuses on two complementary problems The first is to char acterize those series in a given space that remain convergent and have the same sum for any rearrangement of their terms such series are usually called uncon ditionally convergent The second problem is when a series converges only for certain rearrangements of its terms in other words converges conditionally to describe its sum range i e the set of sums of all its convergent rearrangements **Matrix Completions, Moments, and Sums of Hermitian Squares** Mihály Bakonyi,Hugo J. Woerdeman,2011-07-18 Intensive research in matrix completions moments and sums of Hermitian squares has yielded a multitude of results in recent decades This book provides a comprehensive account of this quickly developing area of mathematics and applications and gives complete proofs of many recently solved problems With MATLAB codes and more than 200 exercises the book is ideal for a special topics course for graduate or advanced undergraduate students in mathematics or engineering and will also be a valuable resource for researchers Often driven by questions from signal processing control theory and quantum information the subject of this book has inspired mathematicians from many subdisciplines including linear algebra operator theory measure theory and complex function theory In turn the applications are being pursued by researchers in areas such as electrical engineering computer science and physics The book is self contained has many examples and for the most part requires only a basic

background in undergraduate mathematics primarily linear algebra and some complex analysis The book also includes an extensive discussion of the literature with close to 600 references from books and journals from a wide variety of disciplines

Integral Equations with Difference Kernels on Finite Intervals Lev A. Sakhnovich,2012-12-06 Optimal synthesis light scattering and diffraction on a ribbon are just some of the applied problems for which integral equations with difference kernels are employed The same equations are also met in important mathematical problems such as inverse spectral problems nonlinear integral equations and factorization of operators On the basis of the operator identity method the theory of integral operators with difference kernels is developed here and the connection with many applied and theoretical problems is studied A number of important examples are analyzed **Computer Aided Verification** Warren A. Hunt, Jr.,Fabio Somenzi,2011-05-02 The refereed proceedings of the 15th International Conference on Computer Aided Verification CAV 2003 held in Boulder CO USA in July 2003 The 32 revised full papers and 9 tool papers presented were carefully reviewed and selected from a total of 102 submissions The papers are organized in topical sections on bounded model checking symbolic model checking games trees and counters tools abstraction dense time infinite state systems applications theorem proving automata based verification invariants and explicit model checking **A State Space Approach to Canonical Factorization with Applications** Harm Bart,Israel Gohberg,Marinus A. Kaashoek,André C.M. Ran,2011-02-09 The present book deals with canonical factorization of matrix and operator functions that appear in state space form or that can be transformed into such a form A unified geometric approach is used The main results are all expressed explicitly in terms of matrices or operators which are parameters of the state space representation The applications concern different classes of convolution equations A large part the book deals with rational matrix functions only **New Results in Operator Theory and Its Applications** Israel Gohberg,Yuri I. Lyubich,2012-12-06 This volume is dedicated to the memory of Israel Glazman an outstanding personality and distinguished mathematician the author of many remarkable papers and books in operator theory and its applications The present book opens with an essay devoted to Glazman s life and scientific achievements It focusses on the areas of his unusually wide interests and consists of 18 mathematical papers in spectral theory of differential operators and linear operators in Hilbert and Banach spaces analytic operator functions ordinary and partial differential equations functional equations mathematical physics nonlinear functional analysis approximation theory and optimization and mathematical statistics The book gives a picture of the current state of some important problems in areas of operator theory and its applications and will be of interest to a wide group of researchers working in pure and applied mathematics **Functional Analysis** Yurij M. Berezansky,Zinovij G. Sheftel,Georgij F. Us,2012-12-06 Functional Analysis is a comprehensive 2 volume treatment of a subject lying at the core of modern analysis and mathemati cal physics The first volume reviews basic concepts such as the measure the integral Banach spaces bounded operators and generalized functions Volume II moves on to more ad vanced topics including unbounded operators spectral decomposition expansion in

generalized eigenvectors rigged spaces and partial differential operators This text provides students of mathematics and physics with a clear introduction into the above concepts with the theory well illustrated by a wealth of examples Researchers will appreciate it as a useful reference manual

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