

Mathematical  
Surveys  
and  
Monographs

Volume 92

# Operators, Functions, and Systems: An Easy Reading

Volume I:  
Hardy, Hankel, and Toeplitz

**Nikolai K. Nikolski**



American Mathematical Society

## Selected Titles in This Series

- 92 **Nikolai K. Nikolski**, Operators, functions, and systems: An easy reading. Volume 1: Hardy, Hankel, and Toeplitz, 2002
- 91 **Richard Montgomery**, A tour of subriemannian geometries, their geodesics and applications, 2002
- 90 **Christian Gérard and Izabella Łaba**, Multiparticle quantum scattering in constant magnetic fields, 2002
- 89 **Michel Ledoux**, The concentration of measure phenomenon, 2001
- 88 **Edward Frenkel and David Ben-Zvi**, Vertex algebras and algebraic curves, 2001
- 87 **Bruno Poizat**, Stable groups, 2001
- 86 **Stanley N. Burris**, Number theoretic density and logical limit laws, 2001
- 85 **V. A. Kozlov, V. G. Maz'ya, and J. Rossmann**, Spectral problems associated with corner singularities of solutions to elliptic equations, 2001
- 84 **László Fuchs and Luigi Salce**, Modules over non-Noetherian domains, 2001
- 83 **Sigurdur Helgason**, Groups and geometric analysis: Integral geometry, invariant differential operators, and spherical functions, 2000
- 82 **Goro Shimura**, Arithmeticity in the theory of automorphic forms, 2000
- 81 **Michael E. Taylor**, Tools for PDE: Pseudodifferential operators, paradifferential operators, and layer potentials, 2000
- 80 **Lindsay N. Childs**, Taming wild extensions: Hopf algebras and local Galois module theory, 2000
- 79 **Joseph A. Cima and William T. Ross**, The backward shift on the Hardy space, 2000
- 78 **Boris A. Kupershmidt**, KP or mKP: Noncommutative mathematics of Lagrangian, Hamiltonian, and integrable systems, 2000
- 77 **Fumio Hiai and Dénes Petz**, The semicircle law, free random variables and entropy, 2000
- 76 **Frederick P. Gardiner and Nikola Lakic**, Quasiconformal Teichmüller theory, 2000
- 75 **Greg Hjorth**, Classification and orbit equivalence relations, 2000
- 74 **Daniel W. Stroock**, An introduction to the analysis of paths on a Riemannian manifold, 2000
- 73 **John Locker**, Spectral theory of non-self-adjoint two-point differential operators, 2000
- 72 **Gerald Teschl**, Jacobi operators and completely integrable nonlinear lattices, 1999
- 71 **Lajos Pukánszky**, Characters of connected Lie groups, 1999
- 70 **Carmen Chicone and Yuri Latushkin**, Evolution semigroups in dynamical systems and differential equations, 1999
- 69 **C. T. C. Wall (A. A. Ranicki, Editor)**, Surgery on compact manifolds, second edition, 1999
- 68 **David A. Cox and Sheldon Katz**, Mirror symmetry and algebraic geometry, 1999
- 67 **A. Borel and N. Wallach**, Continuous cohomology, discrete subgroups, and representations of reductive groups, second edition, 2000
- 66 **Yu. Ilyashenko and Weigu Li**, Nonlocal bifurcations, 1999
- 65 **Carl Faith**, Rings and things and a fine array of twentieth century associative algebra, 1999
- 64 **Rene A. Carmona and Boris Rozovskii, Editors**, Stochastic partial differential equations: Six perspectives, 1999
- 63 **Mark Hovey**, Model categories, 1999
- 62 **Vladimir I. Bogachev**, Gaussian measures, 1998
- 61 **W. Norrie Everitt and Lawrence Markus**, Boundary value problems and symplectic algebra for ordinary differential and quasi-differential operators, 1999

*(Continued in the back of this publication)*

**Mathematical  
Surveys  
and  
Monographs**

**Volume 92**

# **Operators, Functions, and Systems: An Easy Reading**

**Volume I:  
Hardy, Hankel, and Toeplitz**

**Nikolai K. Nikolski**

**Translated by  
Andreas Hartmann**



**American Mathematical Society**

## Editorial Board

Peter Landweber                      Tudor Ratiu  
Michael Loss, Chair                  J. T. Stafford

Based on a series of lecture notes, in French,  
Université de Bordeaux, 1991–1995.  
Translated by ANDREAS HARTMANN and greatly revised by the author

2000 *Mathematics Subject Classification*. Primary 47–02, 30–02, 93–02,  
30D55, 47B35, 47A45, 93B05, 93C05.

ABSTRACT. The book joins four formally distant topics of analysis and its applications: Volume 1 contains 1) Hardy classes of holomorphic functions, 2) Spectral theory of Hankel and Toeplitz operators, and Volume 2 contains 3) Function models for linear operators on a Hilbert space and free interpolation, and 4) Infinite-dimensional system theory and signal processing. Beyond standard topics covered by these titles, it includes elements of maximal functions, Littlewood-Paley techniques, the Riemann zeta-function, Wiener filtering (all in Volume 1), as well as moment problems, reproducing kernel spaces, Schatten-von Neumann ideals, stationary processes, best rational approximations, similarity theory, and controllability with the least control operators (in Volume 2).

---

### Library of Congress Cataloging-in-Publication Data

Nikol'skii, N. K. (Nikolai Kapitonovich)

Operators, functions, and systems : an easy reading / Nikolai K. Nikolski ; [translated by Andreas Hartmann and greatly revised by the author].

p. cm. — (Mathematical surveys and monographs, ISSN 0076-5376 ; v. 92)

Contents: v. 1. Hardy, Hankel, and Toeplitz

ISBN 0-8218-1083-9 (v. 1 : alk. paper)

1. Operator theory. 2. Harmonic analysis. 3. Control theory. I. Title. II. Mathematical surveys and monographs ; no. 92.

QA329.N55 2002  
515'.724—dc21

2001053556

---

**Copying and reprinting.** Individual readers of this publication, and nonprofit libraries acting for them, are permitted to make fair use of the material, such as to copy a chapter for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews, provided the customary acknowledgment of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Assistant to the Publisher, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940-6248. Requests can also be made by e-mail to [reprint-permission@ams.org](mailto:reprint-permission@ams.org).

© 2002 by the American Mathematical Society. All rights reserved.

The American Mathematical Society retains all rights  
except those granted to the United States Government.

Printed in the United States of America.

∞ The paper used in this book is acid-free and falls within the guidelines  
established to ensure permanence and durability.

Visit the AMS home page at URL: <http://www.ams.org/>

10 9 8 7 6 5 4 3 2 1      07 06 05 04 03 02



# A Few Words about the Book

## WHAT THIS BOOK IS ABOUT

The book represents a mixture of harmonic and complex analysis with operator theory. The interplay between these disciplines is one of the most significant features of the second half of Twentieth century mathematics. It gave rise to several jewels of analysis, such as the theory of singular integral operators, Toeplitz operators, mathematical scattering theory, Sz.-Nagy-Foias model theory, the L. de Branges proof of the Bieberbach conjecture, as well as solving the principal interpolation problems in complex analysis and discovering the structural properties of function spaces (from Besov to Bergman).

The principal ingredients of the book are clear from the Contents and Subject Index, and indeed a simple list of key words tells more than long explanations. Without reproducing these lists nor the introductions to the four parts A, B, C, and D of the book, I would like give an abridged list of my favorite subjects, ordered by their appearance in the book:

*Hardy classes*

*The Hilbert transformation*

*Weighted polynomial approximation*

*Cyclicity phenomena*

*Maximal and Littlewood-Paley functions*

*The Marcinkiewicz weak type interpolation*

*Wiener filtering theory*

*Riemann  $\zeta$  function*

*Hankel operators: spectral theory, Peller's theory, moment problems*

*Reproducing kernel Hilbert spaces*

*Schatten-von Neumann operator ideals*

*Toeplitz operators*

*The operator corona problem*

*Spectral theory of normal operators*

*Sz.-Nagy-Foias function model*

*Von Neumann inequalities*

*Carleson and generalized free interpolations*

*Theory of spectral multiplicities*

*Elements of semigroup theory*

*Classical control theory of dynamical systems*

*Bases of exponentials on intervals of the real line*

*Elements of the  $H^\infty$  control theory*

## STYLE

I have tried to follow the logic of the above subjects as I understand it. As a consequence, this book is neither a function theory monograph, nor an operator theory manual. It is a treatise on operator-based function theory, or, if you prefer, function-based operator theory. As in my previous book “Treatise on the shift operator” (Springer, 1986) I have in mind a picture close to mathematical reality, where the most interesting and important facts take part of several disciplines simultaneously. This is why the way in which things proceed in this book is sometimes different from the approved didactic style of presentation, when, first of all, background materials should be developed (even if you will need it 300 pages later...), then you go to the next preparatory level, and so on.

Here, new concepts and auxiliary materials appear when they are needed to continue the main theme. This theme is developed as theory of functions on the circle group and of operators acting on them, starting with the basic shift operator, then passing to stationary filtering, and Hankel and Toeplitz operators as compressions of the multiplication operators. Next, we arrive at the model theory for Hilbert space operators as (advanced) compressions of the same shift operator, and, finally, all this machinery is brought together to control dynamical systems. Therefore, taken as a style to telling mathematics, this is more a passion or a tale of mental intrigue than a rationally arranged catalog of facts.

It is also worth mentioning that this book has its origins in four courses I gave in 1992-1996 to graduate students in the University of Bordeaux, France. Although the courses were considerably extended when preparing this book, the text, perhaps, preserves the flavor of interaction with the audience: sometimes I repeat some notions or ideas already stated some tens (or hundreds...) of pages earlier to remind the reader of something what he may have forgotten from the last course.

## BACKGROUND

As it is clear from the preceding lines, the book can be read by anyone having a standard analysis background: Lebesgue measure,  $L^p$  spaces, elements of Fourier series and Fourier transforms (the Plancherel theorem), elementary holomorphic functions, Stone-Weierstrass theorem, Hilbert and Banach spaces, reflexivity, the Hahn-Banach theorem, compactness, and so on.

## FORMAL STRUCTURE

Parts A and B form the first volume of the book, and parts C and D form the second. Formally speaking, parts A, B, C and D are (reasonably) independent of each other in the sense that, for example, I may employ in part B some results of parts A, C, or D, but in the same way that I use (rarely) results from some exterior basic monographs.

The Parts are divided into chapters; there are 25 in the book. All chapters but one contain two special sections: *Exercises and Further Results*, and *Notes and Remarks*. These are important and inseparable parts of the book. To illustrate, the

book contains 1428 propositions conventionally called theorems, lemmas, corollaries, and exercises. For *Exercises and Further Results*, the proofs are called “hints”, and while they are shorter they still contain all the principal ingredients to understand the proof. All exercises were tested by a team of volunteer readers whose names are listed below (there were no casualties...). Some (rare) facts included in exercises and not proved are marked by asterisk \*.

Sections *Notes and Remarks* usually contain surveys of the rest of the theory presented in the main body of the corresponding chapter.

Reference  $A.\alpha.\beta.\gamma$  means subsection  $\alpha.\beta.\gamma$  of Part A;  $\alpha.\beta$  means section  $\beta$  of chapter  $\alpha$  of the Part where you are;  $\alpha.\beta.\gamma(3)$  means point (3) of subsection  $\alpha.\beta.\gamma$ , etc. Sign  $\square$  indicates the end of a proof or a reasoning.

#### THE READER AND THE AUTHOR

As it is clear from the subtitle of the book, I expect that some readers are novices, graduate or undergraduate students, possessing the needed knowledge indicated above. It is also supposed that some readers are experts. Well, I shall be rewarded if there is at least one. In this case, and also anticipating the inevitable reproaches as to why I selected such and such subjects and not others, I permit myself to quote (in my translation from Russian) a great philologist, an expert of texts as such.

*“The answers books give us are to questions that are not exactly the same as the author set before himself, but to those that we are able to raise ourselves... The books encircle us like mirrors, in which we see only our own reflexion; the reason why it is, perhaps, not everywhere the same is because all these mirrors are curved, each in its own way.”*

M.L. Gasparov  
“Philology as morality”

#### WHAT IS MISSED

Of course, I do not intend to list here the rest of mathematics but just to mention explicitly some border subjects that could have been included but were not. These are (without any ordering) *extremal problems* of complex analysis (starting from results of S.Ya. Khavinson and H. Shapiro in the 1960’s); the *problems of harmonic analysis-synthesis* (from L. Schwartz and B. Malgrange of the 1950’s); *invariant subspaces*, from the existence problem in a Hilbert space, up to (more important) classification problems for concrete operators (including descriptions of *closed ideals* in algebras of holomorphic functions); *singular integral models* for hypo- and semi-normal operators; *scattering*; *univalent functions* via quasi-orthogonal decompositions; *realization theory*; *operator valued constrained interpolation*, and some other themes. I have no better way to excuse these omissions than to follow E. Beckenbach and R. Bellman who quoted the following verses (for a similar purpose):

*Oh, the little more, and how much it is!  
And the little less, and what worlds away!*

R. Browning (Saul.st.39)

## ACKNOWLEDGEMENTS

Several people read preliminary versions of the book and gave me their opinions, both mathematical and technical, especially by testing numerous exercises. For this I am greatly indebted to E. Abakumov, A. Aleksandrov, A. Baranov, A. Borichev, M. Gamal, V. Kapustin, S. Kislyakov, S. Shimorin, V. Vasyunin, P. Vitse. Also, I appreciate the time spent by my colleagues A. Borichev, A. Hartmann and S. Kupin in helping me verify the reference list.

It has happened that a rather big part of this book, being lecture notes of my Bordeaux courses, was written in French, excepting some more recent additions. This part of the text was carefully translated into English by Andreas Hartmann, whose work essentially surpassed the simple translation including several constructive mathematical criticisms. I am very grateful to him for this work, as well as to Th.V. Pedersen for reading the translation and to D. Sherman for occasional advice.

My own function for completing preliminary lecture notes up to a self-contained book largely surpassed in time all predicted limits. During all these long months, my wife Ludmila steadily bore this somewhat rash enterprise, and all in all what is done bears the mark of her support.

I am also grateful to the publisher, the American Mathematical Society, for including the book in this series, and for having much patience during entire period of my work and enough flexibility at the moment when it became clear that the result would double the predicted size.

July 23, 2001  
Gradignan

# Contents

A Few Words about the Book	v
<b>Volume 1: Hardy, Hankel and Toeplitz</b>	
<b>Part A. An Invitation to Hardy Classes</b>	<b>1</b>
Chapter 1. Invariant Subspaces of $L^2(\mu)$	7
1.1. Basic Definitions	7
1.2. Doubly Invariant Subspaces	8
1.3. Simply Invariant Subspaces, the Case $\mu = m$	9
1.4. Inner Functions. A Uniqueness Theorem	10
1.5. Invariant Subspaces of $L^2(\mu)$ : the General Case	10
1.6. Exercises and Further Results	13
1.7. Notes and Remarks	17
Chapter 2. First Applications	21
2.1. Straightforward Corollaries	21
2.2. The Problem of Weighted Polynomial Approximation	22
2.3. A Probabilistic Interpretation	23
2.4. The Inner-Outer Factorization	23
2.5. Arithmetic of Inner Functions	24
2.6. A Characterization of Outer Functions	25
2.7. Szegő Infimum and the Riesz Brothers' Theorem	25
2.8. Exercises and Further Results	27
2.9. Notes and Remarks	28
Chapter 3. $H^p$ Classes. Canonical Factorization	31
3.1. The Main Definition	31
3.2. Straightforward Properties	32
3.3. A Digression on Convolutions and Fourier series	32
3.4. Identifying $H^p(\mathbb{D})$ and $H^p$	34
3.5. Jensen's Formula and Jensen's Inequality	35
3.6. The Boundary Uniqueness Theorem	36
3.7. Blaschke Products	37
3.8. Nontangential Boundary Limits	39
3.9. The Riesz–Smirnov Canonical Factorization	41
3.10. Approximation by inner functions and Blaschke products	44
3.11. Vector valued $H^p$ -spaces and the Fatou theorem	46
3.12. Exercises and Further Results	54
3.13. Notes and Remarks	57

Chapter 4. Szegő Infimum, and Generalized Phragmén–Lindelöf Principle	65
4.1. Szegő Infimum and Weighted Polynomial Approximation	65
4.2. How to Recognize an Outer Function	67
4.3. Locally Outer Functions	68
4.4. The Smirnov Class $\mathcal{D}$	72
4.5. A Conformally Invariant Framework	72
4.6. The Generalized Phragmén–Lindelöf Principle	73
4.7. Classical Examples	74
4.8. Exercises and Further Results	75
4.9. Notes and Remarks	87
Chapter 5. Harmonic Analysis in $L^2(\mathbb{T}, \mu)$	93
5.1. Generalized Fourier Series	93
5.2. Bases of Exponentials in $L^2(\mathbb{T}, \mu)$	96
5.3. Harmonic Conjugates	98
5.4. The Helson–Szegő Theorem	99
5.5. An Example	102
5.6. Comments	103
5.7. Exercises and Further Results	104
5.8. Notes and Remarks	129
Chapter 6. Transfer to the Half-Plane	143
6.1. A Unitary Mapping from $L^p(\mathbb{T})$ to $L^p(\mathbb{R})$	143
6.2. Cauchy Kernels and Fourier Transforms	144
6.3. The Hardy Spaces $H_+^p = H^p(\mathbb{C}_+)$	144
6.4. Canonical Factorization and Other Properties	147
6.5. Invariant Subspaces	148
6.6. Exercises and Further Results	150
6.7. Notes and Remarks	151
Chapter 7. Time-Invariant Filtering	153
7.1. The Language of Signal Processing	153
7.2. Frequency Characteristics of Causal Filters	154
7.3. Design Problems (Filter Synthesis)	155
7.4. Inverse Analysis Problems, or How to Tackle a Filter	157
7.5. Exercises and Further Results	159
7.6. Notes and Remarks	160
Chapter 8. Distance Formulae and Zeros of the Riemann $\zeta$ -Function	163
8.1. Distance Functions	163
8.2. Zeros and Singular Measures via Distance Functions	165
8.3. Localization of Zeros of the Riemann $\zeta$ -Function	166
8.4. Invariant Subspaces Related to the $\zeta$ -Function	169
8.5. Exercises and Further Results	170
8.6. Notes and Remarks	171
<b>Part B. Hankel and Toeplitz Operators</b>	<b>173</b>
Chapter 1. Hankel Operators and Their Symbols	179
1.1. Hankel Matrices and Hankel Operators	179

1.2.	The Hardy Space Representation	180
1.3.	Symbols of Hankel Operators and the Nehari Theorem	181
1.4.	Two Proofs of the Nehari Theorem	182
1.5.	An appendix on Hilbert space operators	186
1.6.	Exercises and Further Results	188
1.7.	What is a Hankel operator? A brief survey	195
1.8.	Notes and Remarks	205
Chapter 2.	Compact Hankel Operators	211
2.1.	Essential Norm and the Calkin Algebra	211
2.2.	The Adamyan–Arov–Krein Version of Hartman’s Theorem	212
2.3.	The algebras $H^\infty + C$ and $QC$ , and Compact Commutators	214
2.4.	Invariant Subspaces and Kronecker’s Theorem	216
2.5.	Exercises and Further Results	218
2.6.	Notes and Remarks	224
Chapter 3.	Applications to Nevanlinna–Pick Interpolation	227
3.1.	Model Operators	227
3.2.	Schur and Nevanlinna–Pick Interpolation	231
3.3.	Structure of Interpolating Functions and Rational Approximations	233
3.4.	Exercises and Further Results	236
3.5.	Notes and Remarks	239
Chapter 4.	Essential Spectrum. The First Step: Elements of Toeplitz Operators	243
4.1.	Definition and Existence of the Symbol	243
4.2.	Spectral Inclusions	246
4.3.	The Fundamental Inversion Theorem	249
4.4.	A Local Theory of Semicommutators	252
4.5.	Fredholm Theory of the Toeplitz Algebra $\text{alg } \mathcal{T}_{H^\infty + C}$	256
4.6.	Wiener–Hopf and Hankel Operators on the Real Line	261
4.7.	Exercises and Further Results	262
4.8.	Notes and Remarks	269
Chapter 5.	Essential Spectrum. The Second Step: The Hilbert Matrix and Other Hankel Operators	281
5.1.	Piecewise Continuous Functions	281
5.2.	The Schur Test	282
5.3.	The Hilbert Matrix	283
5.4.	The Main Theorem on the Essential Spectrum	288
5.5.	Essentially Quasi-Nilpotent, and Essentially Self-Adjoint Hankel Operators, and Other Corollaries	292
5.6.	Exercises and Further Results	293
5.7.	Notes and Remarks	302
Chapter 6.	Hankel and Toeplitz Operators Associated with Moment Problems	309
6.1.	The Power Moment Problem	309
6.2.	Hankel Operators Associated with a Measure	311
6.3.	An Integral representation	314

6.4.	The Trigonometric Moment Problem and Positive Toeplitz Forms	315
6.5.	Exercises and Further Results	316
6.6.	Notes and Remarks	324
Chapter 7.	Singular Numbers of Hankel Operators	331
7.1.	The Schmidt Decomposition	331
7.2.	The Basic Adamyan–Arov–Krein Theorem	333
7.3.	Multiplicative Properties of $s$ -Functions	336
7.4.	An Application to Interpolation by Meromorphic Functions: The Schur–Takagi Problem	337
7.5.	Exercises and Further Results	338
7.6.	Notes and Remarks	346
Chapter 8.	Trace Class Hankel Operators	351
8.1.	The Main Theorem. Connection with Rational Approximation	351
8.2.	Information about Besov Classes	352
8.3.	Information about the Class $\mathfrak{S}_1$	354
8.4.	An Integral Representation and the Proof of Peller’s Theorem	355
8.5.	Another Approach to Trace Class Hankel Operators	359
8.6.	Hilbert–Schmidt and Other Schatten–von Neumann Classes $\mathfrak{S}_p$	360
8.7.	Exercises and Further Results	361
8.8.	Notes and Remarks	372
Chapter 9.	Inverse Spectral Problems, Stochastic Processes and One-Sided Invertibility	377
9.1.	Inverse Spectral Problems for Hankel Operators	377
9.2.	One-sided Invertibility of Toeplitz Operators and the Operator Corona Problem	385
9.3.	Exercises and Further Results	393
9.4.	Notes and Remarks	396
	Bibliography	401
	Author Index	441
	Subject Index	447
	Symbol Index	459



**Volume 2: Model Operators and Systems****Part C. Model Operators and Free Interpolation**

## Chapter 1. The Basic Function Model

- 1.1. Unitary Dilations
- 1.2. Functional Embeddings and The Characteristic Function
- 1.3. The Function Model and Its Transcriptions
- 1.4. Models for Certain Accretive and Dissipative Operators
- 1.5. Exercises and Further Results
- 1.6. Notes and Remarks

## Chapter 2. Elements of Spectral Theory in the Language of the Characteristic Function

- 2.1. Invariant Subspaces
- 2.2. The  $H^\infty$ -Functional Calculus
- 2.3. The Class  $C_0$ , Minimal Annihilators, and the Spectrum of  $M_\Theta$
- 2.4. The Commutant Lifting Theorem
- 2.5. Exercises and Further Results
- 2.6. Notes and Remarks

## Chapter 3. Decompositions in Invariant Subspaces and Free Interpolation

- 3.1. Unconditional Bases
- 3.2. Generalized Free Interpolation
- 3.3. Exercises and Further Results
- 3.4. Notes and Remarks

**Part D. Analytic Problems in Linear Systems Control**

## Chapter 1. Basic Theory

- 1.1. The Main Formula
- 1.2. Basic Observations about Controllability
- 1.3. Basic Criteria for ACO, ECO, and NCO
- 1.4. Stable Systems
- 1.5. An Example: Heating of a Metal Bar
- 1.6. Exercises and Further Results
- 1.7. Notes and Remarks

## Chapter 2. First Optimizations: Multiplicity of the Spectrum and the DISC

- 2.1. The Least Dimension of Controlling Subspaces
- 2.2. Reduction to Bounded Operators
- 2.3. Some Properties of the Multiplicity of the Spectrum
- 2.4. The Minimal Dimension of Constrained (Realizable) Control
- 2.5. Exercises and Further Results
- 2.6. Notes and Remarks

## Chapter 3. Eigenvector Decompositions, Vector Valued Exponentials, and Squared Optimization

- 3.1. Examples of Parabolic and Hyperbolic Systems
- 3.2. Complete Generators
- 3.3. Riesz Bases and Exact Controllability

- 3.4. Generalized Controllability and Renormalizations
- 3.5. Null Controllability (NCO)
- 3.6. Weak Controllability
- 3.7. Squared (Energy) Optimization
- 3.8. Control at Time  $\tau = \infty$  and Interpolation in  $H^2$
- 3.9. Notes and Remarks

Chapter 4. A Glance at Bases of Exponentials and of Reproducing Kernels

- 4.1. Small Perturbations of Harmonic Frequencies
- 4.2. Bases of Exponentials on the Half-Line
- 4.3. Bases of Exponentials on Finite Intervals
- 4.4. Bases of Reproducing Kernels in Model Spaces
- 4.5. Back to Exponentials
- 4.6. A Levinson Completeness Theorem
- 4.7. Exercises and Further Results
- 4.8. Notes and Remarks

Chapter 5. A Brief Introduction to  $H^\infty$  Control

- 5.1. Input-Output Maps and Transfer Functions
- 5.2. Noise Minimization, Feedback Control, and Sensitivity
- 5.3. Remarks on Robust Stabilization
- 5.4. Scattering Type Input-Output and Hankel Operators
- 5.5. Remarks on Finite Dimensional Systems
- 5.6. Exercises and Further Results
- 5.7. Notes and Remarks

## Bibliography

- [Ab1] E.V. ABAKUMOV, *Inverse spectral problem for finite rank Hankel operators*, Zapiski Nauchn. Semin. POMI, 217 (1994), 5-15 (Russian); English transl.: J. Math. Sci. (New York), 85 (1997), no. 2, 1759–1766.
- [Ab2] ——— *Cyclicity and approximation by lacunary power series*, Michigan Math. J., 42 (1995), 277–299.
- [Ab3] ——— *Essais sur les opérateurs de Hankel et la capacité d'approximation des séries lacunaires*, Thesis, Univ. Bordeaux, 1994.
- [AbB] E.V. ABAKUMOV AND A.A. BORICHEV, *Shift invariant subspaces with arbitrary indices in weighted  $\ell_A^p$  spaces*, preprint, 1998.
- [AbrKr] M.B. ABRAHAMSE AND T.L. KRIETE, *The spectral multiplicity of a multiplication operator*, Indiana Univ. Math. J., 22 (1972/73), 845–857.
- [AAK1] V.M. ADAMYAN, D.Z. ARO AND M.G. KREIN, *On infinite Hankel matrices and the generalized problems of Carathéodory–Fejer and F. Riesz*, Funkcional. Analiz i Priložen., 2 (1968), 1-19 (Russian); English transl.: Functional. Anal. Appl. 2 (1968), 1–18.
- [AAK2] ——— *On bounded operators commuting with a contraction of class  $C_{00}$  having non-unitarity rank 1*, Funkcional. Analiz i Priložen., 3 (1969), 86-87 (Russian); English transl.: Functional. Anal. Appl. 3 (1969), 242–243.
- [AAK3] ——— *Infinite Hankel block matrices and related problems of extension*, Izvestia Akad. Nauk Armyan. SSR Ser. Mat., 6 (1971), 87–112 (Russian); English transl.: Amer. Math. Soc., Translat., II. Ser. 111 (1978) 133–156.
- [AAK4] ——— *Analytic properties of Schmidt pairs of a Hankel operator and the generalized Schur–Takagi problem*, Matem. Sbornik, 86 (128) (1971), 33–73 (Russian); English transl.: Math. USSR Sbornik, 15 (1971), 31–73.
- [Ag1] J. AGLER, *The Arveson extension theorem and coanalytic models*, Integral Eq. and Oper. Theory, 5 (1982), 608–631.
- [Ag2] ——— *Some interpolation theorems of Nevanlinna–Pick type*, preprint, 1989.
- [Ag3] ——— *Nevanlinna–Pick interpolation on Sobolev space*, Proc. Amer. Math. Soc. 108 (1990), 341–351.
- [Ag4] ——— *On the representation of certain holomorphic functions defined on a polydisc*, pp. 47–66 in: Operator Theory: Adv. and Appl., 48, Birkhäuser–Verlag, Basel, 1990.
- [AY] J. AGLER AND N.J. YOUNG, *A converse to a theorem of Adamyan, Arov, and Krein*, J. Amer. Math. Soc. 12 (1999), no. 2, 305–333.
- [Agm] S. AGMON, *Sur un problème de translations*, C.R. Acad. Sci. Paris, 229 (1949), no. 11, 540–542.
- [AhC] P.R. AHERN AND D.N. CLARK, *Radial limits and invariant subspaces*, Amer. J. Math., 92 (1970), no. 2, 332–342.
- [Air] G.M. AIRAPETYAN, *Multiple interpolation and the property of being a basis for certain biorthogonal systems of rational functions in the Hardy  $H^p$  classes*, Izvestia Akad. Nauk SSSR, Ser. Math., 12 (1977), 262–277 (Russian).
- [Aiz] L.A. AIZENBERG, *Carleman's formulas in complex analysis. First applications*, Novosibirsk, Nauka (Sibirskoe Otdelenie), 1990 (Russian); English transl.: Carleman's formulas in complex analysis, theory and applications; revised translation of the 1990 Russian original, Mathematics and its Applications, 244, Kluwer Academic Publishers Group, Dordrecht, 1993.
- [AizAD] L.A. AIZENBERG, A. AYTUNA, AND P. DJAKOV, *An abstract approach to Bohr's phenomenon*, Proc. Amer. Math. Soc., 128 (2000), no. 9, 2611–2619.

- [Akh1] N.I. AKHIEZER [AHIEZER], *On a proposition of A.N. Kolmogorov and a proposition of M.G. Krein*, Doklady Akad. Nauk SSSR, 50 (1945) (Russian).
- [Akh2] ——— *The classical moment problem*, Moscow, GIFML, 1961 (Russian); English transl.: Olivier & Boyd, Edinburgh–London, 1965.
- [Akh3] ——— *Lectures on approximation theory*, 2nd edition, Nauka, Moscow (Russian); German transl.: *Vorlesungen über Approximationstheorie*, Klaus Fiedler, Mathematische Lehrbücher, Band II Akademie-Verlag, Berlin, 1967.
- [Akh4] ——— *On the weighted approximation of continuous functions by polynomials on the entire real axis*, Uspehi Matem. Nauk, 11 (1956), no. 4, 3–43 (Russian); English transl.: AMS Transl. Series, 22 Ser. 2 (1962), 95–137.
- [AG] N.I. AKHIEZER [AHIEZER] AND I.M. GLAZMAN, *Theory of linear operators in Hilbert space*, 2nd edition, Nauka, Moscow, 1966 (Russian); German transl.: Berlin, Akademie-Verlag, 1960; English transl.: Frederick Ungar, New York, 1961.
- [AK] N.I. AKHIEZER [AHIEZER] AND M. KREIN, *Some questions in the theory of moments*, Nauchn.-Tech. Izd., Kharkov, 1938 (Russian); English transl.: Transl. Math. Monographs, vol. 2, Amer. Math. Soc., Providence, RI, 1962.
- [Aleks1] A.B. ALEKSANDROV, *Discrete measures with compact nowhere dense support that are orthogonal to the rational functions*, Zapiski Nauchn. Semin. Math. Inst. Steklov (LOMI), 73 (1977), 7–15 (Russian); English transl.: J. Soviet Math., 34 (1986), no. 6, 2023–2028.
- [Aleks2] ——— *Invariant subspaces of the backward shift operator in the space  $H^p$  ( $p \in (0, 1)$ )*, Zapiski Nauchn. Semin. LOMI, 92 (1979), 7–29 (Russian).
- [Aleks3] ——— *Invariant subspaces of the shift operators. An axiomatic approach*, Zapiski Nauchn. Semin. Steklov Math. Institute (LOMI), 113 (1981), 7–26 (Russian); English transl.: J. Sov. Math., 22 (1983), 1695–1708.
- [Aleks4] ——— *Multiplicity of boundary values of inner functions*, Izvestia Akad. Nauk Armian. SSR, Mat., 22 (1987), no. 5, 490–503 (Russian).
- [Aleks5] ——— *Inner functions and related spaces of pseudocontinuable functions*, Zapiski Nauchn. Semin. Steklov Math. Institute (LOMI), 170 (1989), 7–33 (Russian); English transl.: J. Soviet Math., 63 (1993), no. 2, 115–129.
- [Aleks6] ——— *Lacunary series and pseudocontinuations*, Zap. Nauchn. Sem. S.-Peterburg. Otdel. Mat. Inst. Steklov. (POMI) 232 (1996), Issled. po Linein. Oper. i Teor. Funktsii. 24,16–32 (Russian); translation in J. Math. Sci. (New York) 92 (1998), no. 1, 3550–3559.
- [Aleks7] ——— *On embedding theorems for coinvariant subspaces of the shift operator, II*, Zapiski Nauchn. Semin. Steklov Math. Institute (St. Petersburg), 262 (1999), 5–48 (Russian).
- [Aleks8] ——— *On embedding theorems for coinvariant subspaces of the shift operator, I*, pp. 45–64 in: Operator Theory: Adv. and Appl., 113 (The S.A. Vinogradov Memorial Volume), Basel, Birkhäuser, 2000.
- [AP] A.B. ALEKSANDROV AND V.V. PELLER, *Hankel operators and similarity to a contraction*, Int. Math. Res. Notices, (1996) no. 6, 263–275.
- [ARR] A. ALEMAN, S. RICHTER AND W. ROSS, *Pseudocontinuations and the backward shift*, Indiana Univ. Math. J., 47 (1998), 223–276.
- [ARS] A. ALEMAN, S. RICHTER, C. SUNDBERG, *Beurling’s theorem for the Bergman space*, Acta Math. 177 (1996), 275–310.
- [All] G.R. ALLAN, *On one-sided inverses in Banach algebras of holomorphic vector-valued functions*, J. London Math. Soc., 42 (1967), 463–470.
- [Alp] D. ALPAY, *Algorithmes de Schur, espaces à noyau reproduisant et théorie des systèmes*, Panoramas et Synthèses, vol. 6, Soc. Math. France, Paris, 1998.
- [Am1] E. AMAR, *Ensembles d’interpolation sur le spectre d’une algèbre d’opérateurs*, Thèse, Dept. Math., Université Paris XI, Orsay, 1977.
- [AB] E. AMAR AND A. BONAMI, *Mesures de Carleson d’ordre  $\alpha$  et solutions au bord de l’équation  $\bar{\partial}$* , Bull. Soc. Math. France, 107 (1979), 23–48.
- [Ander] J.M. ANDERSON, *Bloch functions: the basic theory*, pp. 1–19 in: Operators and function theory, ed. S. Power, Reidel Publ., Dordrecht, 1985.
- [And1] T. ANDO, *On a pair of commutative contractions*, Acta Sci. Math., 24 (1963), 88–90.
- [And2] ——— *De Branges spaces and analytic operator functions*, Lect. Notes, Sapporo University, 1990.

- [And3] ——— *Majorization and inequalities in matrix theory*, Linear Algebra Appl., 199 (1994), 17–67.
- [ABFP] C. APOSTOL, H. BERCOVICI, C. FOIAS AND C. PEARCY, *Invariant subspaces, dilation theory, and the structure of the predual of a dual algebra, I*, J. Funct. Anal., 63 (1985), 369–404.
- [AFHV] C. APOSTOL, L.A. FIALKOW, D.A. HERRERO AND D. VOICULESCU, *Approximation of Hilbert space operators, Vol. II*, Res. Notes Math. 102, Pitman, Boston, 1984.
- [ArG] N.U. ARAKELIAN AND P.M. GAUTHIER, *Propagation of smallness and uniqueness for harmonic and holomorphic functions*, J. Contemp. Math. Anal. (Nat. Acad. Sci. Armenia) 30 (1995), no. 4, 2–24.
- [AFP1] J. ARAZY, S. FISCHER AND J. PEETRE, *Möbius invariant function spaces*, J. Reine Angew. Math., 363 (1985), 110–145.
- [AFP2] ——— *Hankel operators on weighted Bergman spaces*, Amer. J. Math., 110 (1988), 989–1054.
- [Are1] W. ARENDT, *Spectral bound and exponential growth: survey and an open problem*, pp. 397–401 in: Ulmer Seminare Funktionalanalysis und Differentialgleichungen, Heft 1, Universität Ulm, 1996.
- [ArBa] W. ARENDT AND C.J.K. BATTY, *Tauberian theorems and stability of one-parameter semigroups*, Trans. Amer. Math. Soc., 306 (1988), 837–852.
- [ArN] W. ARENDT AND N. NIKOLSKI, *Vector-valued holomorphic functions revisited*, Math. Zeit., 234 (2000), no. 4, 777–805.
- [Aro] N. ARONSZAJN, *Theory of reproducing kernels*, Trans. Amer. Math. Soc., 68 (1950), 337–404.
- [ACS] R. AROSENA, M. COTLAR AND C. SADOSKY, *Weighted inequalities in  $L^2$  and lifting property*, Math. Anal. and Appl., Adv. in Math. Suppl. Stud., 7A (1981), 95–128.
- [ArGh] GR. ARSENE AND A. GHEONDEA, *Completing matrix contractions*, J. Operator Theory, 7 (1982), 179–189.
- [Arv1] W.B. ARVESON, *Subalgebras of  $C^*$ -algebras. I*, Acta Math., 123 (1969), no. 3–4, 141–224.
- [Arv2] ——— *Subalgebras of  $C^*$ -algebras. II*, Acta Math., 128 (1972), no. 3–4, 271–308.
- [Arv3] ——— *Interpolation problems in nest algebras*, J. Funct. Anal., 20 (1975), 208–233.
- [Arv4] ——— *Ten lectures on operator algebras*, CBMS series 55, Amer. Math. Soc., Providence, 1983.
- [Arv5] ——— *Subalgebras of  $C^*$ -algebras. III: multivariable operator theory*, preprint, Berkeley, 1999.
- [At] F.V. ATKINSON, *Discrete and continuous boundary problems*, Academic Press, N.Y., 1964.
- [Atz] A. ATZMON, *Multilinear mappings and estimates of multiplicity*, Integral Eq. Operator Theory, 10 (1987), 1–16.
- [Au] B. AUPETIT, *Propriétés spectrales des algèbres de Banach*, Lect. Notes Math., 735, Springer, Heidelberg, 1979.
- [Av] S.A. AVDONIN *Towards the question on Riesz bases of exponentials in  $L^2$* , Vestnik Leningradskogo Universiteta, ser. matem., mehan. i astron., 13 (1974), 5–12 (Russian).
- [AI1] S.A. AVDONIN AND S.A. IVANOV, *Controllability of systems with distributed parameters and families of exponentials*, UMK VO, Kiev, 1989 (Russian).
- [AI2] ——— *Families of exponentials*, Cambridge Univ. Press, Cambridge, 1995.
- [Ave] R.A. AVETISYAN, *Inequalities of Bernstein type for derivatives of meromorphic functions, and approximation by meromorphic functions on the real line*, Izvestia National. Akad. Nauk Armenii, Matematika, 28 (1993), no. 6, 14–29 (Russian); English transl.: J. Contemp. Math. Anal., 28 (1993), no. 6, 11–24.
- [Ax1] SH. AXLER, *Factorization of  $L^\infty$  functions*, Ann. Math., 106 (1977), 567–572.
- [Ax2] ——— *Bergman spaces and their operators*, in: Surveys of some recent results in operator theory, Vol. 1 (eds. J.B. Conway and B.B. Morrel), Pitman Res. Notes Math. Series 171, 1–50, (1988).
- [AChS] SH. AXLER, A.S.-Y. CHANG AND D. SARASON, *Products of Toeplitz operators*, Integral Eq. Oper. Theory, 1 (1978), 285–309.
- [AZ] SH. AXLER AND D. ZHENG, *The Berezin transform on the Toeplitz algebra*, Studia Math., 127 (1998), 113–136.

- [AzCl] E.A. AZOFF AND K.F. CLANCEY, *Spectral multiplicity for direct integrals of normal operators*, J. Operator Theory, 3 (1980), no. 2, 213–235.
- [Ba] K.I. BABENKO, *On harmonic conjugate functions*, Dokl. Akad. Nauk SSSR, 62 (1948), 157–160 (Russian).
- [Bach] G.F. BACHELIS *On the upper and lower majorant properties in  $L^p(G)$* , Quart. J. Math. Oxford, (2)24 (1973), 119–128.
- [BadPau] C. BADEA AND V.I. PAULSEN *Schur multipliers and operator-valued Foguel–Hankel operators*, Preprint (2000), Univ. Lille-1 (badea@agat.univ-lille1.fr).
- [Baez] L. BAEZ-DUARTE, *On Beurling’s real variable reformulation of the Riemann hypothesis*, Adv. Math. 101 (1993), no. 1, 10–30.
- [BaS] F. BAGEMIDL AND W. SEIDEL, *A problem concerning cluster sets of analytic functions*, Math. Z., 62 (1955), 99–110.
- [BaC] M. BAKONYI AND T. CONSTANTINESCU, *Schur’s algorithm and several applications*, Pitman Res. Notes Math. 261, Longman, Harlow, and Wiley, New York, 1992.
- [Bal] M. BALAZARD, *Completeness problems and the Riemann hypothesis: an annotated bibliography*, manuscript, Univ. de Bordeaux, 2000.
- [BS] M. BALAZARD ET E. SAIAS, *Notes sur la fonction  $\zeta$  de Riemann, 1–3*, manuscripts, Univ. de Bordeaux, 1997.
- [Ball] J.A. BALL, *Models for noncontractions*, J. Math. Anal. Appl., 52 (1975), 235–254.
- [BGR] J.A. BALL, I. GOHBERG, AND L. RODMAN, *Interpolation of rational matrix functions*, (Operator theory: Advances and applications, 45), Basel, Birkhäuser, 1990.
- [BaH] J.A. BALL AND J.W. HELTON, *A Beurling–Lax theorem for the Lie group  $U(m, n)$  which contains most classical interpolation theory*, J. Oper. Theory, 9 (1983), 107–142.
- [BaL] J.A. BALL AND A. LUBIN, *On a class of contractive perturbations of restricted shifts*, Pacific J. Math., 63 (1976), no. 2, 309–323.
- [Ban1] S. BANACH, *Über einige Eigenschaften der lacunären trigonometrischen Reihen*, Studia Math., 2 (1930), 207–220.
- [Ban2] ———, *Théorie des opérations linéaires*, Monografie Matematyczne, Warszawa, 1932.
- [Bara] A. BARANOV, *Differentiation in the de Branges spaces and embedding theorems*, to appear.
- [BaLe] L. BARATCHART AND J. LEBLOND, *Hardy approximation to  $L^p$  functions on subsets of the circle with  $1 \leq p < \infty$* , Constructive Approx., 14 (1998), 41–56.
- [BLP] L. BARATCHART, J. LEBLOND AND J.R. PARTINGTON, *Hardy approximation to  $L^\infty$  functions on subsets of the circle*, Constructive Approx., 12 (1996), 423–436.
- [BKö] K. BARBEY AND H. KÖNIG, *Abstract analytic function theory and Hardy algebras*, Lect. Notes Math., 593, Springer–Verlag, Berlin, 1977.
- [Bar1] N.K. BARI, *On bases in a Hilbert space*, Doklady Akad. Nauk SSSR, 54 (1946), 383–386 (Russian).
- [Bar2] ———, *Biorthogonal systems and bases in a Hilbert space*, Uchenye zapiski MGU (Moscow State Univ.), no. 148, vol. 4 (1951), 69–107 (Russian).
- [BSch] K.F. BARTH AND W.J. SCHNEIDER, *An asymptotic analog of the F. and M. Riesz radial uniqueness theorem*, Proc. Amer. Math. Soc. 22 (1969), no. 1, 53–54.
- [Bat] C.J.K. BATTY, *Asymptotic behaviour of semigroups of operators*, pp. 35–52 in: Banach Center Publications, vol. 30 (ed. J. Zemanek), Warszawa, 1994.
- [BY] C.J.K. BATTY AND S.B. YEATES, *Weighted and local stability of semigroups of operators*, Math. Proc. Cambridge Philos. Soc. 129 (2000), no. 1, 85–98.
- [Bau] H. BAUMGÄRTEL, *Analytic perturbation theory for matrices and operators* Birkhäuser Verlag, Basel, 1985.
- [Bax] G. BAXTER, *A norm inequality for a finite-section Wiener–Hopf equation*, Illinois J. Math. 7 (1963), 97–103.
- [BeaBu] K. BEATROUS AND J. BURBEA, *Reproducing kernels and interpolation of holomorphic functions*, pp. 25–46 in: *Complex Analysis, Functional Analysis and Approximation Theory* (Ed., J. Mujica), 1986.
- [Beau] B. BEAUZAMY, *Introduction to operator theory and invariant subspaces*, North-Holland, 1988.
- [BN] N. BENAMARA AND N.K. NIKOLSKI, *Resolvent test for similarity to a normal operator*, Proc. London Math. Soc., (3) 78 (1999), 585–626.

- [Be] H. BERCOVICI, *Operator theory and arithmetic in  $H^\infty$* , Math. Surveys and Monographs, no. 26, Amer. Math. Soc., Providence, RI, 1988.
- [BF] H. BERCOVICI AND C. FOIAS, *A real variable restatement of Riemann's hypothesis*, Israel J. Math. 48 (1984), 57–68.
- [BFP] H. BERCOVICI, C. FOIAS AND C. PEARCY, *Dual algebras with applications to invariant subspaces and dilation theory*, CBMS series 56, Amer. Math. Soc., Providence, RI, 1985.
- [Ber] C. BERENSTEIN (ED.), *Complex analysis*, Lect. Notes Math., 1275, 1276, 1277, Berlin etc., Springer-Verlag, 1987.
- [BD] C. BERENSTEIN AND M. DOSTAL, *Analytically uniform spaces and their applications to convolution equations*, Lect. Notes Math., 256, Berlin etc., Springer-Verlag, 1972.
- [BT] C. BERENSTEIN AND B.A. TAYLOR, *A new look at interpolation theory for entire functions of one variable*, Adv. in Math., 33 (1979), 109–143.
- [BeChR] C. BERG, J.P.R. CHRISTENSEN AND P. RESSEL, *Harmonic analysis on semigroups. Theory of positive definite and related functions*, Springer-Verlag, NY-Heidelberg, 1984.
- [B.I] I.D. BERG, *An extension of the Weyl-von Neumann theorem to normal operators*, Trans. Amer. Math. Soc. 160 (1971), 365–371.
- [Berge] C.A. BERGER, *Normal dilations*, Thesis, Cornell University, 1963; Dissert. Abstracts, 1964, 24 (1964), no. 7, p. 2918.
- [BergeSh] C.A. BERGER AND B.I. SHAW, *Intertwining, analytic structure, and the trace norm estimate*, Lect. Notes Math., 345 (1973), 1–6.
- [BLo] J. BERGH AND J. LÖFSTRÖM, *Interpolation spaces. An introduction*, Grundlehren der Mathematischen Wissenschaften, no. 223, Springer-Verlag, Berlin-New York, 1976.
- [Berg1] S. BERGMAN, *Über die Entwicklung der harmonischen Funktionen der Ebene und des Raumes nach Orthogonalfunktionen*, Math. Ann., 86 (1922), 238–271.
- [Berg2] ———, *The kernel function and conformal mapping*, Amer. Math. Soc. Math. Surveys, vol. 5, Providence, RI, 1950.
- [BerA] A. BERNARD, *Algèbres quotients d'algèbres uniformes*, C.R. Acad. Sci. Paris, Sér. A, 272 (1971), 1101–1104.
- [Bern1] S.N. BERNSTEIN, *Le problème de l'approximation des fonctions continues sur tout l'axe réel et l'une de ses applications*, Bull. Soc. Math. France, 52 (1924), 399–410.
- [Bern2] ———, *Leçons sur les propriétés extrémales et la meilleure approximation des fonctions analytiques d'une variable réelle*, Gauthier-Villars, Paris, 1926.
- [Bes] O.V. BESOV, *On a family of function spaces. Embedding and extension theorems*, Doklady akad. nauk SSSR, 126 (1959), 1163–1165.
- [Beu1] A. BEURLING, *Sur les fonctions limites quasianalytiques des fractions rationnelles*, pp. 199–210 in: 8 Scand. Math. Congr. Stockholm, 1934.
- [Beu2] ———, *On two problems concerning linear transformations in Hilbert space*, Acta Math. 81 (1949), no. 1–2, 79–93.
- [Beu3] ———, *A closure problem related to the Riemann  $\zeta$ -function*, Proc. Nat. Acad. USA, 41 (1955), no. 5, 312–314.
- [Beu4] ———, *A critical topology in harmonic analysis on semigroups*, Acta Math. 112 (1964), 215–228.
- [BeuM1] A. BEURLING AND P. MALLIAVIN, *On Fourier transforms of measures with compact support*, Acta Math., 107 (1962), 291–309.
- [BeuM2] ———, *On the closure of characters and the zeros of entire functions*, Acta Math., 118 (1967), 79–93.
- [Bha] R. BHATIA, *Matrix analysis*, Springer-Verlag, NY, 1997.
- [BhaH] R. BHATIA AND A.R. HOLBROOK, *A softer, stronger Lidskii theorem*, Proc. Indian Acad. Sci. (Math. Sci.), 99 (1989), no. 1, 75–83.
- [Bir] G.D. BIRKHOFF, *Démonstration d'un théorème élémentaire sur les fonctions entières*, C.R. Acad. Paris, 189 (1929), 473–475.
- [BiS] M.S. BIRMAN AND M.Z. SOLOMYAK, *Spectral theory of selfadjoint operators in Hilbert space*, Leningrad. Univ., Leningrad, 1980 (Russian); English transl.: Mathematics and its Applications (Soviet Series), D. Reidel Publishing Co., Dordrecht, 1987.
- [BiBr] E. BISHOP AND D. BRIDGES, *Constructive analysis*, Springer Verlag, Heidelberg, 1985.
- [Bl1] O. BLASCO, *Boundary values of functions in vector valued Hardy spaces and geometry of Banach spaces*, J. Funct. Anal., 78 (1988), 346–364.

- [Bl2] ——— *Vector-valued Hardy inequalities and B-convexity*, Ark. Mat., 38 (2000), 21-36.
- [Bl3] ——— *Remarks on vector-valued BMOA and vector-valued multipliers*, preprint (2001), to appear in *Positivity*.
- [BJH] P. BLOOMFELD, N.P. JEWELL, AND E. HAYASHI, *Characterization of completely non-deterministic stochastic processes*, Pacific J. Math., 107 (1983), 307–317.
- [Bo1] R.P. BOAS, *Entire functions*, N.Y., Academic Press, 1954.
- [Bo2] ——— *Majorant problems for Fourier series*, J. Anal. Math., 10 (1962), 253–271.
- [Boch] S. BOCHNER, *Harmonic analysis and the theory of probability*, Univ. Calif. Press, 1955.
- [BPh] S. BOCHNER AND R.S. PHILLIPS, *Absolutely convergent Fourier expansions for non-commutative normed rings*, Ann. of Math., (2) 43 (1942), 409–418.
- [Boh] H. BOHR, *A theorem concerning power series*, Proc. London Math. Soc., (2) 13 (1914), 1–5.
- [BoB] A. BONAMI AND J. BRUNA, *On truncations of Hankel and Toeplitz operators*, Publicacions Matemàtiques (Barcelona), 43 (1999), 235–250.
- [BoD] F.F. BONSALL AND J. DUNCAN, *Complete normed algebras*, Berlin etc., Springer-Verlag, 1973.
- [BoGi] F.F. BONSALL AND T.A. GILLESPIE, *Hankel operators with PC symbols and the space  $H^\infty + PC$* , Proc. Royal Soc. Edinburgh, 89 A (1981), 17–24.
- [BP] F.F. BONSALL AND S.C. POWER, *A proof of Hartman's theorem on compact Hankel operators*, Math. Proc. Camb. Phil. Soc., 78 (1975), 447–450.
- [Boo] G. BOOLE, *On the comparison of transcendents, with certain applications to the theory of definite integrals*, Phil. Trans. Royal Soc., 147 (1857), 745–803.
- [Bore] E. BOREL, *Remarques sur la Note de M. Wolff*, C.R. Acad. Sci. Paris, 173 (1921), 1056–1057.
- [Bor1] A. BORICHEV, *The generalized Fourier transformation, Titchmarsh's theorem and asymptotically holomorphic functions*, Algebra i Analiz, 1 (1989), no. 4, 17–53; English transl.: Leningrad Math. J., 1 (1990), 825–857.
- [Bor2] ——— *Beurling algebras and the generalized Fourier transform*, Proc. London Math. Soc., (3) 73 (1996), 431–480.
- [Bor3] ——— *Estimates from below and cyclicity in Bergman-type spaces*, Internat. Math. Research Notes (1996), no. 12, 603–611.
- [Bor4] ——— *Invariant subspaces of given index in Banach spaces of analytic functions*, Journ. reine und angew. Math., 505 (1998), 23–44.
- [Bor5] ——— *On the closure of polynomials in weighted spaces of functions on the real line*, Indiana Univ. Math. J., to appear.
- [BH1] A. BORICHEV AND H. HEDENMALM, *Completeness of translates in weighted spaces on the half-line*, Acta Math., 174 (1995), no. 1, 1–84.
- [BH2] ——— *Harmonic functions of maximal growth: invertibility and cyclicity in Bergman spaces*, J. Amer. Math. Soc., 10 (1997), 761–796.
- [BHV] A. BORICHEV, H. HEDENMALM AND A. VOLBERG, *Invertibility, cyclicity and subspaces of big index in large Bergman spaces*, manuscript, 2000.
- [BoS1] A. BORICHEV AND M. SODIN, *The Hamburger moment problem and weighted polynomial approximation on discrete subsets of the real line*, J. Analyse Math., 76 (1998), 219–264.
- [BoS2] ——— *Weighted polynomial approximation and the Hamburger moment problem*, Acta Univ. Upsaliensis, 64 (1999), 110–122.
- [BoS3] ——— *Krein's entire functions and the Bernstein approximation problem*, Illinois J. Math., to appear.
- [Bori1] I.A. BORICHEVA, *An application of the Schur method to the free interpolation problems in the model space*, Algebra i Analiz, 7 (1995), no. 4, 44–64 (Russian); English Transl.: St.Petersburg Math. J., 7 (1996), no. 4, 543–560.
- [Bori2] ——— *Geometric properties of projections of reproducing kernels on  $z^*$ -invariant subspaces of  $H^2$* , J. Funct. Anal., 161 (1999), 397–417.
- [BoriD] I.A. BORICHEVA AND E.M. DYN'KIN, *A non-classical free interpolation problem*, Algebra i Analiz, 4:5 (1992), 45-90 (Russian); English transl.: St.Petersburg Math. J., 4:5 (1993).
- [Bö] A. BÖTTCHER, *Toeplitz operators with piecewise continuous symbols — a neverending story?*, Jahresber. Deutsch. Math.-Verein. 97 (1995), no. 4, 115–129.



- [BöG] A. BÖTTCHER AND S.M. GRUDSKY, *Toeplitz operators with discontinuous symbols — phenomena beyond piecewise continuity*, In: Operator theory: Advances and applications, 90 (1996), Basel, Birkhäuser, 55–118.
- [BöG2] ——— *Toeplitz matrices, asymptotic linear algebra and functional analysis*, Hindustan Book Agency, New Delhi, 2000.
- [BöK] A. BÖTTCHER AND YU.I. KARLOVICH, *Carleson curves, Muckenhoupt weights, and Toeplitz operators*, Birkhäuser Verlag, Basel, 1997.
- [BöSe] A. BÖTTCHER AND M. SEYBOLD, *Discrete one-dimensional zero-order pseudodifferential operators on spaces with Muckenhoupt weights*, Algebra i Analiz, 13:2 (2001); (Reprinted in St. Petersburg Math. J., 13:2 (2002)).
- [BSi1] A. BÖTTCHER AND B. SILBERMANN, *Invertibility and asymptotics of Toeplitz matrices*, Akademie-Verlag, Berlin, 1983.
- [BSi2] ——— *Analysis of Toeplitz operators*, Akademie-Verlag, Berlin, and Springer-Verlag, 1990.
- [BSi3] ——— *Introduction to large truncated Toeplitz matrices*, New York etc., Springer-Verlag, 1999.
- [Bour] N. BOURBAKI, *Théories spectrales*, Eléments de mathématique, Fasc. XXXII, Hermann, Paris, 1967.
- [BouSh] P.S. BOURDON AND J.H. SHAPIRO, *Cyclic phenomena for composition operators*, Mem. Amer. Math. Soc. 125 (1997), no. 596.
- [Bou1] A. BOURGAIN, *Some remarks on Banach spaces in which martingale difference sequences are unconditional*, Ark. Mat., 21 (1983), no. 2, 163–168.
- [Bou2] ——— *Bilinear forms on  $H^\infty$  and bounded bianalytic functions*, Trans. Amer. Math. Soc., 286 (1984), no. 1, 313–337.
- [Bou3] ——— *On the similarity problem for polynomially bounded operators on Hilbert space*, Israel J. Math., 54 (1986), 227–241.
- [Boz] M. BOZEJKO, *Positive-definite kernels, length functions on groups and a noncommutative von Neumann inequality*, Studia Math., 95 (1989), 107–118.
- [Br] J. BRAM, *Subnormal operators*, Duke Math. J., 22 (1955), no. 1, 75–94.
- [BR] O. BRATTELI AND D. ROBINSON, *Operator algebras and quantum statistical mechanics*, New York, Springer-Verlag, 1981.
- [Bre] S. BREHMER, *Über vertauschbare Kontraktionen des Hilbertschen Raumes*, Acta Sci. Math. Szeged, 22 (1961), 106–111.
- [Bro1] M.S. BRODSKII, *On a problem of I.M. Gelfand*, Uspehi Matem. Nauk, 12 (1957), no. 2, 129–132 (Russian).
- [Bro2] ——— *On unicellularity of the integration operator and a Titchmarsh theorem*, Uspehi Matem. Nauk, 20 (1965), no. 5, 189–192 (Russian).
- [Bro3] ——— *Triangular and Jordan representation of linear operators*, Moscow, Nauka, 1969 (Russian); English transl.: Amer. Math. Soc., Providence, 1971.
- [BrL] M.S. BRODSKII AND M.S. LIVSHIC, *Spectral analysis of non-selfadjoint operators and intermediate systems*, Uspehi Matem. Nauk, 13 (1958), no. 1, 3–85 (Russian).
- [Brown] A. BROWN, *A version of multiplicity theory*, pp. 129–160 in: Topics in operator theory (ed. C. Pearcy), Math. Surveys series, 13, Amer. Math. Soc., Providence, 1974.
- [BDF] L.G. BROWN, R.G. DOUGLAS, AND P.A. FILLMORE, *Unitary equivalence modulo the compact operators and extensions of  $C^*$ -algebras*, Lect. Notes Math., Springer-Verlag, 345 (1973), 58–128.
- [BrH] A. BROWN AND P. HALMOS, *Algebraic properties of Toeplitz operators*, J. Reine Angew. Math., 213 (1963), 89–102.
- [BSZ] A. BROWN, A. SHIELDS, AND K. ZELLER, *On absolutely convergent exponential sums*, Trans. Amer. Math. Soc. 96 (1960), no. 1, 162–183.
- [Bu1] A.V. BUKHVALOV, *Continuity of operators in spaces of measurable vector-valued functions with applications to the study of Sobolev spaces and spaces of analytic functions in the vector-valued case*, Doklady Akad. Nauk SSSR, 246 (1979), no. 3, 524–528 (Russian); English transl.: Sov. Math., Dokl., 20 (1979), 480–484.
- [Bu2] ——— *Application of methods of the theory of order-bounded operators to the theory of operators in  $L^p$ -spaces*, Uspehi Matem. Nauk, 38 (1983), no. 6, 37–83 (Russian); English transl.: Russ. Math. Surv. 38 (1983), no. 6, 43–98.

- [BuD] A.V. BUKHVALOV AND A.A. DANILEVICH, *Boundary properties of analytic and harmonic functions with values in Banach spaces*, *Matem. Zametki*, 31 (1982), no. 2, 203–214 (Russian); English transl.: *Math. Notes*, 31 (1983), no. 1–2, 104–110.
- [Bun] J.W. BUNCE, *Models for  $n$ -tuples of non-commuting operators*, *J. Funct. Anal.*, 57 (1984), 21–30.
- [Burk] D.L. BURKHOLDER, *A geometric condition that implies the existence of certain singular integrals of Banach-space-valued functions*, pp. 270–286 in: *Conference on Harmonic Analysis in Honor of Antony Zygmund*, eds. W. Beckner, A. Calderon, R. Fefferman, and P. Jones, *Wadsworth Int. Math. Series*, 1983.
- [Bur] L. BURLANDO, *Continuity of spectrum and spectral radius in Banach algebras*, pp. 53–100 in: *Banach Center Publications*, vol. 30 (ed. J. Zemanek), Warszawa, 1994.
- [Butk] A.G. BUTKOVSKII, *Methods of control of distributed parameter systems*, Nauka, Moscow, 1995.
- [But] J.R. BUTZ,  *$s$ -numbers of Hankel matrices*, *J. Funct. Anal.*, 15 (1974), 297–305.
- [Can] D.G. CANTOR, *Power series with integral coefficients*, *Bull. Amer. Math. Soc.*, 69 (1963), 362–366.
- [Cara] S.R. CARADUS, *Universal operators and invariant subspaces*, *Proc. Amer. Math. Soc.*, 23 (1969), no. 3, 526–527.
- [Car1] T. CARLEMAN, *Zur Theorie der linearen Integralgleichungen*, *Math. Zeit.*, 9 (1921), 196–217.
- [Car2] ——— *Sur les séries  $\sum \frac{A_n}{z-z_n}$* , *C.R. Acad. Sci. Paris*, 174 (1922), 1056–1057.
- [Car3] ——— *Les fonctions quasi analytiques*, Gauthier-Villars, Paris, 1926.
- [C1] L. CARLESON, *Representations of continuous functions*, *Math. Zeit.*, 66 (1957), 447–451.
- [C2] ——— *An interpolation problem for bounded analytic functions*, *Amer. J. Math.*, 80 (1958), 921–930.
- [C3] ——— *Interpolations by bounded analytic functions and the corona problem*, *Ann. of Math.*, 76 (1962), 547–559.
- [C4] ——— *On convergence and growth of partial sums of Fourier series*, *Acta Math.*, 116 (1966), 135–157.
- [Cha] B.L. CHALMERS, *Some interpolation problems in Hilbert spaces*, *Michigan Math. J.*, 18 (1971), 41–50.
- [ChL] C. CHICONE AND YU. LATUSHKIN, *Evolution semigroups in Dynamical systems and differential equations*, *Math. Surveys and Monographs*, 70, Amer. Math. Soc., Providence, 1999.
- [Chr] O. CHRISTENSEN, *Frames, Riesz bases, and discrete Gabor/wavelet expansions*, *Bull. Amer. Math. Soc.*, 38 (2001), no. 3, 273–291.
- [CiRos] J.A. CIMA AND W.T. ROSS, *The backward shift on the Hardy space*, *Amer. Math. Soc. Surveys and Monographs*, vol. 79, Providence, 2000.
- [CiSt] J.A. CIMA AND M. STESSIN, *On the recovery of analytic functions*, *Canad. J. Math.*, 48 (2) (1996), 288–301.
- [Clan] K. CLANCEY, *Seminormal operators*, *Lect. Notes Math.*, 742, Springer-Verlag, 1979.
- [CG] K. CLANCEY AND I. GOHBERG, *Factorization of matrix functions and singular integral operators*, *Operator theory: Advances and applications*, 3, Basel, Birkhäuser, 1981.
- [Cl1] D.N. CLARK, *On commuting contractions*, *J. Math. Anal. Appl.*, 32 (1970), 590–596.
- [Cl2] ——— *One dimensional perturbations of restricted shifts*, *J. Analyse Math.*, 25 (1972), 169–191.
- [Cl3] ——— *On Toeplitz operators with loops, II*, *J. Oper. Theory*, 7 (1982), 109–123.
- [Cle] PH. CLÉMENT. H. HEIJMANS. S. ANGENENT. C. VAN DUIJN. B. DE PAGTER (EDS.), *One-parameter semigroups*, *CWI Monographs*, 5, North-Holland Publishing Co., Amsterdam–New York, 1987.
- [Cob1] L.A. COBURN, *Weyl's theorem for nonnormal operators*, *Mich. Math. J.*, 13 (1966), 285–288.
- [Cob2] ——— *The  $C^*$ -algebra generated by an isometry. I*, *Bull. Amer. Math. Soc.*, 73 (1967), 722–726.
- [Coh] P. COHEN, *A note on constructive methods in Banach algebras*, *Proc. Amer. Math. Soc.*, 12:1 (1961), 159–164.

- [Cohn] W.S. COHN, *Carleson measures for functions orthogonal to invariant subspaces*, Pacific J. Math., 103 (1982), no. 2, 367–384.
- [CV] W.S. COHN AND I.E. VERBITSKII, *Factorization of tent spaces and Hankel operators*, J. Funct. Anal., 175 (2000), no. 2, 308–329.
- [CM] R.R. COIFMAN AND Y. MEYER, *Ondelettes et opérateurs. III. Opérateurs multilinéaires*, Paris, Hermann, 1990.
- [CR] R.R. COIFMAN AND R. ROCHBERG, *Representation theorems for holomorphic and harmonic functions in  $L^p$* , pp. 11–66 in: Representation theorems for Hardy classes, Astérisque 77, Soc. Math. France, Paris, 1980.
- [CRW] R.R. COIFMAN, R. ROCHBERG, AND G. WEISS, *Factorization theorems for Hardy spaces in several variables*, Ann. Math., 103 (1976), 611–635.
- [CoiW] R.R. COIFMAN AND G. WEISS, *Transference methods in analysis*, CBMS regional conf. series in math., 31, Amer. Math. Soc., Providence, RI, 1977.
- [CLW] B.J. COLE, K. LEWIS, AND J. WERMER, *A characterization of Pick bodies*, J. London Math. Soc. (2), 48 (1993), 316–328.
- [CW1] B.J. COLE AND J. WERMER, *Pick interpolation, von Neumann inequalities, and hyperconvex sets*, In: Complex potential theory (Montreal, PQ, 1993), 89–129, NATO Adv. Sci. Inst. Ser. C Math. Phys. Sci., 439, Kluwer Acad. Publ., Dordrecht, 1994.
- [CW2] ———, *Ando’s theorem and sums of squares*, Indiana Univ. Math. J., 48 (2000), no. 3, 767–791.
- [CL] E.F. COLLINGWOOD AND A.J. LOHWATER, *The theory of cluster sets*, Cambridge Univ. Press, 1966.
- [CF] I. COLOJOARA AND C. FOIAS, *The theory of generalized spectral operators*, Gordon and Breach, N.Y., 1968.
- [Con] J.B. CONWAY, *The Theory of Subnormal Operators*, Math. Surveys and monographs 36, Amer. Math. Soc., Providence, RI, 1991.
- [CY] J.B. CONWAY AND LIMING YANG, *Some open problems in the theory of subnormal operators*, pp. 201–209 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy, and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Cot1] M. COTLAR, *A combinatorial inequality and its application to  $L^2$  spaces*, Rev. Math. Cuyana, 1 (1955), 41–55.
- [CS1] M. COTLAR AND C. SADOSKY, *On the Helson–Szegő theorem and a related class of modified Toeplitz kernels*, pp. 383–407 in: Harmonic analysis in Euclidean spaces (Williamstown, MA, 1978), Part 1, eds. G. Weiss, and S. Wainger, Proc. Symp. Pure Math. 35, Amer. Math. Soc., Providence, 1979.
- [CS2] ———, *On some  $L^p$  versions the Helson–Szegő theorem*, pp. 306–317 in: Conference on harmonic analysis in honor of Antoni Zygmund, Vol. I, II (Chicago, Ill., 1981), Wadsworth Math. Ser., Wadsworth, Belmont, Calif., 1983.
- [CS3] ———, *Generalized Toeplitz kernels, stationarity and harmonizability*, J. Analyse Math., 44 (1984/85), 117–133.
- [CS4] ———, *A lifting theorem for subordinated invariant kernels*, J. Funct. Anal., 67 (1986), 345–359.
- [CS5] ———, *Toeplitz liftings of Hankel forms*, pp. 22–43 in: Function spaces and applications (Lund, 1986), Lect. Notes Math., 1302, Springer, Berlin and New York, 1988.
- [CS6] ———, *Weakly positive matrix measures, generalized Toeplitz forms, and their applications to Hankel and Hilbert transform operators*, pp. 93–120 in: Operator Theory: Adv. and Appl. (Basel, Birkhäuser), vol. 58, 1992.
- [CS7] ———, *Abstract, weighted, and multidimensional Adamyan–Arov–Krein theorems, and the singular numbers of Sarason commutators*, Integr. Eq. Oper. Theory, 17 (1993), 169–201.
- [CS8] ———, *Nehari and Nevanlinna–Pick problems and holomorphic extensions in the polydisk in terms of restricted BMO*, J. Funct. Anal., 124 (1994), no. 1, 205–210.
- [CD] M.J. COWEN AND R.G. DOUGLAS, *Operators possessing an open set of eigenvalues*, Colloq. Math. Soc. Janos Bolyai, 323–341; Amsterdam, North-Holland, 1980.
- [CrD] M. CRABB AND A.M. DAVIE, *Von Neumann’s inequality for Hilbert space operators*, Bull. London Math. Soc., 7 (1975), 49–50.
- [CPr] R.F. CURTAIN AND A.J. PRITCHARD, *Infinite-dimensional linear systems theory*, Lect. Notes CIS, vol. 8, Springer–Verlag, Berlin, 1978.

- [CZ] R.F. CURTAIN AND H. ZWART, *An introduction to infinite-dimensional linear systems theory*, Springer-Verlag, Heidelberg, 1995.
- [Cur] R. CURTO, *An operator theoretic approach to truncated moment problem*, pp. 75-104 in: *Banach Center Publications*, Vol.38 (Eds. J. Janas, F.H. Szafraniec and J. Zemanek), Warszawa.
- [Dan] V.W. DANIEL, *Convolution operators on Lebesgue spaces at the half-line*, Trans. Amer. Math. Soc., 164 (1972), 479-488.
- [Dat] R. DATKO, *Extending a theorem of A.M. Liapounov to Hilbert Space*, J. Math. Anal. Appl., 32 (1970), 610-616.
- [Da] G. DAVID, *Wavelets and singular integrals on curves and surfaces*, Lect. Notes Math., 1465, Berlin, Springer-Verlag, 1991.
- [Dav] K.R. DAVIDSON, *Nest algebras. Triangular forms for operator algebras on Hilbert space*, Pitman Res. Notes Math. Series, 191, Longman Sci&Tech, UK, 1988.
- [DP] K.R. DAVIDSON AND V.I. PAULSEN, *Polynomially bounded operators*, J. Reine Angew. Math., 487 (1997), 153-170.
- [DPi1] K.R. DAVIDSON AND D.R. PITTS, *Nevanlinna-Pick interpolation for non-commutative analytic Toeplitz algebras*, Integral Eq. Oper. Theory, 31 (1998), no. 3, 321-337.
- [DPi2] ———, *The algebraic structure of non-commutative analytic Toeplitz algebras*, Math. Ann. 311 (1998), no. 2, 275-303.
- [Davies] E.B. DAVIES, *Spectral theory and differential operators*, Cambridge Univ. Press, Cambridge, 1995.
- [Davi] CH. DAVIS, *J-unitary dilation of a general operator*, Acta Sci. Math. Szeged, 31 (1970), 75-86.
- [DF] CH. DAVIS AND C. FOIAS, *Operators with bounded characteristic functions and their J-unitary dilations*, Acta Sci. Math. Szeged, 32 (1971), 127-139.
- [dB1] L. DE BRANGES, *The Bernstein problem*, Proc. Amer. Math. Soc., 10 (1959), 825-832.
- [dB2] ———, *Hilbert spaces of entire functions*, Prentice Hall, Englewood Cliffs, N.J., 1968.
- [dB3] ———, *Square summable power series*, Unpublished manuscript, 400 pp., 1984.
- [dB4] ———, *Underlying concepts in the proof of the Bieberbach conjecture*, Proc. Internat. Congr. Math. at Berkeley 1986, Berkeley, 25-42.
- [dB5] ———, *A conjecture which implies the Riemann hypothesis*, J. Funct. Anal., 121 (1994), 117-184.
- [dB6] ———, *A proof of the Riemann hypothesis*, preprint, Purdue University, Lafayette, 1997.
- [dB7] ———, *Invariant subspaces and the Stone-Weierstrass theorem*, preprint, Purdue University, Lafayette, 2000.
- [dBR1] L. DE BRANGES AND J. ROVNYAK, *Square summable power series*, Holt, Rinehart and Winston, N.Y., 1966.
- [dBR2] ———, *Canonical models in quantum scattering theory*, pp. 295-392 in: *Perturbation theory and its applications in quantum mechanics*, Madison, 1965, ed. C.H. Wilcox, Wiley, N.Y., 1966
- [dBS] L. DE BRANGES AND L. SCHULMAN, *Perturbations of unitary transformations*, J. Math. Anal. and Appl., 23 (1968), no. 2, 294-326.
- [Del] R. DELAUBENFELS, *Similarity to a contraction, for power bounded operators with finite peripheral spectrum*, Trans. Amer. Math. Soc., 350 (1998), no. 8, 3169-3191.
- [dLR] K. DE LEEUW AND W. RUDIN, *Extreme points and extreme problems in  $H_1$* , Pacific J. Math., 8 (1958), 467-485.
- [Den] A. DENJOY, *Sur les séries de fractions rationnelles*, Bull. Soc. Math. France, 52 (1924), 418-434.
- [Dev1] A. DEVINATZ, *The factorization of operator valued functions*, Ann. of Math., (2) 73 (1961), 458-495.
- [Dev2] ———, *Toeplitz operators on  $H^2$  spaces*, Trans. Amer. Math. Soc., 112 (1964), 304-317.
- [Dev3] ———, *On Wiener-Hopf operators*, in *Functional Analysis* (B.R. Gelbaum, ed.), Proc. Conf., Irvine, CA, 1966, pp.81-118; Washington D.C., Thompson Book Co., 1967.
- [DevSh] A. DEVINATZ AND M. SHINBROT, *General Wiener-Hopf operators*, Trans. Amer. Math. Soc., 145 (1969), 467-494.
- [DeVL] R.A. DEVORE AND G.G. LORENTZ, *Constructive approximation*, Springer-Verlag, Heidelberg-Berlin, 1993.

- [Dij] A. DIJKSMA, *Almost commutant lifting in a Krein space setting*, Analysis Conference in honor of C. Foias, October 18-19, Amsterdam.
- [Dix] J. DIXMIER, *Les moyennes invariantes dans les semi-groupes et leurs applications*, Acta Sci. Math. Szeged, 12 (1950), 213–227.
- [Djr] M.M. DJRBASHIAN [DZHRBASHYAN], *Integral transforms and representations of functions of complex variable*, Nauka, Moscow, 1966 (Russian).
- [DjSh] M.M. DJRBASHIAN AND F.A. SHAMOYAN, *Topics in theory of  $A_\alpha^p$  spaces*, Teubner-Verlag, Leipzig, 1988.
- [DolR] S. DOLECKI AND D. RUSSEL, *A general theory of observation and control*, SIAM J. Control and Optim., 15 (1977), 185–220.
- [Don1] W.F. DONOGHUE, *The lattice of invariant subspaces of a completely continuous quasinilpotent transformation*, Pacif. J. Math., 7 (1957), no. 2, 1031–1035.
- [Don2] ———, *Monotone matrix functions and analytic continuation*, N.Y., Springer-Verlag, 1974.
- [Dou1] R.G. DOUGLAS, *On factoring positive operator functions*, J. Math. Mech., 16 (1966), 119–126.
- [Dou2] ———, *On majorization, factorization and range inclusion of operators in Hilbert space*, Proc. Amer. Math. Soc., 17 (1966), 413–415.
- [Dou3] ———, *Structure theory for operators, I*, J. Reine Angew. Math., 232 (1968), 180–193.
- [Dou4] ———, *On the operator equations  $S^*XT = X$  and related topics*, Acta Sci. Math. Szeged, 30 (1969), no. 1–2, 19–32.
- [Dou5] ———, *Banach algebra techniques in operator theory*, N.Y., Academic Press, 1972.
- [Dou6] ———, *Banach algebra techniques in the theory of Toeplitz operators*, CBMS series, 15, Amer. Math. Soc., Providence, RI, 1973.
- [Dou7] ———, *Canonical models*, pp. 163–218 in: Topics in operator theory (ed., C. Pearcy), Math. Surveys series, 13, Amer. Math. Soc., Providence, 1974.
- [DR] R.G. DOUGLAS AND W. RUDIN, *Approximation by inner functions*, Pasif. J. Math., 31 (1969), 313–320.
- [DSar] R.G. DOUGLAS AND D. SARASON, *Fredholm Toeplitz operators*, Proc. Amer. Math. Soc., 26 (1970), 117–120.
- [DSS] R.G. DOUGLAS, H.S. SHAPIRO, AND A.L. SHIELDS, *Cyclic vectors and invariant subspaces of the backward shift operator*, Ann. Inst. Fourier, 20 (1970), 37–76.
- [DN] L.N. DOVBYSH AND N.K. NIKOLSKI, *Two ways to avoid the hereditary completeness*, Zapiski Nauchn. Semin. LOMI, 65 (1976), 183–188 (Russian); English transl.: J. Sov. Math., 16 (1981), 1175–1179.
- [DNS] L.N. DOVBYSH, N.K. NIKOLSKI, AND V.N. SUDAKOV, *How "good" can a non-hereditarily complete family be?*, Zapiski Nauchn. Semin. LOMI, 73 (1977), 52–69 (Russian); English transl.: J. Soviet Math., 34 (1986), 2050–2060.
- [Dow] H.R. DOWSON, *Spectral theory of linear operators*, Academic Press, London New York, 1978.
- [DFT] J.C. DOYLE, B.A. FRANCIS AND A.R. TANNENBAUM, *Feedback control theory*, McMillan, 1982.
- [Dru1] S. DRURY, *A generalization of von Neumann's inequality to the complex ball*, Proc. Amer. Math. Soc., 68 (1978), no. 3, 300–304.
- [Dru2] ———, *Remarks on von Neumann's inequality*, pp. 14–32 in: Banach spaces, harmonic analysis, and probability theory, Proceedings 1980–1981 (eds. R. Blai and S. Sydney), Lect. Notes Math., 995, Springer-Verlag, Heidelberg, 1983.
- [DuE] R.J. DUFFIN AND J.J. EACHUS, *Some notes on an expansion theorem of Paley and Wiener*, Bull. Amer. Math. Soc., 48 (1942), no. 12, 850–855.
- [DS1] N. DUNFORD AND J. SCHWARTZ, *Linear operators. Part 1. General theory*, Wiley-Interscience, New York, 1958.
- [DS2] ———, *Linear operators. Part 2. Spectral theory. Self-adjoint operators in Hilbert space*, Wiley-Interscience, New York, 1963.
- [DS3] ———, *Linear operators. Part 3. Spectral operators*, Wiley-Interscience, New York, 1971.
- [Du1] P. DUREN, *Theory of  $H^p$  spaces.*, Academic Press, New York, 1970.
- [Du2] ———, *Bergman spaces*, AMS, 2001.

- [DRSh] P.L. DUREN, B.W. ROMBERG, AND A.L. SHIELDS, *Linear functionals on  $H^p$  spaces with  $0 < p < 1$* , J. Reine Angew. Math., 238 (1969), 32–60.
- [Dya1] K.M. DYAKONOV, *Generalized Hardy inequalities and pseudocontinuable functions*, Ark. Mat., 34 (1996), 231–244.
- [Dya2] ——— *Kernels of Toeplitz operators via Bourgain’s factorization theorem*, J. Funct. Anal., 170 (2000), 93–106.
- [Dya3] ——— *Continuous and compact embeddings between star-invariant subspaces*, pp. 65–76 in: Operator Theory: Adv. and Appl., 113 (The S.A. Vinogradov Memorial Volume), Basel, Birkhäuser, 2000.
- [Dym1] H. DYM, *J contractive matrix functions, reproducing kernel Hilbert spaces and interpolation*, Amer. Math. Soc., Providence, R.I., 1989.
- [Dym2] ——— *Book review: The commutant lifting approach to interpolation problems*, by C. Foias and A. Frazho [FF], Bull. Amer. Math. Soc., 31:1 (1994), 125–140.
- [Dym3] ——— *A Basic Interpolation Problem*, pp. 381–424 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy, and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [DyMc] H. DYM AND H.P. MCKEAN, *Gaussian processes, function theory and the inverse spectral problem*, NY, Academic Press, 1976.
- [Dyn1] E.M. DYN’KIN, *An operator calculus based on the Cauchy–Green formula, and quasianalyticity of the classes  $\mathcal{D}(h)$* , Zapiski Nauchnyh Seminarov LOMI, 19 (1970), 221–226 (Russian); English transl.: Seminars in Math., V.A.Steklov Math. Inst., Leningrad, vol. 19, 128–131, Consultant Bureau, N.Y.-London, 1972.
- [Dyn2] ——— *An operator calculus based on the Cauchy–Green formula*, Zapiski Nauchnyh Seminarov LOMI, 30 (1972), 33–39 (Russian); English transl.: J. Soviet Math., 4 (1975), no. 2 (1976) 329–334, Consultant Bureau, N.Y., 1976.
- [Dyn3] ——— *Methods of the Theory of Singular Integrals: Hilbert Transform and Calderon-Zygmund Theory*, pp. 197–292 in: Itogi Nauki i Techniki, Contemp. Problems Math. (Russian Math. Encyclopaedia), 15, VINITI, Moscow, 1987 (Russian); English transl.: Encyclopaedia of Math. Sci., vol. 15, 167–260, Berlin etc., Springer-Verlag, 1991.
- [Dyn4] ——— *The pseudoanalytic extension*, J. Analyse Math., 60 (1993), 45–70.
- [Dyn5] ——— *Inequalities for rational functions*, J. Approx. Theory, 91 (1997), 349–367.
- [DO] E.M. DYN’KIN AND B.P. OSILENKER, *Weighted estimates of singular integrals and their applications*, in Itogi Nauki i Techniki Ser. Math. Anal., vol. 21, 42–129, VINITI, Moscow, 1983 (Russian); English transl.: J. Soviet Math., 30 (1985), 2094–2154.
- [Ed.H] H.M. EDWARDS, *Riemann’s Zeta function*, Academic Press, New York, 1974.
- [Ed] R.E. EDWARDS, *Fourier series. A modern introduction*, vol. 1&2, Springer Verlag, Heidelberg, 1982.
- [EG] R.E. EDWARDS AND G.I. GAUDRY, *Littlewood–Paley and multiplier theory*, Berlin etc., Springer-Verlag, 1977.
- [Ehr] L. EHRENPREIS, *Fourier analysis in several variables*, Wiley-Interscience, New York, 1970.
- [Eid1] V.YA. EIDERMAN, *On a sum of values of a function of a certain class along a sequence of points*, Izvestia VUZ’ov. Matematika, 1 (1992), 89–97 (Russian); English transl.: Russ. Math., 36 (1992), no. 1, 87–95.
- [Eid2] ——— *Metric characteristics of exceptional sets and unicity theorems in function theory*, Steklov Math. Inst. St.Petersburg, 2nd Doctor Thesis, 1999, 192 pp.
- [EIR] O. EL-FALLAH AND T. RANSFORD, *Extremal growth of powers of operators satisfying conditions of Reiss-Ritt type*, Preprint, Univ. Laval, Québec, Canada, 2000.
- [ENZ] O. EL-FALLAH, N.K. NIKOLSKI AND M. ZARRABI, *Resolvent estimates in Beurling-Sobolev algebras*, Algebra i Analiz, 6 (1998), 1–80 (Russian); English transl.: St.Petersburg Math. J., 6 (1999), 1–69.
- [Enf] P. ENFLO, *A counterexample to the approximation property in Banach spaces*, Acta Math., 130 (1973), 309–317.
- [ESZ] J. ESTERLE, E. STROUSE, AND F. ZOUAKIA, *Stabilité asymptotique de certains semi-groupes d’opérateurs et idéaux primaires de  $L^1(\mathbb{R}^+)$* , J. Operator Theory, 28 (1992), 203–227.

- [EV] J. ESTERLE AND A. VOLBERG, *Sous-espaces invariants par translations bilatérales de certains espaces de Hilbert de suites de suites quasi-analytiquement pondérées*, C.R. Acad. Sci. Paris, Sér.I, 326 (1998), 295–300.
- [Ex] R. EXEL, *Hankel matrices over right ordered amenable groups*, Canad. Math. Bull., 33 (1990), no. 4, 404–415.
- [FP] L.D. FADDEEV AND B.S. PAVLOV, *Scattering theory and automorphic functions*, Zapiski Nauchn. Semin. LOMI 27 (1972), 161–193 (Russian); English transl.: J. Sov. Math., 3 (1975), 522–548.
- [Fa] P. FATOU, *Séries trigonométriques et séries de Taylor*, Acta Math., 30 (1906), 335–400.
- [FS] C. FEFFERMAN AND E.M. STEIN,  *$H^p$  spaces of several variables*, Acta Math., 129 (1972), no. 3–4, 137–193.
- [Fe] A. FEINTUCH, *Robust control theory in Hilbert spaces*, Ben-Gurion Univ. of the Negev, Lect. Notes, 1995.
- [GF] A.I. FELDMAN AND I. GOHBERG, see I. Gohberg and A.I. Feldman.
- [Fej] L. FEJÉR, *Ueber trigonometrische Polynome*, J. reine angew. Math., 146 (1916), 53–82.
- [Fer] S.H. FERGUSON, *Polynomially bounded operators and Ext groups*, Proc. Amer. Math. Soc., 124 (1996), no. 9, 2779–2785.
- [F] J.-P. FERRIER, *Spectral theory and complex analysis*, North-Holland, Amsterdam N.Y., 1973.
- [Fil] P.A. FILLMORE, *Notes on operator theory*, Van Nostrand Reinhold Co, N.Y. etc, 1970.
- [FLS] K.M. FLORENS, YU.I. LYUBARSKII AND K. SEIP, *A direct interpolation method for irregular sampling*, Preprint, Trondheim University, 2000.
- [Fo1] S.R. FOGUEL, *Normal operators of finite multiplicity*, Comm. Pure Appl. Math., 11 (1958), no. 3, 297–313.
- [Fo2] ———, *A counterexample to a problem of Sz.-Nagy*, Proc. Amer. Math. Soc., 15 (1964), 788–790.
- [Foi1] C. FOIAS, *Sur certains théorèmes de J. von Neumann concernant les ensembles spectraux*, Acta Sci. Math. Szeged, 18 (1957), 15–20.
- [Foi2] ———, *Unele aplicatii ale multimilor spectrale. I. Masura armonica-spectrala*, Studii si cercetari. mat. Acad. RPR, 10 (1959), no. 2, 365–401 (Rumanian).
- [Foi3] ———, *Some applications of structural models for operators on Hilbert spaces*, Actes Congrès Int. Math. (Nice, 1970), vol. 2, pp. 433–440, Gauthier-Villars, Paris, 1971.
- [Foi4] ———, *On the scalar parts of a decomposable operator*, Rev. Roumaine Math. Pures Appl., 17 (1972), 1181–1198.
- [FF] C. FOIAS AND A.E. FRAZHO, *The commutant lifting approach to interpolation problems*, Operator theory: Advances and applications, 44, Basel, Birkhäuser, 1990.
- [FFGK] C. FOIAS, A.E. FRAZHO, I. GOHBERG AND M.A. KAASHOEK, *Metric constrained interpolation, commutant lifting and systems interpolation*, Basel, Birkhäuser, 1998.
- [FW] C. FOIAS AND J. WILLIAMS, *On a class of polynomially bounded operators*, preprint circa 1980, unpublished.
- [FoS] Y. FOURÈS AND I.E. SEGAL, *Causality and analyticity*, Trans. Amer. Math. Soc., 78 (1955), 385–405.
- [Fr] B. FRANCIS, *A course in  $H^\infty$  control theory*. Lect. Notes CIS, 88, Springer-Verlag, 1987.
- [FR1] R. FRANKFURT AND J. ROVNYAK, *Finite convolution operators*, J. Funct. Analysis, 49 (1975), no. 2, 347–374.
- [FR2] ———, *Recent results and unsolved problems on finite convolution operators*, pp. 133–150 in: Linear spaces and approximation (eds. P. Butzer and B. Sz.-Nagy), ISNM vol. 40, Birkhäuser Verlag, Basel, 1978.
- [Fra] A.E. FRAZHO, *Models for noncommuting operators*, J. Funct. Anal., 48 (1982), 1–11.
- [Fri1] E. FRICAIN, *Uniqueness theorems for analytic vector valued functions*, Zapiski Nauchn. Semin. POMI, 247 (1997), 242–267; J. Soviet Math., 101 (2000), no. 3, 3193–3210.
- [Fri2] ———, *Propriétés géométriques des suites de noyaux reproduisants dans les espaces modèles*, Thèse, Bordeaux, 1999.
- [Fri3] ———, *Bases of reproducing kernels in model spaces*, J. Operator Theory, to appear.

- [Frie] K.O. FRIEDRICHS, *On certain inequalities and characteristic value problems for analytic functions and for functions of two variables*, Trans. Amer. Math. Soc., 41 (1937), 321–364.
- [Fro] O. FROSTMAN, *Potential d'équilibre et capacité des ensembles avec quelques applications à la théorie des fonctions*, Medd. Lunds Univ. Mat. Sem., 3 (1935), 1–118.
- [Fug] B. FUGLEDE, *A commutativity theorem for normal operators*, Proc. Amer. Math. Soc., 36 (1950), 35–40.
- [Fuh1] P.A. FUHRMANN, *On the corona theorem and its applications to spectral problems in Hilbert space*, Trans. Amer. Math. Soc., 132 (1968), 55–66.
- [Fuh2] ———, *Exact controllability and observability and realization theory in Hilbert space*, J. Math. Anal. Appl., 53 (1976), 377–392.
- [Fuh3] ———, *Linear systems and operators in Hilbert space*, McGraw Hill Int., NY, 1981.
- [Ful] W. FULTON, *Eigenvalues, invariant factors, highest weights, and Schubert calculus*, Bull. Amer. Math. Soc., 37:3 (2000), 209–249.
- [Gab] R.M. GABRIEL, *Some results concerning the integrals of moduli of regular functions along curves of certain types*, Proc. London Math. Soc., 28 (1928), 121–127.
- [Gai] D. GAIER, *Vorlesungen über Approximation im Komplexen*, Birkhäuser, 1980.
- [Gama1] M.F. GAMAL, *Weak generators of the measure algebra and unicellularity of convolution operators*, Zapiski Nauchn. Semin. POMI, 232 (1996), 73–85 (Russian); English transl.: J. Soviet Math., 92 (1998), no. 1.
- [Gama2] ———, *Invariant subspaces and generators of the commutant of a model operator*, Thesis, Steklov Inst. Math., St.Petersburg, 1997.
- [Gama3] ———, *Quasimilarity, pseudosimilarity, and lattices of invariant subspaces of weak contractions*, Abstracts of Tenth Summer St. Petersburg Meeting in Math. Analysis, p. 14, Euler Int. Math. Inst., August 2001.
- [Gam] T.W. GAMELIN, *Uniform Algebras*, Englewood Cliffs N.J., Prentice Hall, 1969.
- [Gan] F.R. GANTMACHER, *The theory of matrices*, 2nd edition, Moscow, Nauka, 1966 (Russian); English transl. of the 1st edition: N.Y., Chelsea, 1960.
- [GCRF] J. GARCIA-CUERVA AND J.L. RUBIO DE FRANCIA, *Weighted norm inequalities and related topics*, Math. Studies 116, North Holland, 1985.
- [Gar] J.B. GARNETT, *Bounded analytic functions*, Academic Press, New York, 1981.
- [GarN] J.B. GARNETT AND A. NICOLAU, *Interpolating Blaschke products generate  $H^\infty$* , Pacific J. Math., 173 (1996), no. 2, 501–510.
- [GHVid] E.M. GAVURINA, V.P. HAVIN [KHAVIN] AND I.V. VIDENSKII, *Analogs of the interpolation formula of Carleman–Krylov–Goluzin*, pp. 359–388 in: Operator Theory and Function Theory, 12, Leningrad Gosud. Universitet, Leningrad, 1983.
- [Gea] L. GEARHART, *Spectral theory for contraction semigroups on Hilbert space*, Trans. Amer. Math. Soc., 236 (1978), 385–394.
- [Gel1] I.M. GELFAND, *A problem*, Uspehi Matem. Nauk, 5 (1938), 233 (Russian).
- [Gel2] ———, *A remark on N.K. Bari's paper "Biorthogonal systems and bases in a Hilbert space"*, Uchenye Zapiski MGU (Moscow State Univ.), 4 (1951), no. 148, 224–225 (Russian).
- [GN] I.M. GELFAND AND M.A. NAIMARK, *On inclusion of a normed ring in the ring of operators on a Hilbert space*, Matem. Sbornik, 12 (1943), 197–213 (Russian); English transl. in: Gelfand I.M., *Collected papers. I.*, Springer-Verlag, 1987.
- [GRS] I.M. GELFAND, D.A. RAIKOV AND G.E. SHILOV, *Commutative normed rings*, Moscow, Fizmatgiz, 1960 (Russian); English transl.: NY, Chelsea 1964.
- [Geo] D. GEORGIJEVIC, *Bases orthogonales dans les espaces  $H^p(e)$  et  $H^p$* , C.R. Acad. Sci. Paris, Ser. A, 289 (1979), 73–74.
- [Gersh] S.A. GERSHGORIN, *Über die Abgrenzung der Eigenwerte einer Matrix*, Izvestia Acad. Sci. SSSR, Fiz.-Mat. (1931), 749–754.
- [GNPTV] A. GILLESPIE, F. NAZAROV, S. POTT, S. TREIL AND A. VOLBERG, *Logarithmic growth for weighted Hilbert transform and vector Hankel operators*, Preprint, Michigan State Univ., 1998; to appear in Algebra i Analiz (St.Petersburg Math. J.).
- [GiN] J.I. GINSBERG AND D.J. NEWMAN, *Generators of certain radical algebras*, J. Approx. Theory, 3 (1970), no. 3, 229–235.
- [GS] YU.P. GINZBURG AND L.V. SHEVCHUK, *On the Potapov theory of multiplicative representations*, pp. 28–47 in: Operator Theory: Adv. Appl., 72, Birkhäuser, Basel, 1994.



- [Goh1] I. GOHBERG, *On an application of the theory of normed rings to singular integral equations*, Uspehi Matem. Nauk, 7 (1952), no. 2, 149–156 (Russian).
- [GF] I. GOHBERG AND A.I. FELDMAN, *Convolution equations and projection methods for their solutions*, RIO of Moldavian Academy, Kishinev, and Nauka, Moscow, 1971 (Russian); English transl.: Amer. Math. Soc., Providence, R.I., 1974.
- [GGK] I. GOHBERG, S. GOLDBERG AND M.A. KAASHOEK, *Classes of linear operators*, Vol. I and II, Birkhäuser, Basel, 1990, 1993.
- [GK1] I. GOHBERG AND M.G. KREIN, *Introduction to the theory of linear non-selfadjoint operators on Hilbert space*, Nauka, Moscow, 1965 (Russian); English transl.: Amer. Math. Soc., Providence, R.I., 1969.
- [GK2] ———, *The theory of Volterra operators in Hilbert space and applications*, Nauka, Moscow, 1967 (Russian); English transl.: Amer. Math. Soc., Providence, R.I., 1970.
- [GK3] ———, *On a description of contractions similar to unitaries*, Funktsional. Analiz i Prilozhen., 1 (1967), no. 1, 38–60 (Russian).
- [GKru1] I. GOHBERG AND N.YA. KRUPNIK, *On the algebra generated by Toeplitz matrices*, Funktsional. Analiz i Prilozhen., 3 (1969), no. 2, 46–56 (Russian).
- [GKru2] ———, *One-dimensional linear singular integral equations*, “Shtiintsa”, Kishinev, 1973 (Russian); English transl.: Vol. I and II, Birkhäuser Verlag, Basel, 1992.
- [GM] I. GOHBERG AND A. MARKUS, *On certain inequalities between eigenvalues and matrix entries of linear operators*, Izvestia Acad. Sci. Mold. SSR, 5 (1962), 103–108 (Russian).
- [Go] G.M. GOLUZIN, *Geometric theory of functions of a complex variable*, Moscow, Nauka, 1966 (Russian); English transl.: Amer. Math. Soc., Providence, R.I., 1969.
- [GoK] G.M. GOLUZIN AND V.I. KRYLOV, *Generalized Carleman formula and its applications to analytic continuation of functions*, Matem. Sbornik, 40 (1933), no. 2, 144–149 (Russian).
- [Gon] A.A. GONCHAR, *Quasianalytic continuation of analytic functions across a Jordan arc*, Doklady Akad. Nauk SSSR, 166 (1966), 1028–1031 (Russian); English transl.: Soviet Math. Doklady, 7 (1966), 213–216.
- [GHVin] E.A. GORIN, S.V. HRUSCHEV [KHRUSCHEV] AND S.A. VINOGRADOV, *Interpolation in  $H^\infty$  along P. Jones’ lines*, Zapiski Nauchn. Semin. LOMI, 113 (1981), 212–214 (Russian); English transl.: J. Soviet Math., 22 (1983), 1838–1839.
- [GorK] E.A. GORIN AND M.I. KARAHANIAN, *An asymptotic version of the Fuglede-Putnam theorem for commutators of elements of a Banach algebra*, Matem. Zametki, 22 (1977), no. 2, 179–188 (Russian). English transl.: Soviet Math. Notes 22 (1977), no. 1–2, 591–596 (1978).
- [GMcG] C.C. GRAHAM AND O.C. MCGEHEE, *Essays in Commutative Harmonic Analysis*, New York – Heidelberg, Springer-Verlag, 1979.
- [GSz] U. GRENANDER AND G. SZEGÖ, *Toeplitz forms and their applications*, Univ. of California Press, Berkeley, 1958.
- [GrN] M.B. GRIBOV AND N.NIKOLSKI, *Invariant subspaces and rational approximation*, Zapiski Nauchnyh Semin. LOMI, 92 (1979), 103–114 (Russian).
- [Gri] L.D. GRIGORYAN, *Estimates of the norm of holomorphic components of meromorphic functions in domains with a smooth boundary*, Mat. Sbornik, 100(142):1 (1976), 156–164 (Russian); English transl.: Math. USSR Sbornik, 29 (1976).
- [Gr-E] K.-G. GROSSE-ERDMANN, *Universal families and hypercyclic operators*, Bull. Amer. Math. Soc., 36 (1999), no. 3, 345–381.
- [Gub1] G.M. GUBREEV, *Spectral analysis of biorthogonal expansions generated by Muckenhoupt weights*, Zapiski Nauchnyh Seminarov LOMI, 190 (1991), 34–80 (Russian); English transl.: J. Math. Sci. 71 (1994), no. 1, 2192–2221.
- [Gub2] ———, *Unconditional bases of Hilbert spaces composed of values of vector valued entire functions of exponential type*, Funkzion. Analiz i Prilozhen., 33 (1999), no. 1, 62–65 (Russian); English transl.: Funct. Anal. Appl. 33 (1999), no. 1, 52–55
- [GubO] G.M. GUBREEV AND E.I. OLEFIR, *Unconditional bases of certain families of functions, the matrix Muckenhoupt condition, and Carleson series in the spectrum*, Zapiski Nauchnyh Seminarov POMI (St.Petersburg), 262 (1999), 90–126 (Russian).
- [GuM] V.I. GURARIY AND M.A. MELITIDI, *Stability of completeness of sequences in Banach spaces*, Bull. Acad. Sci. Polon., ser. math., astron. et phys., 18:9 (1970), 533–536 (Russian).

- [GuV] V.I. GURARII AND V.I. MATSAEV [MACAEV], *Lacunary power sequences in spaces  $C$  and  $L^p$* , *Izvestia Akad. Nauk SSSR, Ser. Mat.*, 30 (1966), 3–14 (Russian).
- [Gur] V.P. GURARII, *Group theoretical methods in commutative harmonic analysis*, *Itogi Nauki i Techniki, Contemp. Problems Math. (Russian Math. Encyclopaedia)*, 25, VINITI, Moscow, 1988 (Russian); English transl.: *Encyclopaedia of Math. Sci.*, vol. 25, Berlin etc., Springer–Verlag, 1997.
- [Had] J. HADAMARD, *Leçons sur la propagation des ondes*, Hermann, Paris, 1903.
- [Hall] T. HALL, *Sur l'approximation polynômiale des fonctions d'une variable réelle*, pp. 367–369 in: IX-ème Congrès Math. Scand. (1938), Helsingfors, 1939.
- [Hal1] P. HALMOS, *Normal dilations and extensions of operators*, *Summa Brasil. Math.*, 2 (1960), 125–134.
- [Hal2] ———, *A Hilbert space problem book*, Springer–Verlag, Berlin etc., 1967.
- [Hal3] ———, *Ten problems in Hilbert space*, *Bull. Amer. Math. Soc.*, 76 (1970), 887–933.
- [Ham1] H. HAMBURGER, *Über eine Erweiterung des Stieltjesschen Momentproblems*, I, II, *Math. Ann.*, 81, 82 (1920, 1921).
- [Ham2] ———, *Über die Zerlegung des Hilbertschen Raumes durch vollstetige lineare Transformationen*, *Math. Nachr.*, 4 (1951), 56–69.
- [HaL1] G.H. HARDY AND J.E. LITTLEWOOD, *Some new properties of Fourier constants*, *Math. Ann.*, 97 (1926), 159–209.
- [HaL2] ———, *A new proof of a theorem on rearrangements*, *J. London Math. Soc.*, 23 (1948), 163–168.
- [HLP1] G.H. HARDY, J.E. LITTLEWOOD, AND G. POLYA, *Some simple inequalities satisfied by convex functions*, *Messenger of Math.*, 58 (1929), 145–152.
- [HLP2] ———, *Inequalities*, Cambridge, 1934.
- [HaWr] G.H. HARDY AND E.M. WRIGHT, *An introduction to the theory of numbers*, Fourth Ed., Clarendon Press, Oxford, 1962.
- [Har] P. HARTMAN, *On completely continuous Hankel matrices*, *Proc. Amer. Math. Soc.*, 9 (1958), 862–866.
- [HW1] P. HARTMAN AND A. WINTNER, *On the spectra of Toeplitz's matrices*, *Amer. J. Math.*, 72 (1950), 359–366.
- [HW2] ———, *The spectra of Toeplitz's matrices*, *Amer. J. Math.*, 76 (1954), 867–882.
- [Hart1] A. HARTMANN, *Une approche de l'interpolation libre généralisée par la théorie des opérateurs et caractérisation des traces  $H^p|_\Lambda$* , *J. Operator Theory*, 35 (1996), 281–316.
- [Hart2] ———, *Free interpolation in Hardy–Orlicz spaces*, *Studia Math.*, (2) 135 (1999), 179–190.
- [HSr] M. HASUMI AND T. SRINIVASAN, *Invariant subspaces of continuous functions*, *Canad. J. Math.*, 17 (1965), no. 4, 643–651.
- [Hau] F. HAUSDORFF, *Mengenlehre*, 3. Aufl. Berlin–Leipzig, W. de Gruyter, 1935.
- [Hav] V.P. HAVIN [KHAVIN], *Methods and structure of commutative harmonic analysis*, pp. 1–112 in: *Itogi Nauki i Techniki, Contemp. Problems Math. (Russian Math. Encyclopaedia)*, 15 (ed. N. Nikolski), VINITI, Moscow, 1987 (Russian); English transl.: *Encyclopaedia of Math. Sci.*, 15, Berlin etc., Springer–Verlag, 1991.
- [HJ] V.P. HAVIN [KHAVIN] AND B. JÖRNICKE, *The uncertainty principle in harmonic analysis*, Berlin etc., Springer–Verlag, 1974.
- [HN1] V.P. HAVIN [KHAVIN] AND N.K. NIKOLSKI, *V.I. Smirnov's results in complex analysis and their subsequent developments*, pp. 111–145 in: V.I. Smirnov, *Selected papers. Complex Analysis, Mathematical Diffraction Theory*, Leningrad State Univ. Publishers, 1988 (Russian).
- [HN2] V.P. HAVIN [KHAVIN] AND N.K. NIKOLSKI, *Stanislav Aleksandrovich Vinogradov, his life and mathematics*, pp. 1–18 in: *Complex Analysis, operator theory, and related topics: S.A. Vinogradov — In Memoriam* (eds. V. Havin and N. Nikolski) *Operator Theory: Adv. and Appl.*, Basel, Birkhäuser–Verlag, 2000.
- [HVin] V.P. HAVIN [KHAVIN] AND S.A. VINOGRADOV, *Free interpolation in  $H^\infty$  and in some other function classes, I and II*, *Zapiski Nauchn. Semin. LOMI*, 47 (1974), 15–54, 56 (1976), 12–58 (Russian); English transl.: *J. Soviet Math.*, 9 (1978), 137–171, 14 (1980), 1027–1065.

- [HWo] V.P. HAVIN [KHAVIN] AND H. WOLF, *Poisson kernel is the only approximative identity asymptotically multiplicative on  $H^\infty$* , Zapiski Nauchn. Seminarov LOMI, 170 (1989), 82–89 (Russian).
- [Hay] E. HAYASHI, *The kernel of a Toeplitz operator*, Integral Eq. Oper. Theory, 9 (1986), 588–591.
- [Ha] W.K. HAYMAN, *Identity theorems for functions of bounded characteristic*, J. London Math. Soc., (2) 58 (1998), 127–140.
- [HKZ] H. HEDENMALM, B. KORENBLUM AND K. ZHU, *Theory of Bergman spaces*, N.-Y.-Heidelberg, etc., Springer-Verlag, 2000.
- [HeV] H. HEDENMALM, A. VOLBERG, *Zero-free invariant subspaces in weighted Bergman spaces with critical topology*, manuscript, 1996.
- [Hei] E. HEINZ, *Ein v. Neumannscher Satz über beschränkte Operatoren im Hilbertschen Raum*, Göttinger Nachr. (1952), 5–6.
- [Hel] H. HELSON, *Lectures on invariant subspaces*, N.Y., Academic Press, 1964.
- [HL1] H. HELSON AND D. LOWDENSLAGER, *Invariant subspaces*, pp. 251–262 in: Proc. Intern. Symp. Linear Spaces, Jerusalem, Pergamon Press, Oxford, 1961.
- [HL2] ———, *Prediction theory and Fourier series in several variables, II*, Acta Math., 106 (1961), 175–213.
- [HSa] H. HELSON AND D. SARASON, *Past and future*, Math. Scand., 21 (1967), 5–16.
- [HS] H. HELSÓN AND G. SZEGÖ, *A problem of prediction theory*, Ann. Mat. Pur. Appl., 51 (1960), 107–138.
- [Helt1] J.W. HELTON, *Discrete time systems, operator models and scattering theory*, J. Funct. Anal., 16 (1974), 15–38.
- [Helt2] ———, *Operator theory, analytic functions, matrices and electrical engineering*, CBMS conf. series in Math., 68, AMS, Providence, RI, 1987.
- [HM] J.W. HELTON AND O. MERINO, *Classical control using  $H^\infty$  methods*, Univ. of California, San Diego, 1994.
- [Her] G. HERGLOTZ, *Über Potenzreihen mit positiven reellen Teil im Einheitskreise*, Berichte Verh. Kgl.-sächs. Gesellsch. Wiss. Leipzig, Math.-Phys. Klasse, 63 (1911), 501–511.
- [Herr1] D.A. HERRERO, *On multicyclic operators*, Integral Equat. and Operator Theory, 1 (1978), 57–102.
- [Herr2] ———, *Approximation of Hilbert space operators*, Vol.I, Res. Notes Math. 72, Pitman, Boston, 1982.
- [HerrMcD] D.A. HERRERO AND J. MC DONALD, *On multicyclic operators and the Vasyunin–Nikolski discalgebra*, Integral Equat. and Operator Theory, 6 (1983), 206–223.
- [HTW] D.A. HERRERO, TH.J. TAYLOR, AND Z.Y. WANG, *Variation of the point spectrum under compact perturbations*, pp. 113–158 in: Operator Theory: Adv. and Appl. 32, Birkhäuser-Verlag, Basel, 1988.
- [Hig1] J.R. HIGGINS, *Completeness and basis properties of sets of special functions*, Cambridge Univ. Press, Cambridge, 1977.
- [Hig2] ———, *Five short stories about the cardinal series*, Bull. Amer. Math. Soc., 12 (1985), 45–89.
- [Hil1] D. HILBERT, *Grundzüge einer allgemeinen Theorie der linearen Integralgleichungen*, I–VI, Nachr. Akad. Wiss. Göttingen, Math.-Phys. Kl., (1904), 49–91; (1905), 213–259; (1905), 307–338; (1906), 157–227; (1906), 439–480; (1910), 355–417.
- [Hil2] ———, *Grundzüge einer allgemeinen Theorie der linearen Integralgleichungen*, Leipzig, 1912.
- [HPh] E. HILLE AND R.S. PHILLIPS, *Functional analysis and semi-groups*, Amer. Math. Soc. Coll. Publ. 31, Providence, 1957.
- [HT] E. HILLE AND J.D. TAMARKIN, *On the absolute integrability of Fourier transforms*, Fund. Math., 25 (1935), 329–352.
- [Hir] R.A. HIRSCHFELD, *On polynomials in several Hilbert space operators*, Math. Zeit., 127 (1972), 224–234.
- [Hi] D. HITT, *Invariant subspaces of  $H^2$  of the annulus*, Pacific J. Math., 134 (1988), 101–120.
- [Hof] K. HOFFMAN, *Banach spaces of analytic functions*, Prentice-Hall, Englewood Cliffs, N.J., 1962.

- [Hol] J.A. HOLBROOK, *Spectral variation of normal matrices*, Linear Alg. Appl., 174 (1992), 131–141.
- [WH] E. HOPF AND N. WIENER, *see* N. Wiener and E. Hopf.
- [Hör1] L. HÖRMANDER, *Estimates for translation invariant operators in  $L^p$  spaces*, Acta Math., 104 (1960), 93–140.
- [Hör2] ——— *The analysis of partial differential operators*, vol. 1 and 2, Springer–Verlag, Heidelberg, 1983.
- [HoJ] R.A. HORN AND C.R. JOHNSON, *Topics in matrix analysis*, Cambridge Univ. Press, NY, 1990.
- [How1] J.S. HOWLAND, *Trace class Hankel operators*, Quart. J. Math., Oxford, (2) 22 (1971), 147–159.
- [How2] ——— *On a theorem of Gearhart*, Integral Equations and Operator Theory, 7 (1984), 138–142.
- [How3] ——— *Spectral theory of operators of Hankel type, I.*, Indiana Univ. Math. J., 41 (1992), no. 2, 409–426.
- [How4] ——— *Spectral theory of operators of Hankel type, II.*, Indiana Univ. Math. J., 41 (1992), no. 2, 427–434.
- [Hr] S.V. HRUSCHEV [KHRUSCHEV], *Perturbation theorems for bases of exponentials and the Muckenhoupt condition*, Doklady Akad. Nauk SSSR, 247 (1979), no. 1, 44–48 (Russian); English transl.: Soviet Math. Dokl., 20 (1979), no. 4, 665–669.
- [HrN] S.V. HRUSCHEV [KHRUSCHEV] AND N.K. NIKOLSKI, *A function model and some problems in the spectral theory of functions*, Trudy Mat. Inst. Steklova, 176 (1987), 97–210 (Russian); English transl.: Proc. Steklov Inst. Math. (1988), no. 3, 101–214.
- [HP1] S.V. HRUSCHEV [KHRUSCHEV] AND V.V. PELLER, *Hankel operators, best approximations and stationary Gaussian processes*, Uspehi Mat. Nauk, 37 (1982), no. 1, 53–124 (Russian); English transl.: Russian Math. Surveys, 37 (1982), no. 1, 61–144.
- [HP2] ——— *Moduli of Hankel operators, past and future*, pp. 92–97 in: Linear and Complex analysis problem book. 199 research problems (eds. V. Havin, S. Hruschev and N. Nikolski), Lect. Notes Math. 1043, Springer–Verlag, Berlin, 1984.
- [HP3] ——— *Hankel operators of Schatten-von Neumann class and their applications to stationary processes and best approximations*, published as Appendix 5 in N. Nikolski [N19].
- [HV] S.V. HRUSCHEV AND S.A. VINOGRADOV, *Free Interpolation in the Space of Uniformly Convergent Taylor Series*, Lect. Notes Math., 864 (1981), 171–213.
- [HNP] S.V. HRUSCHEV, N. NIKOLSKI AND B.S. PAVLOV, *Unconditional bases of exponentials and reproducing kernels*, Lect. Notes Math., 864 (1981), 214–335.
- [HMW] R. HUNT, B. MUCKENHOUT AND R.L. WHEEDEN, *Weighted norm inequalities for the conjugate function and Hilbert transform*, Trans. Amer. Math. Soc., 176 (1973), 227–251.
- [HY] YA.I. HURGIN [KHURGIN] AND V.P. YAKOVLEV, *Compactly supported functions in physics and engineering*, Nauka, Moscow, 1971 (Russian).
- [IR] I.A. IBRAGIMOV AND YU.A. ROZANOV, *Gaussian stochastic processes*, Moscow, Nauka, 1970 (Russian); English transl.: N.Y.–Heidelberg etc., Springer–Verlag, 1978.
- [In] A.E. INGHAM, *A note on Fourier transforms*, J. London Math. Soc., 9 (1934), 29–32.
- [Io] I.S. IOKHVIDOV, *Hankel and Toeplitz matrices and forms. Algebraic theory*, Moscow, Nauka, 1974 (Russian); English transl.: Birkhuser, Boston, Mass., 1982.
- [IK] SH.-I. IZUMI AND T. KAWATA, *Quasi-analytic class and closure of  $\{t^n\}$  in the interval  $(-\infty, \infty)$* , Tôhoku Math. J., 43 (1937), 267–273.
- [IP] S.A. IVANOV AND B.S. PAVLOV, *Vector valued systems of exponentials and zeros of entire matrix functions*, Vestnik Leningrad University, 1980, no. 1, 25–31 (Russian); English transl.: Vestn. Leningr. Univ. Math., 13 (1981), 31–38.
- [JaPa] B. JACOB AND J.R. PARTINGTON, *The Weiss conjecture on admissibility of observation operators for contraction semigroups*, Preprint, 2000.
- [JPR] S. JANSON, J. PEETRE, AND R. ROCHBERG, *Hankel forms and the Fock space*, Revista Mat. Iberoamer., 3 (1987), 61–138.
- [J1] P. JONES, *Extension theorems for BMO*, Indiana Univ. Math. J., 29 (1979), 41–66.
- [J2] ———  *$L^\infty$  estimates for the  $\bar{\partial}$ -problem in a half-plane*, Acta Math., 150 (1980), 137–152.

- [J3] ——— *Ratios of interpolating Blaschke products*, Pacific J. Math., 95 (1981), no. 2, 311–321.
- [JZ] V.I. JUDOVICH AND V.P. ZAKHARYUTA, *The general form of a linear functional in  $H_p'$* , Uspekhi Matem. Nauk, 19 (1964), no. 2, 139–142 (Russian).
- [Ju] G. JULIA, *Sur la représentation analytique des opérateurs bornés ou fermés de l'espace hilbertien*, C.R. Acad. Sci. Paris, 219 (1944), 225–227.
- [Kac.I] I.S. KAC, *Inclusion of Hamburger's power moment problem in the spectral theory of the canonical systems*, Zapiski Nauchn. Semin. POMI (Steklov Math. Inst., St.Petersburg), vol.262 (1999), 147–171 (Russian).
- [Kac.IKr] I.S. KAC AND M.G. KREIN, *On spectral functions of strings*, in: Appendix 2 to the Russian translation of the book F. Atkinson [At], pp. 648–737 (Russian), Izdat. Mir, Moscow, 1968.
- [Kac] M. KAC, *Can one hear the shape of a drum?*, Amer. Math. Monthly, 73 (1966), no. 4, part II, 1–24.
- [KSt] S. KACZMARZ AND H. STEINHAUS, *Theorie der Orthogonalreihen*, Monografje matematyczne, Warszawa–Lwow, 1935.
- [Kad] M.I. KADEC [KADETS], *The exact value of the Paley–Wiener constant*, Doklady Akad. Nauk SSSR, 155 (1964), no. 6, 1253–1254 (Russian); English transl.: Soviet Math. Doklady, 5 (1964), no. 2, 559–561.
- [Kah1] J.-P. KAHANE, *Lectures on mean periodic functions*, Tata Institute Fund. Research, Bombay, 1959.
- [Kah2] ——— *Séries de Fourier absolument convergentes*, Springer–Verlag, Berlin, etc., 1970.
- [Kah3] ——— *Travaux de Beurling et Malliavin*, Séminaire Bourbaki, 7 (1995), no. 225, 27–39.
- [Kai] T. KAILATH, *Linear Systems*, Prentice Hall, 1980.
- [Kal] G.K. KALISCH, *A functional analysis proof of Titchmarsh's theorem on convolution*, J. Math. Anal. and Appl., 5 (1962), no. 2, 176–183.
- [KFA] R.E. KALMAN, P.L. FALB, AND M.A. ARBIB, *Topics in mathematical system theory*, McGraw–Hill, 1969.
- [KanA] L.V. KANTOROVICH AND G.P. AKILOV, *Functional analysis*, 2nd edition, Nauka, Moscow, 1977 (Russian); English trans.: Pergamon Press, Oxford–Elmsford, N.Y., 1982.
- [Kap1] V.V. KAPUSTIN, *Reflexivity of operators: general methods and a criterion for almost isometric contractions*. Algebra i Analiz, 4 (1992), no. 2, 141–160 (Russian); English transl.: St.Petersburg Math. J., 4 (1993), no. 2.
- [Kap2] ——— *Function calculus for almost isometric operators*, Zapiski Nauchn. Seminarov POMI, 217 (1994), 59–73 (Russian); English transl.: J. Soviet Math.
- [KLi1] V.V. KAPUSTIN AND A.V. LIPIN, *Operator algebras and lattices of invariant subspaces. I*, Zapiski Nauchn. Seminarov LOMI (Leningrad), 178 (1989), 23–56 (Russian); English transl.: J. Soviet Math., 61 (1992), no. 2, 1963–1981.
- [KLi2] ——— *Operator algebras and lattices of invariant subspaces. II*, Zapiski Nauchn. Seminarov LOMI (Leningrad), 190 (1991), 110–147 (Russian); English transl.: J. Math. Sci., 71 (1994), no. 1, 2240–2262.
- [KasS] B.S. KASHIN AND A.A. SAAKYAN, *Orthogonal series*, “Nauka”, Moscow, 1984 (Russian).
- [Kat] T. KATO, *Perturbation theory for linear operators*, Springer–Verlag, Berlin etc., 1966.
- [KKY] V.E. KATSNEL'SON [KACNEL'SON], A.Y. KHEIFETS AND P.M. YUDITSKII, *An abstract interpolation problem and the theory of extensions of isometric operators*, pp. 83–96 in: Operators in function spaces and problems in function theory, ed. V.A. Marchenko, Kiev, Naukova Dumka, 1987 (Russian); English transl.: Topics in interpolation theory, ed. H. Dym et al., Oper. Theory Adv. Appl. 95, Basel, Birkhäuser, 1997, pp. 283–298.
- [KM] V.E. KATSNEL'SON [KACNEL'SON] AND V.I. MATSAEV [MACAEV], *Spectral sets for operators in a Banach space and estimates of functions of finite-dimensional operators*, Teoria Funckcii, Funkcional. Analiz i Prilozhenia (Kharkov), 1966, no. 3, 3–10 (Russian).
- [Ka] Y. KATZNELSON, *An introduction to Harmonic Analysis*, New York, Dover, 1976.
- [KaTz] Y. KATZNELSON AND L. TZAFRIRI, *On power bounded operators*, J. Funct. Anal., 68 (1986), 313–328.
- [Ke] M.V. KELDYSH, *Sur l'approximation en moyenne par polynômes des fonctions d'une variable complexe*, Matem. Sbornik, 16 (58) (1945), 1–20.

- [KZ] K. KELLAY AND M. ZARRABI, *Normality, non-quasianalyticity and invariant subspaces*, J. Operator Theory, to appear.
- [KLS] D. KHAVINSON, T.L. LANCE, AND M.I. STESSIN, *Wandering property in the Hardy space*, Mich. Math. J., 44 (1997), no. 3, 597–606.
- [Kha1] S.YA. KHAVINSON [S.JA. HAVINSON], *Extremum problems for functions satisfying supplementary restrictions inside the region and an application to problems of approximation*, Doklady Akad. Nauk SSSR, 135 (1960), 29–32 (Russian); English transl.: Soviet Math. Dokl., 1 (1960), 1263–1266.
- [Kha2] ——— *Some approximation theorems involving the magnitude of the coefficients of the approximating functions*, Doklady Akad. Nauk SSSR, 196:6 (1971) (Russian); English transl.: Soviet Math. Dokl., 12:1 (1971), 366–370.
- [Kha3] ——— *On complete systems in Banach spaces*, Izvestia Akad. Nauk Armen. SSR, Mat., 20 (1985), no. 2, 89–110 (Russian).
- [Kh] A. KHEIFETS, *The Abstarct Interpolation Problem and applications*, pp. 351–380 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy, and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Kis1] S.V. KISLYAKOV, *On projections onto the set of Hankel matrices*, Zapiski Nauchnyh Sem. LOMI (Steklov Inst., Leningrad), 126 (1983), 109–116 (Russian); English transl.: J. Soviet Math., 27 (1984), 2495–2500.
- [Kis2] ——— *Classical themes of Fourier analysis*, in Itogi Nauki i Techniki, Contemp. Problems Math. (Russian Math. Encyclopaedia), vol. 15 (eds. V. Khavin and N. Nikolski), 135–196, VINITI, Moscow, 1987 (Russian); English transl.: Encyclopaedia of Math. Sci., vol. 15, 113–166, Springer–Verlag, Berlin etc., 1991.
- [Kis3] ——— *Exceptional sets in harmonic analysis*, pp. 199–227 in: Itogi Nauki i Techniki, Contemp. Problems Math. (Russian Math. Encyclopaedia), 42 (eds. V. Khavin and N. Nikolski), VINITI, Moscow, 1989 (Russian); English transl.: Encyclopaedia of Math. Sci., vol. 42, 195–222, Berlin etc., Springer–Verlag, 1992.
- [Kle] I. KLEMEŠ, *Finite Toeplitz matrices and sharp Littlewood conjectures*, Algebra i Analiz, 13:1 (2001), 39–59 (Reprinted in: St. Petersburg Math. J., 13:1 (2002)).
- [K1] A.N. KOLMOGOROV, *Sur les fonctions harmoniques conjuguées et les séries de Fourier*, Fund. Math., 7 (1925), 24–29.
- [K2] ——— *Stationary sequences in Hilbert space*, Bull. Moscow Univ. Math. 2 (1941), no. 6, 1–40 (Russian).
- [K3] ——— *Une série de Fourier-Lebesgue divergente presque partout*, Fundamenta Math., 4 (1923), 324–338.
- [K4] ——— *Une série de Fourier-Lebesgue divergente partout*, C.R. Acad. Sci. Paris, 183 (1926), 1327–1329.
- [Kö] H. KÖNIG, *Eigenvalue distribution of compact operators*, Oper. Theory: Adv. and Appl. 16, Birkhäuser-Verlag, Basel, 1986.
- [Kon] S.V. KONYAGIN, *On the Littlewood problem*, Izvestia Akad. Nauk SSSR, ser. mat., 45:2 (1981), 243–265.
- [Ko1] P. KOOSIS, *Interior compact spaces of functions on a half-line*, Comm. Pure Appl. Math., 10 (1957), no. 4, 583–615.
- [Ko2] ——— *L'approximation pondérée par des polynômes et par des sommes exponentielles imaginaires*, Ann. Sci. Ecole Norm. Sup., 81 (1964), no. 4, 387–408.
- [Ko3] ——— *Moyennes quadratiques pondérées de fonctions périodiques et de leur conjuguées harmoniques*, C.R. Acad. Sci. Paris, Ser. A, 291 (1980), 255–257.
- [Ko4] ——— *Introduction to  $H^p$  spaces*, Cambridge Univ. Press, Cambridge etc., 1980.
- [Ko5] ——— *The logarithmic integral, Vol.I&II*, Cambridge Univ. Press, 1988,1992.
- [Ko6] ——— *Leçons sur le théorème de Beurling et Malliavin*, Les Publications CRM, Montréal, 1996.
- [Ko7] ——— *Carleson's interpolation theorem deduced from a result of Pick*, pp. 151–162 in: Complex analysis, operators, and related topics, Operator Theory: Adv. Appl., 113, Birkhauser, Basel, 2000.
- [SzK\*] A. KORANYI AND B. SZÖKEFALVI-NAGY, see B. Szökefalvi-Nagy and A. Koranyi.
- [Kor1] B. KORENBLUM, *Closed ideals of the ring  $A^n$* , Functional Analysis and its applications, 6 (1972), no. 3, 38–52.
- [Kor2] ——— *A Beurling type theorem*, Acta Math., 138 (1977), 265–293.

- [Kor3] ——— *Cyclic vectors in some spaces of analytic functions*, Bull. Amer. Math. Soc., 5 (1981), 317–318.
- [Kore] J. KOREVAAR, *Zero distribution of entire functions and spanning radius for a set of complex exponentials*, pp. 293–312 in: Aspects of contemporary complex analysis (Proc. NATO Adv. Study Inst., Univ. Durham, Durham, 1979), Academic Press, London–New York, 1980.
- [Kot] V.A. KOTELNIKOV, *Conducting capacity of the “ether” and a wire in electrical communications*, in: Vsesojuznyi Energeticheskii Komitet, Materials to the First All-Union Congress on Problems of the Technical Reconstruction of Communications and Developments of the Weak Current Engineering. Izdat. of the Communication Administration of RKKA, Moscow, 1933 (Russian).
- [KT] G. KÖTHE UND O. TOEPLITZ, *Lineare Räume mit unendlich vielen Koordinaten und Ringe unendlicher Matrizen*, J. Reine Angew. Math., 171 (1934), 251–270.
- [KP] I.V. KOVALISHINA AND V.P. POTAPOV, *An indefinite metric in the Nevanlinna–Pick problem*, Doklady AN Armyan. SSR, 59 (1974), 17–22 (Russian).
- [Kra1] I.F. KRASICHKOV-TERNOVSKII, *An interpretation of the Beurling–Malliavin theorem on the radius of completeness*, Matem. Sbornik, 180 (1989), no. 3, 397–423 (Russian); English transl.: Math. USSR Sbornik, 66 (1990), no. 2, 405–429.
- [LKMV] N. KRAVITSKY, M.S. LIVSHIC, A.S. MARKUS AND V. VINNIKOV, see M.S. Livshic, N. Kravitsky, A.S. Markus and V. Vinnikov.
- [Kr1] M.G. KREIN, *On a generalization of some investigations of G. Szegő, V. Smirnov and A. Kolmogorov*, Doklady Akad. Nauk SSSR, 46 (1945), no. 3, 95–98 (Russian).
- [Kr2] ———, *On a generalization of investigations of Stieltjes*, Doklady Akad. Nauk SSSR, 87:6 (1952), 881–884 (Russian).
- [Kr3] ——— *The theory of self-adjoint extensions of semi-bounded Hermitian operators and applications, I&II*, Mat. Sbornik, 20 (1947), 431–495; 21 (1947), 365–404.
- [Kr4] ——— *Integral equations on a half-line with kernel depending upon the difference of the arguments*, Uspehi Matem. Nauk, 13 (1958), no. 5, 3–120 (Russian); English transl.: Amer. Math. Soc. Transl., (2) 22 (1962), 163–288.
- [Kr5] ——— *Introduction to the geometry of indefinite  $J$ -spaces and to the theory of operators in those spaces*, pp. 15–92 in: Vtoraia Letniaya Matematicheskaiia Shkola, Part I, Kiev, Naukova Dumka, 1965 (Russian); English transl.: Amer. Math. Soc. Transl., (2) 93 (1970), 103–176.
- [Kr6] ——— *Analytical problems and results in theory of linear operators on a Hilbert space*, pp. 189–216 in: Proc. Int. Math. Congress 1966, Moscow, Mir, 1968 (Russian).
- [KN] M.G. KREIN AND A.A. NUDEL'MAN, *The Markov moment problem and extremal problems*, Moscow, Nauka, 1973 (Russian); English transl.: Transl. Math. Monographs, Vol. 50, Amer. Math. Soc., Providence, R.I., 1977.
- [KR] M.G. KREIN AND P.G. REHTMAN, *On the problem of Nevanlinna–Pick*, Trudi Odes'kogo Derzh. Univ. Mat., 2 (1938), 63–68 (Russian).
- [KPS] S.G. KREIN, YU.I. PETUNIN AND E.M. SEMENOV, *Interpolation of linear operators*, Moscow, Nauka, 1978 (Russian); English transl.: Amer. Math. Soc. Providence, RI, 1982.
- [Kre] H.-O. KREISS, *Über die Stabilitätsdefinition für Differenzgleichungen die partielle Differentialgleichungen approximieren*, Nord. Tidskr. Inf. (BIT), 2 (1962), 153–181.
- [Kri1] T.L. KRIETE, *Complete non-selfadjointness of almost selfadjoint operators*, Pacific J. Math., 42 (1972), 413–437.
- [Kri2] ——— *Splitting and boundary behavior in certain  $H^2$  spaces*, pp. 80–86 in: Linear and Complex Analysis problem Book 3, vol. II, eds. V.P. Havin and N.K. Nikolski, Lect. Notes Math., 1574 (1994).
- [Kro] L. KRONECKER, *Zur Theorie der Elimination einer Variablen aus zwei algebraischen Gleichungen*, Königl. Preuss. Akad. Wiss. (Berlin) (1881), 535–600; see also pp. 113–192 in: Leopold Kronecker's Werke II, Chelsea Publishing Co., New York 1968.
- [Kru] N.YA. KRUPNIK, *Banach algebras with symbol and singular integral operators*, Shtiintsa, Kishinev, 1984 (Russian); English transl.: Birkhäuser–Verlag, Basel, 1987.
- [Kry] V.I. KRYLOV, *On functions regular in a half-plane*, Matem. Sbornik, 6 (48) (1939), 95–138 (Russian); English transl.: Amer. Math. Soc. Transl. (2) 32 (1963), 37–81.

- [Kup] S. KUPIN, *Linear resolvent growth test for similarity of a weak contraction to a normal operator*, Arkiv Math., to appear.
- [KuT] S. KUPIN AND S. TREIL, *Linear resolvent growth of a weak contraction does not imply its similarity to a normal operator*, Illinois J. Math., to appear.
- [Ku] S.T. KURODA, *On a theorem of Weyl-von Neumann*, Proc. Japan Acad. 34 (1958), 11–15.
- [LTh] M. LACEY AND C. THIELE,  *$L^p$  estimates on the bilinear Hilbert transform*, Proc. Nat. Acad. Sci. USA, 94 (1997), no. 1, 33–35.
- [Lar] R. LARSEN, *An introduction to the theory of multipliers*, Springer-Verlag, N.Y.–Heidelberg, 1971.
- [Lav] M.A. LAVRENTIEV, *Towards the theory of conformal mappings*, pp. 129–245, in Proc. Fiz.-Mat. Steklov Institute, Mathematics, vol V (1934), Izd. Akad. Nauk SSSR.
- [Lax1] P.D. LAX, *Remarks on the preceding paper*, Comm. Pure Appl. Math., 10 (1957), no. 4, 617–622.
- [Lax2] ———, *Translation invariant spaces*, Acta Math., 101 (1959), 163–178.
- [LPh1] P.D. LAX AND R.S. PHILLIPS, *Scattering theory*, AP, N.Y.–London, 1967.
- [LPh2] ———, *Scattering theory for automorphic functions*, Princeton Univ. Press, Princeton, N.J., 1976.
- [LM] N.A. LEBEDEV AND I.M. MILIN, *On an inequality*, Vestnik Leningrad. Universiteta, Ser. mat., meh., astron., 19 (1965), no. 4, 157–158 (Russian).
- [Leb] A. LEBOW, *On von Neumann's theory of spectral sets*, J. Math. Anal. and Appl., 7 (1963), no. 1, 64–90.
- [Leg] R. LEGGETT, *On the invariant subspace structure of compact dissipative operators*, Indiana Univ. Math. J., 22 (1973), no. 10, 919–928.
- [Leh] O. LEHTO, *On the first boundary value problem for functions harmonic in the unit circle*, Ann. Acad. Sci. Fenn., Ser. AI, 210 (1955), 1–26.
- [Leo1] A.F. LEONTIEV, *Exponential series*, Nauka, Moscow, 1976 (Russian).
- [Leo2] ———, *Sequences of polynomials of exponentials*, Nauka, Moscow, 1980 (Russian).
- [Le1] B.JA. LEVIN, *Distribution of zeros of entire functions*, Moscow, GITTL, 1956 (Russian); English transl.: Providence, RI, Amer. Math. Soc., 1980.
- [Le2] ———, *On bases of exponentials in  $L^2$* , Zapiski Mat. Otdel. Fiz.-Mat. Fac. Harkov Univ. and Harkov Mat. Obschestva, Ser. 4, 27 (1961), 39–48 (Russian).
- [LeN] N. LEVINSON, *Gap and density theorems*, Amer. Math. Soc. Coll. Publ., XXVI, 1940.
- [Lew] S. LEWIN, *Über einige mit der Konvergenz im Mittel verbundenen Eigenschaften von Funktionalfolgen*, Math. Zeitschr., 32 (1930), no. 4.
- [LinR] P. LIN AND R. ROCHBERG, *The essential norm of Hankel operator on the Bergman space* Integral Equations Operator Theory 17 (1993), no. 3, 361–372.
- [Lin] V.YA. LIN, *Holomorphic fiberings and multivalued functions of elements of a Banach algebra*, Funkt. Analiz i Prilozh., 7 (1973), no. 2, 43–51; English transl.: Funct. Anal. Appl. 7 (1973), 122–128.
- [Lind] E. LINDELÖF, *Sur un principe général de l'analyse et ces applications à la théorie de la représentation conforme*, Acta Soc. Sci. Fenn., 46:4 (1915).
- [LT] J. LINDENSTRAUSS AND L. TZAFRIRI, *Classical Banach spaces, vol. I&II*, Springer-Verlag, Berlin etc., 1977, 1979.
- [Lio] J.-L. LIONS, *Optimal control of systems described by partial differential equations*, Springer-Verlag, Heidelberg, 1971.
- [LiP] J.-L. LIONS AND J. PEETRE, *Sur une classe d'espaces d'interpolation*, Inst. Hautes Etudes Sci. Publ. Math., 19 (1964), 5–68.
- [Lit] J.E. LITTLEWOOD, *On inequalities in the theory of functions*, Proc. London Math. Soc., 23 (1925), 481–519.
- [LS] G.S. LITVINCHUK AND I. SPITKOVSKY, *Factorization of measurable matrix functions*, Berlin, Akademie-Verlag, and Basel, Birkhäuser-Verlag, 1987.
- [Liv1] M.S. LIVSHIC, *On an application of the theory of Hermitian operators to the generalized moment problem*, Dokl. AN SSSR, 44 (1944) (Russian).
- [Liv2] ———, *On a class of linear operators on Hilbert space*, Matem. Sbornik, 19 (1946), 239–260 (Russian).



- [Liv3] ——— *Operators, Oscillations, Waves. Open Systems*, Nauka, Moscow, 1966 (Russian); English transl.: Transl. Math. Monographs 34, Amer. Math. Soc., Providence, 1973.
- [LKMV] M.S. LIVSHIC, N. KRAVITSKY, A.S. MARKUS AND V. VINNIKOV, *Theory of commuting nonselfadjoint operators*, Kluwer Publ., Dordrecht, 1995.
- [LNS] A.I. LOGINOV, M.A. NAIMARK AND V.S. SHULMAN, *Nonselfadjoint operator algebras on a Hilbert space*, Itogi Nauki, VINITI, Moscow, Math. Anal. 12 (1974), 413–465 (Russian); Engl. transl.: J. Soviet. Math., 5 (1976), 250–278.
- [Lor] E.R. LORCH, *Bicontinuous linear transformations in certain vector spaces*, Bull. Amer. Math. Soc., 45 (1939), 564–569.
- [Low] D. LOWDENSLAGER, *On factoring matrix valued functions*, Ann. of Math., (2) 78 (1963), 450–454.
- [Lu] D.H. LUECKING, *Characterizations of certain classes of Hankel operators on the Bergman space of the unit disk*, J. Funct. Anal., 110 (1992), no. 2, 247–271.
- [Lus] N.N. LUSIN, *Integral and trigonometric series*, Moscow, 1915 (Russian); 2nd edition 1951, Izd. Akad. Nauk SSSR (Russian).
- [LPr] N.N. LUSIN AND I.I. PRIVALOV, *Sur l'unicité et la multiplicité des fonctions analytiques*, Ann. Sci. Ecole Norm. Sup., (3) 42 (1925), 143–191.
- [LZ] W.A.J. LUXEMBOURG AND A.C. ZAAENEN, *Riesz spaces. I.*, North-Holland, 1971.
- [Ly] YU.I. LYUBARSKII, *Completeness of a biorthogonal family*, manuscript, Bordeaux, 1997.
- [LyR] YU.I. LYUBARSKII AND A. RASHKOVSKII, *Complete interpolating sequences for Fourier transforms supported by convex symmetric polygons*, Preprint, Trondheim University, 2000.
- [LyS1] YU.I. LYUBARSKII AND K. SEIP, *A uniqueness theorem for bounded analytic functions*, Bull. London Math. Soc. (2) 58 (1997), 127–140.
- [LyS2] ——— *Weighted Paley–Wiener spaces*, Preprint, Trondheim University, 2000.
- [Lyu] YU.I. LYUBICH, *Functional analysis*, Itogi nauki i tehniki. Fundamental'nye napravleniya, vol. 19 (ed. N.K. Nikolski), VINITI Publ., Moscow, 1988 (Russian); English transl.: Encyclopaedia of Math. Sciences, vol. 19, Berlin etc., Springer-Verlag, 1992.
- [LyuV] YU.I. LYUBICH AND VŪ QUÔC PHÔNG, *Asymptotic stability of linear differential equations on Banach spaces*, Studia Math., 88 (1988), 37–42.
- [Mac] G.W. MACKAY, *Harmonic analysis as the exploitation of symmetry — a historical survey*, Rice Univ. Studies, 64 (1978), no. 2–3, 73–228.
- [McL] G.R. MACLANE, *Asymptotic values of holomorphic functions*, Rice Univ. Studies Monographs Math., Houston, 1963.
- [Mag] W. MAGNUS, *On the spectrum of Hilbert's matrix*, Amer. J. Math., 72 (1950), 699–704.
- [MakB] B.M. MAKAROV, *On the moment problem in certain function spaces*, Doklady Akad. Nauk SSSR, 127 (1959), 957–960 (Russian).
- [MV1] N.G. MAKAROV AND V.I. VASYUNIN, *A model for noncontractions and stability of the continuous spectrum*, Lect. Notes Math., 864 (1981), 365–412.
- [MV2] ——— *On quasi-similarity of model contractions with non-equal defects*, Zapiski Nauchn. Seminarov LOMI (Leningrad), 149 (1986), 24–37 (Russian); English transl.: J. Soviet Math., 42 (1988), no. 2, 1550–1561.
- [Man1] S. MANDELBOJT, *Séries adhérentes. Régularisation des suites. Applications*, Paris, Gauthier-Villars, 1952.
- [Man2] ——— *Closure theorems and composition theorems*, Izdat. Inostr. Literatury, Moscow, 1962 (Russian).
- [Man3] ——— *Séries de Dirichlet*, Gauthier-Villars, Paris, 1969.
- [Marc] J. MARCINKIEWICZ, *Sur l'interpolation d'opérations*, C.R. Acad. Sci. Paris, 208 (1939), 1272–1273.
- [MZ] J. MARCINKIEWICZ AND A. ZYGMUND, *Quelques inégalités pour les opérateurs linéaires*, Fund. Math., 32 (1939), 115–121.
- [MM] M. MARCUS AND H. MINC, *A survey of matrix theory and matrix inequalities*, Allyn and Bacon, Boston, 1964.
- [Mark] R.J. MARKS II, *Introduction to Shannon sampling and interpolation*, Springer Verlag, New York, 1991.

- [Ma1] A.C. MARKUS, *Some completeness criteria for the system of root vectors of a linear operator on a Banach space*, Matem. Sbornik, 70 (1966), 526–561 (Russian); English transl. in American Mathematical Society Translations, (2) 85, Twelve papers on functional analysis and geometry, American Mathematical Society, Providence, R.I., 1969.
- [Ma2] ———, *The spectral synthesis problem for operators with the point spectrum*, Izvestia AN SSSR, ser. matem., 34 (1970), no. 3, 662–688 (Russian); English transl.: Math. USSR Izvestia, 4 (1970), 670–696.
- [MaS] A.S. MARKUS AND A.A. SEMENTSUL, *A version of Bochner-Phillips-Allan's theorem*, Izvestia Akad. Nauk Moldavian SSR, Ser. Phys. Techn. and Mathem. Sci., 2 (1989), 14–18 (Russian).
- [MAT] R.A. MARTINEZ-AVENDAÑO AND S.R. TREIL, *An inverse spectral problem for Hankel operators*, manuscript, 1999.
- [MO] A.W. MARSHALL AND I. OLKIN, *Inequalities: theory of majorization and its applications*, Academic Press, NY, 1979.
- [Mar] D.E. MARSHALL, *Blaschke products generate  $H^\infty$* , Bull. Amer. Math. Soc., 82 (1976), 494–496.
- [Mas] P. MASANI, *Wiener's contribution to generalized harmonic analysis, prediction theory and filter theory*, Bull. Amer. Math. Soc. 72 (1966), no. 1, part II, 73–125.
- [MW1] P.R. MASANI AND N. WIENER, *The prediction theory of multivariate stochastic processes*, Acta Math., 98 (1957), 111–150, 99 (1958), 93–137.
- [MW2] ———, *On bivariate stationary processes and the factorization of matrix valued functions*, Teoria Veroyant. i Primenenia, 4 (1959), no. 3, 322–331.
- [Masl] V.P. MASLOV, *Operator methods*, Nauka, Moscow, 1973 (Russian); French transl.: Mir, Moscow, 1987.
- [Mats] V.I. MATSAEV [MACAEV], *On a class of completely continuous operators*, Doklady Akad. Nauk SSSR, 139 (1961), no. 3, 548–551 (Russian); English transl.: Sov. Math., Dokl., 2 (1961), 972–975.
- [Mat] R.F. MATVEEV, *On the regularity of discrete time multivariate stochastic processes*, Doklady Akad. Nauk SSSR, 126 (1959), no. 5, 713–715.
- [McE] B. MCENNIS, *Dilations of holomorphic semigroups*, J. Operator Theory, 23 (1990), 21–42.
- [McGPs] O.C. MCGEHEE, L. PIGNO, AND B. SMITH, *Hardy's inequality and the  $L^1$ -norm of exponential sums*, Ann. Math., 113 (1981), 613–618.
- [Meg] A. MEGRETSKII, *A quasinilpotent Hankel operator*, Algebra i Analiz, 2 (1990), no. 4, 201–212 (Russian); English transl.: Leningrad Math. J., 2 (1991), no. 4, 879–889.
- [MPT] A. MEGRETSKII, V. PELLER AND S. TREIL, *The inverse spectral problem for self-adjoint Hankel operators*, Acta Math., 174 (1995), no. 2, 241–309.
- [MeM] R. MENNICKEN AND M. MÖLLER, *Nonselfadjoint boundary eigenvalue problems*, manuscript, 2000.
- [Mer1] S.N. MERGELYAN, *On an integral related to analytic functions*, Izvestia AN SSSR, Seria Matem., 4 (1951), 395–400 (Russian).
- [Mer2] ———, *Weighted approximation by polynomials*, Uspehi Matem. Nauk, 11 (1956), no. 5, 107–152 (Russian); English transl.: AMS Transl. Series, Ser. 2, 10 (1958), 59–106.
- [Mey] Y. MEYER, *Ondelettes et opérateurs. II. Opérateurs de Calderon-Zygmund*, Paris, Hermann, 1990.
- [Mi1] S.G. MIKHLIN, *Composition of singular integrals*, Doklady Acad. Nauk SSSR, 2 (II) (1936), no. 1 (87), 3–6 (Russian).
- [Mi2] ———, *Singular integral equations*, Uspehi Mat. Nauk, 3 (1936), 29–112 (Russian).
- [Mi3] ———, *Multivariate singular integrals and integral equations*, GIFML, Moscow, 1936 (Russian); English transl.: Pergamon Press, Oxford, 1965.
- [Mi4] ———, *Numerical realization of variational processes*, Nauka, Moscow, 1936 (Russian).
- [Min1] A.M. MINKIN, *Reflection of exponents and unconditional bases of exponentials*, Algebra i Analiz, 3 (1991), no. 5, 109–134 (Russian); English transl.: St. Petersburg Math. J., 3 (1992), no. 5, 1043–1068.
- [Min2] ———, *Reflection of indices and unconditional bases of exponentials*, manuscript.
- [Ml] W. MLAK, *Dilations of Hilbert space operators (general theory)*, Dissertationes Math., 153 (1978).

- [Moe] C. MOELLER, *On the spectra of some translation invariant spaces*, J. Math. Anal. Appl., 4 (1962), 267–296.
- [Mol] C. MOLLER, *General properties of the characteristic matrix in the theory of elementary particles. I*, Danske Vid. Selsk. Mat.-Fys. Medd., 23 (1945), no. 1, 1–48.
- [Mu] B. MUCKENHOUT, *Weighted norm inequalities for the Hardy maximal function*, Trans. Amer. Math. Soc., 165 (1972), 207–226.
- [Muh] P.S. MUHLY, *Compact operators in the commutant of a contraction*, J. Funct. Anal., 8 (1971), 197–224.
- [Mün] C.H. MÜNTZ, *Über den Approximationssatz von Weierstrass*, pp. 303–312 in: H.A. Schwarz Festschrift; Ch. 11:345, Berlin, 1914.
- [Mur] G.J. MURPHY,  *$C^*$ -algebras and operator theory*, Boston etc., Academic Press, 1990.
- [Nab1] S.N. NABOKO, *Absolutely continuous spectrum of a nondissipative operator, and the function model; I and II*, Zapiski Nauchn. Seminarov LOMI, 65 (1976), 90–102, 73 (1977), 118–135 (Russian); English transl.: J. Soviet Math., 16 (1981), no. 3, 1109–1118, 34 (1986), 2090–2101.
- [Nab2] ———, *The function model of perturbation theory and its applications to scattering theory*, Trudy Math. Inst. Steklova, 147 (1980), 86–114, Moscow (Russian); English transl.: Proc. Steklov Math. Inst., 147 (1981), 85–116.
- [Nab3] ———, *Conditions for similarity to unitary and selfadjoint operators*, Funktsional’nyi Analiz i ego Prilozhenia, 18 (1984), no. 1, 16–27 (Russian); English transl.: Funct. Anal. Appl., 18 (1984), 13–22.
- [Nag] R. NAGEL (ED.), *One parameter semigroups of positive operators*, Lect. Notes Math., 1184 (1984), Springer-Verlag, Berlin.
- [SzNF\*] C. FOIAS AND B. SZÖKEFALVI-NAGY, see B. Szökefalvi-Nagy and C. Foias.
- [Nai1] M.A. NAIMARK, *Spectral functions of a symmetric operator*, Izvestia Acad. Nauk SSSR, ser. matem., 4 (1940), no. 3, 277–318 (Russian).
- [Nai2] ———, *On a representation of additive operator valued set functions*, Doklady Acad. Nauk SSSR, 41 (1943), 373–375 (Russian).
- [Nai3] ———, *Positive definite operator functions on a commutative group*, Izvestia Acad. Nauk SSSR, ser. matem., 7 (1943), 237–244.
- [Nai4] ———, *Normed rings*, Nauka, Moscow (2nd edition, 1968) (Russian); English transl.: Wolters-Noordhoff Publishing, Groningen, 1972.
- [LNS] M.A. NAIMARK, A.I. LOGINOV AND V.S. SHULMAN, see A.I. Loginov, M.A. Naimark and V.S. Shulman.
- [Nak1] T. NAKAZI, *Commuting dilations and uniform algebras*, Canadian J. Math., XLII (1990), no. 5, 776–789.
- [Nak2] ———,  *$\rho$ -dilations and hypo-Dirichlet algebras*, Acta Sci. Math. Szeged, 56 (1992), 175–181.
- [NY] T. NAKAZI AND T. YAMAMOTO, *Some singular integral operators and Helson-Szegő measures*, J. Funct. Analysis, 88 (1990), no. 2, 366–384.
- [Nat] I.P. NATANSON, *On an infinite system of linear equations*, Izvestia Fiz.-Mat. Obshchestva Kazan, (3) 7 (1934/35), 97–98 (Russian; German summary).
- [Naz] F.L. NAZAROV, *Local estimates of exponential polynomials and their applications to inequalities of uncertainty principle type*, Algebra i Analiz, 5 (1993), no. 4, 3–66 (Russian); English transl.: St.Petersburg Math. J., 5 (1994), no. 4, 663–717.
- [NPVT] F. NAZAROV, G. PISIER, S. TREIL AND A. VOLBERG, *Sharp estimates in vector Carleson imbedding theorem and for vector paraproducts*, to appear in J. Reine angew. Math.
- [NT] F. NAZAROV, S. TREIL, *The weighted norm inequalities for Hilbert transform are now trivial*, C.R. Acad. Sci. Paris, Sér. I, 323 (1996), 717–722.
- [NTV1] F. NAZAROV, S. TREIL AND A. VOLBERG, *Cauchy integral and Calderon-Zygmund operators on nonhomogeneous spaces*, Int. Math. Research Notices, 15 (1997), 703–726.
- [NTV2] ———, *Counterexample to the infinite dimensional Carleson embedding theorem*, C.R. Acad. Sci. Paris, Sér. I, 325 (1997), 383–388.
- [NazV] F. NAZAROV AND A. VOLBERG, *Nonhomogeneous Calderon-Zygmund operators and spaces  $K_{\Theta}$* , Address to the IWOTA 2000 conference, June 13–16, 2000, Bordeaux.
- [Neh] Z. NEHARI, *On bounded bilinear forms*, Ann. of Math., 65 (1957), 153–162.

- [Nel] E. NELSON, *The distinguished boundary of the unit operator ball*, Proc. Amer. Math. Soc., 12 (1961), 994–995.
- [vN1] J. VON NEUMANN, *Zur Algebra der Funktionaloperatoren und Theorie der normalen Operatoren*, Math. Annalen, 102 (1929), 370–427.
- [vN2] ——— *Charakterisierung des Spektrums eines Integraloperators*, Act. Sci. et Ind., Paris, 1935.
- [vN3] ——— *Some matrix inequalities and metrization of matrix space*, Zapiski Tomskogo Universiteta, 1 (1937), 286–300; also published in "Collected works", vol.IV, pp.205–219, Pergamon Press, Oxford, 1962.
- [vN4] ——— *On rings of operators, Reduction theory*, Ann. of Math., 50 (1949), 401–485.
- [vN5] ——— *Eine Spektraltheorie für allgemeine Operatoren eines unitären Raumes*, Math. Nachr., 4 (1951), 258–281.
- [NS] J. VON NEUMANN AND R. SCHATTEN, *The cross-space of linear transformations, I, II and III*, Ann. of Math. (2), 47 (1946), 73–84; 47 (1946), 608–630; 49 (1948), 557–582.
- [Ne] F. NEVANLINNA AND R. NEVANLINNA, *Über die Eigenschaften analytischer Functionen in der Umgebung einer singulären Stelle oder Linie*, Acta Soc. Sci. Fenn., 50 (1922), no. 5, 1–46.
- [Nev.O1] O. NEVANLINNA, *On the growth of the resolvent operators for power bounded operators*, pp. 247–264 in: Banach Center Publications, 38 (eds. J. Janas, F.H. Szafraniec and J. Zemanek), Warszawa, 1997.
- [Nev.O2] O. NEVANLINNA, *Meromorphic resolvents and power bounded operators*, International Linear Algebra Year (Toulouse, 1995), BIT 36 (1996), no. 3, 531–541.
- [Nev1] R. NEVANLINNA, *Über beschränkte analytische Funktionen*, Ann. Acad. Sci. Fenn., 32 (1929), no. 7.
- [Nev2] ——— *Eindeutige analytische Funktionen*, 2nd ed., Springer-Verlag, 1953.
- [New] J.D. NEWBURGH, *The variation of spectra*, Duke Math. J., 18 (1951), 165–176.
- [Newm] D.J. NEWMAN, *The closure of translates in  $l^p$* , Amer. J. Math., 86 (1964), no. 3, 651–667.
- [NPT] A. NICOLAU, J. PAU AND P.J. THOMAS, *Smallness sets for bounded holomorphic functions*, J. Anal. Math. 82 (2000), 119–148.
- [Nie] J.I. NIETO, *Sur le théorème d'interpolation de J. Lions et J. Peetre*, Can. Math. Bull., 14 (1971), 373–376.
- [N.L] L.N. NIKOLSKAIA, *A stability criterion for the point spectrum of a linear operator*, Matematicheskie Zametki, 18 (1975), 601–607 (Russian); English transl.: Math. Notes, 18 (1975), 946–949.
- [N1] N.K. NIKOLSKI [NIKOL'SKII], *On invariant subspaces of unitary operators*, Vestnik Leningrad. Univ, Matem. Mehanika Astronom., 21 (1966), 36–43 (Russian).
- [N2] ——— *On spaces and algebras of Toeplitz matrices acting on  $l^p$* , Sibirskii Mat. Zhurnal, 7 (1966), no. 1, 146–158 (Russian); English transl.: Sib. Math., J. 7, (1966), 118–126.
- [N3] ——— *Invariant subspaces of the shift operator in some sequence spaces*, PhD Thesis, Leningrad University (Russian), 1966.
- [N4] ——— *Complete extensions of Volterra operators*, Izvestia Akad. Nauk SSSR, ser. matem., 33 (1969), no. 6, 1349–1355 (Russian); English transl.: Math. URSS – Izvestia, 3 (1969), no. 6, 1271–1276.
- [N5] ——— *On perturbations of the spectra of unitary operators*, Matem. Zametki, 5 (1969), no. 3, 341–350 (Russian); English transl.: Math. Notes, 5 (1969), 207–211.
- [N6] ——— *The multiple shift with the simple spectrum*, Zapiski Nauchn. Seminarov LOMI, 19 (1970), 227–236 (Russian); English transl.: Seminars Math. Steklov Inst. Leningrad, 19 (1970), 132–136.
- [N7] ——— *Five problems on invariant subspaces*, Zapiski Nauchn. Seminarov LOMI, 23 (1971), 115–127 (Russian); English transl.: J. Sov. Math., 2 (1974), 441–450.
- [N8] ——— *Invariant subspaces in operator theory and function theory*, pp. 199–412 in: Itogi Nauki (VINITI, Moscow), Math. Anal., 12 (1974) (Russian); Engl. transl.: J. Soviet. Math., 5 (1976), 129–249.
- [N9] ——— *Selected problems of weighted approximation and spectral analysis*, Trudy Math. Inst. Steklova, 120 (1974), Moscow (Russian); English transl.: Proc. Steklov Math. Inst., 120 (1974), AMS, Providence, 1976.

- [N10] ——— *Lectures on the shift operator. IV.*, Zapiski Nauchn. Seminarov LOMI, 65 (1976), 103–132 (Russian); English transl.: J. Soviet Math., 16 (1981), no. 3, 1118–1139.
- [N11] ——— *The present state of the problem of spectral analysis and synthesis*, pp. 240–282 in: Proc. First Summer School on Linear Operators and Functional Spaces, Novosibirsk, 1975; Nauka, Sibirsk. Otdel., Novosibirsk, 1977 (Russian); English transl.: pp. 240–282 in: American Mathematical Society Translations (2), 124, Fifteen papers on functional analysis, American Mathematical Society, Providence, RI, 1984.
- [N12] ——— *A tauberian theorem on the spectral radius*, Sibir. Mat. Zh., 18 (1977), no. 6, 1367–1372 (Russian); English transl.: Sib. Math. J., 18 (1978), 969–973.
- [N13] ——— *Two problems on spectral synthesis*, Zapiski Nauchn. Seminarov LOMI, 81 (1978), 139–141 (Russian); English transl.: J. Soviet Math., 26 (1984), 2185–2186; reprinted in Lect. Notes Math., 1043 (1984), 378–381.
- [N14] ——— *Bases of invariant subspaces and operator interpolation*, Trudy Math. Inst. Steklova, 130 (1978), 50–123 (Russian); English transl.: Proc. Steklov Math. Inst., 130 (1979), no. 4, 55–132.
- [N15] ——— *What problems do spectral theory and complex analysis solve for each other?*, pp. 631–638 in: Proc. Internat. Congr. Math. (Helsinki, 1978), Vol. 2, Acad. Sci. Fenn., Helsinki, 1980.
- [N16] ——— *Bases of exponentials and values of reproducing kernels*, Doklady Akad. Nauk SSSR, 252 (1980), no. 6, 1316–1320 (Russian); English transl.: Soviet Math. Dokl., 21 (1980), no. 3, 937–941.
- [N17] ——— *Methods for calculations of the spectral multiplicity of orthogonal sums*, Zapiski Nauchn. Seminarov LOMI, 126 (1983), 150–158 (Russian); English transl.: J. Soviet Math. 27 (1984), 2521–2526.
- [N18] ——— *Ha-plitz operators: a survey of some recent results*, pp. 87–138 in: Operators and function theory, Proc. NATO ASI at Lancaster, 1984 (ed. S. Power), Dordrecht, Reidel Publ. Co., 1985.
- [N19] ——— *Treatise on the shift operator*, Springer-Verlag, Berlin etc., 1986.
- [N20] ——— *Interpolation libre dans l'espace de Hardy*, C.R. Acad. Sci. Paris, Sér. I, 304 (1987), no. 15, 451–454.
- [N21] ——— *A few notes on generalized free interpolation*, U.U.D.M. Report 1988:3, Uppsala.
- [N22] ——— *Multicyclicity phenomenon. I. An introduction and maxi-formulas*, pp. 9–57 in: Toeplitz Operators and Spectral Function Theory, Operator Theory: Adv. and Appl., 42, Birkhäuser, 1989.
- [N23] ——— *Distance formulae and invariant subspaces, with an application to localization of zeros of the Riemann  $\zeta$ -function*, Ann. Inst. Fourier, 45 (1995), no. 1, 143–159.
- [N24] ——— *Yngve Domar's forty years in harmonic analysis*, Acta Univ. Upsaliensis, 58 (1995), 45–78.
- [N25] ——— *Featured Review of the paper by A. Borichev and H. Hedenmalm "Completeness of translates in weighted spaces on the half-line" (Acta Math., 174 (1995), no. 1, 1–84)*, Math. Rev., 96f:43003.
- [N26] ——— *In search of the invisible spectrum*, Ann. Inst. Fourier, 49 (1999), no. 6, 1925–1998.
- [N27] ——— *Remarks concerning completeness of translates in function spaces*, J. Approx. Theory, 98 (1999), 303–315.
- [HN\*] N.K. NIKOLSKI AND V.P. HAVIN [KHAVIN], see V.P. Havin [Khavin] and N.K. Nikolski.
- [HrN] N.K. NIKOLSKI AND S.V. HRUSCHEV [KHRUSCHEV], see S.V. Hruschev [Khruschev] and N.K. Nikolski.
- [NiP1] N.K. NIKOLSKI AND B.S. PAVLOV, *Expansions in characteristic vectors of non-unitary operators and the characteristic function*, Zap. Nauchn. Semin. Leningr. Otd. Mat. Inst. Steklov, 11 (1968), 150–203 (Russian); English transl.: Semin. Math., V.A. Steklov Math. Inst., Leningr., 11 (1968), 54–72.
- [NiP2] ——— *Bases of eigenvectors of completely nonunitary contractions and the characteristic function*, Izv. Akad. Nauk SSSR, Ser. Mat., 34 (1970), 90–133 (Russian); English transl.: Math. USSR Izv., 4 (1970), 91–134 (1970).

- [NTr] N. NIKOLSKI AND S. TREIL, *Linear resolvent growth of rank one perturbation of a unitary operator does not imply its similarity to a normal operator*, to appear.
- [NVa1] N.K. NIKOLSKI AND V.I. VASYUNIN, *Control subspaces of minimal dimension. Elementary introduction. Discotheca*, Zapiski Nauchnyh Semin. LOMI, 113 (1981), 41–75 (Russian).
- [NVa2] ———, *Control subspaces of minimal dimension, unitary and model operators*, J. Operator Theory, 10 (1983), 307–330.
- [NVa3] ———, *Control subspaces of minimal dimension and rootvectors*, Integral Equat. Oper. Theory, 6 (1983), no. 2, 274–311.
- [NVa4] ———, *Notes on two function models*, pp. 113–141 in: The Bieberbach conjecture, Proc. Symp. on the occasion of the proof, Amer. Math. Soc. Math. Surveys and Monographs, 21 (1986) (A. Baernstein, D. Drasin, P. Duren and A. Marden, eds.), Providence, R.I.
- [NVa5] ———, *A unified approach to function models, and the transcription problem*, pp. 405–434 in: The Gohberg anniversary collection (Calgary, 1988), vol. 2, eds. H.Dym et al., Operator Theory: Adv. Appl., 41, Birkhäuser, Basel, 1989.
- [NVa6] N.K. NIKOLSKI AND V.I. VASYUNIN, *Quasiorthogonal decompositions with respect to complementary metrics, and estimates of univalent functions*, Algebra i Analiz, 2 (1990), no. 4, 1–81 (Russian); English transl.: Leningrad Math. J., 2 (1991), no. 4, 691–764.
- [NVa7] ———, *Operator valued measures and coefficients of univalent functions*, Algebra i Analiz, 3 (1991), no. 6, 1–75 (Russian); English transl.: Leningrad Math. J., 3 (1992), no. 6, 1199–1270.
- [NVa8] ———, *Elements of spectral theory in terms of the free function model. Part I: basic constructions*, pp. 211–302 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [NV] N.K. NIKOLSKI AND A.L. VOLBERG, *Tangential and approximate free interpolation*, pp. 277–299 in: Analysis and partial differential equations, ed. C. Sadosky, N.Y., Marcel Dekker, 1990.
- [S.Nik] S.M. NIKOL'SKII, *Approximation of functions of several variables, and embedding theorems*, Nauka, Moscow, 1969 (Russian); English transl.: Springer-Verlag, Berlin etc., 1975.
- [Nor] E.A. NORDGREN, *Compact operators in the algebra generated by essentially unitary  $C_0$  operators*, Proc. Amer. Math. Soc., 51 (1975), 159–162.
- [Nos] K. NOSHIRO, *Cluster sets*, Springer-Verlag, Berlin-Heidelberg, 1960.
- [Nud] A.A. NUDEL'MAN, *On a new problem of moment type*, Doklady AN SSSR, 233 (1977), 792–795 (Russian); English transl.: Soviet Math. Dokl., 18 (1977), 507–510.
- [Ny] B. NYMAN, *On the one-dimensional translation group and semi-group in certain function spaces*, Thesis, Uppsala Univ., 1950.
- [Ob] R.J. OBER, *A note on a system theoretic approach to a conjecture by Peller-Khrushchev: the general case*, IMA J. Math. Control and Inform., 7 (1990), 35–45.
- [ObM] R.J. OBER AND S. MONTGOMERY-SMITH, *Bilinear transformation of infinite-dimensional state-space systems and balanced realizations of non-rational transfer functions*, SIAM J. Control and Optimization, 28 (1990), 438–465.
- [O'N] M.D. O'NEILL, *The convex hull of the interpolating Blaschke products generates  $H^\infty$* , Michigan Math. J., 44 (1997), no. 3, 419–434.
- [Orl] W. ORLICZ, *Über unbedingte Konvergenz in Funktionenräumen*, Studia Math., 2 (1933), 41–47.
- [Ost] A. OSTROVSKI, *Sur quelques applications des fonctions convexes et concaves au sens de I. Schur*, J. Math. Pures Appl., 31 (1952), 253–292.
- [Pag1] L.B. PAGE, *Bounded and compact vectorial Hankel operators*, Trans. Amer. Math. Soc., 150 (1970), 529–539.
- [Pag2] ———, *Applications of the Sz.-Nagy and Foias lifting theorem*, Indiana Univ. Math. J., 20:2 (1970), 135–145.
- [Pal] R.E.A.C. PALEY, *On the lacunary coefficients of power series*, Annals of Math., 34 (1933), 615–616.
- [PW] R.E.A.C. PALEY AND N. WIENER, *Fourier transforms in the complex domain*, Amer. Math. Soc. Colloquium Publ., 19, Providence, RI, 1934.
- [Pa] A. PAPOULIS, *Signal analysis*, Auckland etc., McGraw-Hill, 1984.

- [Paro] M. PARODI, *La localisation des valeurs caractéristiques des matrices et ses applications*, Gauthier-Villars, Paris, 1959.
- [Par1] S. PARROTT, *Unitary dilations for commuting contractions*, Pacific Math. J., 34 (1970), no. 2, 481–490.
- [Par2] ———, *On a quotient norm and the Sz.-Nagy–Foias lifting theorem*, J. Funct. Anal., 30 (1978), 311–328.
- [Part] J.R. PARTINGTON, *An introduction to Hankel operators*, Cambridge, Cambridge Univ. Press, 1988.
- [PartW] J.R. PARTINGTON AND G. WEISS, *Admissible observation operators for the right shift semigroups*, preprint, 1999.
- [Pat] D.I. PATIL, *Recapturing  $H^2$ -function on a polydisc*, Trans. Amer. Math. Soc., 188 (1974), 97–103.
- [PauT] J. PAU AND P. THOMAS, *Decrease of bounded holomorphic functions along discrete sets*, Prépublication N° 217, 14pp., Université Toulouse III, 2001.
- [Pau] V.I. PAULSEN, *Completely bounded maps and dilations*, Pitman Res. Notes Math., 146, New York, Longman, 1986.
- [P1] B.S. PAVLOV, *Dilation theory and spectral analysis of nonselfadjoint differential operators*, pp. 3–69 in: Operator theory in linear spaces, Proc. 7th Winter School, Drogobych, 1974 (ed. B. Mityagin), Central Econom. Institute, Moscow, 1975 (Russian); English transl.: Amer. Math. Soc. Transl. (2), 115 (1981), 103–142.
- [P2] ———, *On conditions for separation of the spectral components of a dissipative operator*, Izvestia Akad. Nauk SSSR, Ser. Matem., 39 (1975), 123–148 (Russian); English transl.: Math. USSR Izvestia, 9 (1976), 113–137.
- [P3] ———, *Bases of exponentials and the Muckenhoupt condition*, Doklady Akad. Nauk SSSR, 247 (1979), no. 1, 37–40 (Russian); English transl.: Soviet Math. Dokl., 20 (1979), no. 4, 655–659.
- [FP] B.S. PAVLOV AND L.D. FADDEEV, see L.D. Faddeev and B.S. Pavlov.
- [Paz] A. PAZY, *Semigroups of linear operators and applications to partial differential equations*, Springer-Verlag, Heidelberg, 1983.
- [Pea] C. PEARCY, *Some recent developments in operator theory*, CBMS series, 36, Amer. Math. Soc., Providence, RI, 1978.
- [PSh] C. PEARCY AND A.L. SHIELDS, *A survey of the Lomonosov technique in the theory of invariant subspaces*, pp. 219–229 in: Topics in operator theory (ed. C. Pearcy), Math. Surveys series, 13, Amer. Math. Soc., Providence, 1974.
- [Pee] J. PEETRE, *New thoughts on Besov spaces*, Duke University Math. Series 1, Math. Dept., Duke Univ., Durham, NC, 1976.
- [Pek1] A.A. PEKARSKII, *Inequalities of Bernstein type for derivatives of rational functions, and inverse theorems of rational approximation*, Matem. Sbornik, 124 (166) (1984), no. 4, 571–588 (Russian); English transl.: Math. USSR Sbornik, 52 (1985), no. 2, 557–574.
- [Pek2] ———, *Estimates of derivatives of rational functions in  $L_p(-1, 1)$* , Matem. Zametki, 39 (1986), no. 3, 388–394; English transl.: Math. Notes, 39 (1986), no. 3–4, 212–216.
- [Pek3] ———, *Norm comparison for rational functions in the Bloch space and the Carathéodory-Fejér space*, Algebra i Analiz, 11:4 (1999), 139–150 (Russian); English transl.: St. Petersburg Math. J., 11:4 (2000).
- [Pel1] A. PELCZYNSKI, *On universality of some Banach spaces*, Vestnik Len. Gos. Universiteta, 13 (1962), no. 3, 22–29 (Russian).
- [Pel2] ———, *Banach spaces of analytic functions and absolutely summing operators*, CBMS regional conf. series math., 30, Amer. Math. Soc., Providence, RI, 1977.
- [Pe1] V.V. PELLER, *Hankel operators of class  $\mathfrak{S}_p$  and their applications (rational approximation, Gaussian processes, the problem of majorization of operators)*, Matem. Sbornik, 113 (155) (1980), no. 4, 538–581 (Russian); English transl.: Math. USSR Sbornik, 41 (1982), 443–479.
- [Pe2] ———, *An analogue of von Neumann's inequality, isometric dilation of contractions, and approximation by isometries in spaces of measurable functions*, Trudy Inst. Steklova, 155 (1981), 103–150 (Russian); English transl.: Proc. Steklov Inst. Math. (1983), 101–145.
- [Pe3] ———, *Estimates of functions of power bounded operators on Hilbert spaces*, J. Operator Theory, 7 (1982), 341–372.

- [Pe4] ——— *Vectorial Hankel operators and related operators of the Schatten-von Neumann class  $\mathfrak{S}_p$* , Int. Equat. Operator Theory, 5 (1982), 244–272.
- [Pe5] ——— *A description of Hankel operators of the class  $\mathfrak{S}_p$  for  $p > 0$ , investigation of the rate of rational approximation and other applications*, Matem. Sbornik 122 (164) (1983), no. 4, 481–510 (Russian); English transl.: Math. USSR Sbornik, 50 (1985), 465–494.
- [Pe6] ——— *Estimates of functions of Hilbert space operators, similarity to a contraction and related function algebras*, pp. 199–204 in: Linear and Complex Analysis problem Book, Lect. Notes Math., 1043 (eds. V.P. Havin, S.V. Hruscev and N.K. Nikolski), Springer-Verlag, Berlin, 1984.
- [Pe7] ——— *Nuclear Hankel operators acting between  $H^p$  spaces*, pp. 213–220 in: Operator Theory: Adv. Appl., 14, Birkhäuser Verlag, Basel, 1984.
- [Pe8] ——— *Spectrum, similarity, and invariant subspaces of Toeplitz operators*, Izvestia Akad. Nauk SSSR, ser. matem., 50 (1986), no. 4, 776–787; English transl.: Math. USSR Izvestiya, 29 (1987), 133–144.
- [Pe9] ——— *Hankel operators and multivariate stationary processes*, pp. 357–371 in: *Operator Theory: Operator Algebras and Applications, NH, 1988*, Proc. Sympos. Pure Math., 51, Part 1, Amer. Math. Soc., Providence, RI, 1990.
- [Pe10] ——— *An excursion into the theory of Hankel operators*, pp. 65–120 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [HP\*] V.V. PELLER AND S.V. HRUSCHEV [KHRUSCHEV], see S.V. Hruschev [Khruschev] and V.V. Peller.
- [Peterm] S. PETERMICHL, *Dyadic shift and a logarithmic estimate for Hankel operator with matrix symbol*, C.R. Acad. Sci. Paris, Ser. I Math., 330:6 (2000), 455–460.
- [PetW] S. PETERMICHL AND J. WITTER, *An estimate for weighted Hilbert transform via Bellman functions*, Preprint, 16 pp., Mich. State Univ., 2000.
- [Pet] K.E. PETERSEN, *Brownian motion, Hardy spaces and bounded mean oscillation*, Cambridge University Press, 1977.
- [Pic] G. PICK, *Über die Beschränkungen analytischer Funktionen, welche durch vorgegebene Funktionswerte bewirkt werden*, Math. Ann., 77 (1916), 7–23.
- [Pie1] A. PIETSCH, *Eigenvalues and  $s$ -numbers*, Akad. Verlagstellerschaft Geest&Portig K.-G., Leipzig, 1987.
- [Pie2] ——— *Operator ideals*, Berlin, Math. Monographien Bd. 16, Deutscher Verlag Wissenschaft., 1978.
- [Pil] G. PISIER, *Similarity problems and completely bounded maps*, Lect. Notes Math., 1618, Berlin-NY, Springer-Verlag, 1995.
- [Pi2] ——— *A polynomially bounded operator on Hilbert space which is not similar to a contraction*, J. Amer. Math. Soc., 10 (1997), 351–369.
- [Pl1] A.I. PLESSNER, *Über das Verhalten analytischer Funktionen am Rande ihres Definitionsbereichs*, J. Reine Angew. Math., 158 (1927), 219–227.
- [Pl2] ——— *On semi-unitary operators*, Doklady Akad. Nauk SSSR, 25 (1939), 708–710 (Russian).
- [Pol1] A.G. POLTORATSKI, *On the boundary behavior of pseudocontinuable functions*, Algebra i Analiz, 5 (1993), no. 2, 189–210 (Russian); English transl.: St.Petersburg Math. J., 5 (1994), 389–406.
- [Pol2] ——— *Integral representation and uniqueness sets for star-invariant subspaces*, to appear in: Proc. of IWOTA 2000, Operator Theory: Adv. Appl., Birkhäuser, Basel.
- [PSz] G. POLYA AND G. SZEGÖ, *Aufgaben und Lehrsätze aus der Analysis, Vol. 1,2*, Berlin, Springer, 1925; English transl.: Berlin and N. Y., Springer-Verlag, 1972.
- [Pom] CH. POMMERENKE, *Univalent functions*, Vandenhoeck and Göttingen Ruprecht, 1975.
- [Pon] L.S. PONTRYAGIN, *Hermitian operators in spaces with an indefinite metric*, Izvestia AN SSSR, Seria Matem., 8 (1944), no. 1, 243–280 (Russian).
- [Pop1] G. POPESCU, *von Neumann inequality for  $(\mathcal{B}(H))^n_1$* , Math. Scand., 68 (1991), 292–304.
- [Pop2] ——— *Noncommutative disc algebras and their representations*, Proc. Amer. Math. Soc., 124 (1996), 2137–2148.



- [Pot] V.P. POTAPOV, *On the multiplicative structure of  $J$ -nonexpanding matrix functions*, Trudy Moskov. Mat. Obschestva, 4 (1955), 125–236 (Russian); English transl.: Amer. Math. Soc. Transl. (2), 15 (1960), 131–243.
- [Po1] S.C. POWER, *Hankel operators on Hilbert space*, Bull. London Math. Soc., 12 (1980), 422–442.
- [Po2] ——— *Hankel operators on Hilbert space*, Pitman Res. Notes Math., 64, Boston etc., Pitman, 1982.
- [Pr1] I.I. PRIVALOV, *Cauchy integral*, Saratov University, 1919 (Russian).
- [Pr2] ——— *Boundary properties of analytic functions*, 2nd edition, Moscow, 1950 (Russian); German transl.: Berlin, Deutscher Verlag, 1956.
- [PV] V. PTÁK AND P. VRBOVÁ, *Operators of Toeplitz and Hankel type*, Acta Sci. Math. Szeged, 52 (1988), 117–140.
- [Pu] M. PUTINAR, *Generalized eigenfunction expansions and spectral decompositions* pp. 265–286 in: *Banach Center Publications*, Vol. 38 (Eds., J. Janas, F.H. Szafraniec and J. Zemanek), Warszawa.
- [PuV] M. PUTINAR AND F.-H. VASILESCU, *Solving moment problems by dimensional extension*, Ann. of Math., 149 (1999), 1087–1107.
- [Put1] C.R. PUTNAM, *On normal operators in Hilbert space*, Amer. J. Math., 73 (1951), 357–362.
- [Put2] ——— *Commutation properties of Hilbert space operators and related topics*, Springer Verlag, Berlin etc., 1967.
- [Put3] ——— *An inequality for the area of hyponormal spectra*, Math. Zeitschr., 28 (1971), 473–477.
- [Q] P. QUIGGIN, *For which reproducing kernel Hilbert spaces is Pick's theorem true?*, Integral Eq. Oper. Theory, 16 (1993), 244–266.
- [RR] H. RADJAVI AND P. ROSENTHAL, *Invariant subspaces*, Berlin etc., Springer-Verlag, 1973.
- [Red1] R.M. REDHEFFER, *A note on completeness*, Notices Amer. Math. Soc., 16 (1967), 830.
- [Red2] ——— *Two consequences of the Beurling-Malliavin theory*, Proc. Amer. Math. Soc., 36 (1972), no. 1, 116–122.
- [Red3] ——— *Completeness of sets of complex exponentials*, Adv. Math., 24 (1977), 1–62.
- [RS] M. REED AND B. SIMON, *Methods of modern mathematical physics, vol.1–4*, Academic Press, N.Y., 1972–1979.
- [Re] E. REICH, *On non-Hermitian Toeplitz matrices*, Math. Scand., 10 (1962), 145–152.
- [Rei] H. REINHARD, *Éléments de mathématiques du signal, Tome 1–2*, Paris, Dunod, 1995.
- [Rick] C.E. RICKART, *General theory of Banach algebras*, Van Nostrand, 1960.
- [Ric] W.J. RICKER, *The spectral theorem: a historical viewpoint*, pp. 365–393 in: Ulmer Seminare, Funktionalanalysis und Differentialgleichungen, Heft 4 (eds. W. Arendt, W. Balsemer, W. Kratz, U. Stadtmüller), Ulm, 1999.
- [Rie1] F. RIESZ, *Sur certains systèmes singuliers d'équations intégrales*, Ann. Ecole Normale Sup. (3), 28 (1911), 33–62.
- [Rie2] ——— *Über die Randwerte einer analytische Funktion*, Math. Z., 18 (1923), 87–95.
- [RieR] F. AND M. RIESZ, *Über die Randwerte einer analytische Funktion*, pp. 27–44 in: Quatrième Congrès des Math. Scand., Stockholm, 1916.
- [RSzN] F. RIESZ AND B. SZÖKEFALVI-NAGY, *Leçons d'analyse fonctionnelle*, Troisième édition, Szeged, Akadémiai Kiado, 1955.
- [RieM1] M. RIESZ, *Sur le problème des moments. I; II; III*, Ark. för Mat. Astr. Fys., 16 (1922); 17 (1923).
- [RieM2] ——— *Sur les fonctions conjuguées et les séries de Fourier*, C.R. Acad. Sci. Paris, Ser. A–B, 178 (1924), 1464–1467.
- [RieM3] ——— *Sur les maxima des formes bilinéaires et sur les fonctionnelles linéaires*, Acta Math., 49 (1926), 465–497.
- [RieM4] ——— *Sur les fonctions conjuguées*, Math. Zeit., 27 (1927), 218–244.
- [Ro1] R. ROCHBERG, *Trace ideal criteria for Hankel operators and commutators*, Indiana Univ. Math. J., 31 (1982), no. 6, 913–925.
- [Ro2] ——— *Decomposition theorems for Bergman spaces and their applications*, pp. 225–278 in: *Operators and function theory*, ed. S.Power, Reidel Publ., Dordrecht, 1985.

- [Ro3] ——— *Higher-order Hankel forms and commutators*, pp. 155–178 in: *Holomorphic Spaces*, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Rol] S. ROLEWICZ, *On orbits of elements*, *Studia Math.*, 33 (1969), 17–22.
- [Ros1] M. ROSENBLUM, *On the Hilbert matrix, I*, *Proc. Amer. Math. Soc.*, 9 (1958), 137–140.
- [Ros2] ——— *On the Hilbert matrix, II*, *Proc. Amer. Math. Soc.*, 9 (1958), 581–585.
- [Ros3] ——— *On a theorem of Fuglede and Putnam*, *J. London Math. Soc.*, 33 (1958), 376–377.
- [Ros4] ——— *Summability of Fourier series in  $L^p(\mu)$* , *Trans. Amer. Math. Soc.*, 105 (1962), no. 1, 32–42.
- [Ros5] ——— *Self-adjoint Toeplitz operators*, Summer Institute of Spectral Theory and Statistical Mechanics 1965, Brookhaven National Laboratory, Upton, NY, 1966 (MR 34 #4084).
- [Ros6] ——— *A corona theorem for countably many functions*, *Integral Equations and Operator Theory*, 3 (1980), 125–137.
- [RoR] M. ROSENBLUM AND J. ROVNYAK, *Hardy classes and operator theory*, Oxford Univ. Press, 1985.
- [RosSha] W.T. ROSS AND H.S. SHAPIRO, *Notes on generalized analytic continuation*, manuscript, 143pp., 2001.
- [Rota] G.C. ROTA, *On models for linear operators*, *Comm. Pure Appl. Math.*, 13 (1960), no. 3, 468–472.
- [Roz1] YU.A. ROZANOV, *Spectral theory of multi-dimensional stationary random processes with discrete time*, *Uspehi Matem. Nauk*, 13 (1958), no. 2, 93–142 (Russian); English transl.: *Selected Transl. in Math. Stat. and Probability*, 1 (1961), 253–306.
- [Roz2] ——— *Linear extrapolation of discrete time multivariate stochastic processes of rank 1*, *Doklady Akad. Nauk SSSR*, 125 (1959), no. 2, 277–280.
- [Roz3] ——— *Stationary stochastic processes*, Moscow, Fizmatgiz, 1963 (Russian); English transl.: San Francisco etc., Golden-Day 1967.
- [Ru1] W. RUDIN, *The radial variation of analytic function*, *Duke Math. J.*, 22 (1955), 235–242.
- [Ru2] ——— *Boundary values of continuous functions*, *Proc. Amer. Math. Soc.*, 7 (1956), 808–811.
- [Ru3] ——— *Fourier analysis on groups*, Wiley&Sons, N.Y., 1962.
- [Ru4] ——— *Real and complex analysis*, McGraw-Hill Book Company, N.Y. etc., 1966.
- [Ru5] ——— *Function theory in polydiscs*, New York, Benjamin, 1969.
- [Ru6] ——— *Functional Analysis*, McGraw-Hill Book Company, N.Y. etc., 1973.
- [RuVin] S.E. RUKSHIN AND S.A. VINOGRADOV, *On free interpolation of germs of analytic functions in Hardy classes*, *Zapiski Nauchn. Semin. LOMI*, 107 (1982), 36–45 (Russian); English transl.: *J. Soviet Math.*, 36 (1987), no. 3, 319–325.
- [Rus] D.L. RUSSEL, *Controlability theory for linear partial differential equations : recent progress and open problems*, *SIAM Review*, 20 (1978), 639–739.
- [RW] D.L. RUSSEL AND G. WEISS, *A general necessary condition for exact observability*, *SIAM J. Control and Optim.*, 32 (1994), 1–23.
- [Sad1] C. SADOSKY, *Some applications of majorized Toeplitz kernels*, pp. 581–626 in: *Topics in Modern Harmonic Analysis*, Proc. Seminar Torino and Milano (May–June 1982), Vol. II, Inst. Naz. Alta Matematica F. Severi, Roma, 1983.
- [Sad2] ——— *Liftings of kernels shift-invariant in scattering theory*, pp. 303–336 in: *Holomorphic Spaces*, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Sai] S. SAITOH, *Theory of reproducing kernels and its applications*, Pitman Res. Notes Math. Series 189, Longman, 1988.
- [Sakh] L.A. SAKHNOVICH, *Spectral analysis of Volterra operators and inverse problems*, *Doklady Akad. Nauk SSSR*, 115 (1957), no. 4, 666–669.
- [Sal] D. SALAMON, *Realization theory in Hilbert space*, *Math. Systems Theory*, 21 (1989), 147–164.
- [S1] D. SARASON, *The  $H^p$  spaces on an annulus*, *Mem. Amer. Math. Soc.*, 56 (1965).
- [S2] ——— *On spectral sets having connected complement*, *Acta Sci. Math. Szeged*, 26 (1965), 289–299.

- [S3] ——— *Weak-star generators of  $H^\infty$* , Pacific J. Math., 17 (1966), 519–528.
- [S4] ——— *Generalized interpolation in  $H^\infty$* , Trans. Amer. Math. Soc., 127 (1967), no. 2, 179–203.
- [S5] ——— *Weak-star density of polynomials*, J. Reine Angew. Math., 252 (1972), 1–15.
- [S6] ——— *On products of Toeplitz operators*, Acta Sci. Math. Szeged, 35 (1973), 7–12.
- [S7] ——— *Functions of vanishing mean oscillation*, Trans. Amer. Math. Soc., 207 (1975), 391–405.
- [S8] ——— *Nearly invariant subspaces for the backward shift*, pp. 481–493 in: Operator theory: Adv. and Appl., 35, Basel, Birkhäuser, 1988.
- [S9] ——— *Sub-Hardy Hilbert spaces in the unit disk*, Univ. of Arkansas Lect Notes, 10, N.Y. etc., John Wiley&Sons, 1994.
- [Scha] H.H. SCHAEFER, *Topological vector spaces*, Springer-Verlag, Berlin, 1991.
- [Schm1] E. SCHMIDT, *Entwicklung willkürlicher Funktionen nach Systemen vorgeschriebener*, Math. Annalen, 63 (1907), 433–476.
- [Schm2] ——— *Über die Auflösung linearer Gleichungen mit unendlich vielen Unbekannten*, Rend. Circolo Mat. Palermo, 25 (1908), 53–77.
- [Schmi] H. SCHMIDT, Jahresber. deutsch. Math. Verein., Section 2, 43 (1933), 6–7.
- [Schu] J. SCHUBERT, *The corona theorem as an operator theorem*, Proc. Amer. Math. Soc., 69 (1978), 73–76.
- [Sch1] I. SCHUR, *Bemerkungen zur Theorie der beschränkten Bilinearformen mit unendlich vielen Veränderlichen*, J. reine angew. Math., 140 (1911), 1–28.
- [Sch2] ——— *Über die Potenzreihen, die im Innern des Einheitskreises beschränkt sind, I&II*, J. Reine Angew. Math., 147 (1917), 205–232; 148 (1918), 122–145 (German); English transl.: Operator Theory: Adv. Appl., 18, Birkhäuser Verlag, Basel, 1986.
- [Schw1] L. SCHWARTZ, *Etude des sommes d'exponentielles réelles*, Hermann, Paris, 1943.
- [Schw2] ——— *Approximation d'une fonction quelconque par des sommes d'exponentielles imaginaires*, Ann. Fac. Sci. Univ. Toulouse (4), 6, (1943), 111–176.
- [Schw3] ——— *Théorie générale des fonctions moyenne-périodiques*, Ann. Math., 48 (1947), no. 4, 857–927.
- [Sed] A.M. SEDLETSKII, *Biorthogonal expansions of functions in series of exponentials on intervals of the real line*, Uspehi Mat. Nauk, 37 (1982), no. 5, 51–95 (Russian); English transl.: Russian Math. Surveys, 37 (1983), no. 5, 57–108.
- [Sei1] K. SEIP, *Regular sets of sampling and interpolation for weighted Bergman spaces*, Proc. Amer. Math. Soc., 117 (1993), no. 1, 213–220.
- [Sei2] ——— *Beurling type density theorems in the unit disk*, Invent. math., 113 (1993), 21–39.
- [Sei3] ——— *On the connection between exponential bases and certain related sequences in  $L^2(-\pi, \pi)$* , J. Funct. Anal., 130 (1995), no. 1, 131–160.
- [Se] D. SELEGUE, *A  $C^*$ -algebra extension of the Szegő trace formula*, Talk given at the GPOTS, Arizona State Univ., Tempe, 1996.
- [Sem] S. SEMMES, *Trace ideal criteria for Hankel operators, and applications to Besov classes*, Integral Equations Operator Theory, 7 (1984), no. 2, 241–281.
- [Sham] F.A. SHAMOYAN, *Weak invertibility in some spaces of analytic functions*, Akad. Nauk Armyan. SSR Dokl., 74 (1982), no. 4, 157–161 (Russian).
- [Shan] C.E. SHANNON, *A mathematical theory of communications*, Bell System Tech. J., 27 (1948), 379–423, 623–656.
- [ShanW] C.E. SHANNON AND W. WEAVER, *The mathematical theory of communication*, Urbana, Illinois, 1949.
- [Shap] J.H. SHAPIRO, *Composition operators and classical function theory*, Springer-Verlag, 1993.
- [Sha1] H.S. SHAPIRO, *Weakly invertible elements in certain function spaces, and generators in  $l_1$* , Mich. Math. J., 11 (1964), 161–165.
- [Sha2] ——— *A class of singular functions*, J. Canad. Math., 20 (1968), no. 6, 1425–1431.
- [Sha3] ——— *Generalized analytic continuation*, pp. 151–163 in: Symposia on theoretical physics and mathematics, vol. 8 (Madras), Plenum Press, New York, 1968.
- [Sha4] ——— *Some function-theoretic problems motivated by the study of Banach algebras*, pp. 95–113 in: Proc. NRL Conference on Classical Function Theory, ed. F.Gross, Washington, D.C., NRL, 1970.

- [ShaS] H.S. SHAPIRO AND A.L. SHIELDS, *On some interpolation problems for analytic functions*, Amer. J. Math., 83 (1961), 513–532.
- [Sh1] A.L. SHIELDS, *Weighted shift operators and analytic function theory*, pp. 49–128 in: Topics in operator theory, ed. C. Pearcy, Math. Surveys 13, Amer. Math. Soc., Providence, 1974.
- [Sh2] ——— *On Möbius bounded operators*, Acta Sci. Math. Szeged, 40 (1978), 371–374.
- [Sh3] ——— *Cyclic vectors in Banach spaces of analytic functions*, pp. 315–349 in: Operators and function theory, ed. S.C. Power, NATO ASI Series 153, Dordrecht etc., Reidel, 1985.
- [Shim1] S.M. SHIMORIN, *Wold-type decompositions and wandering subspaces for operators close to isometries*, J. Reine Angew. Math., 531 (2001), 147–189.
- [Shim2] ——— *Approximate spectral synthesis in the Bergman space*, Duke Math. J., 101 (2000), no. 1, 1–39.
- [Shi] N.A. SHIROKOV, *Analytic functions smooth up to the boundary*, Lect. Notes Math., 1312, Springer-Verlag, 1988.
- [ShV] N.A. SHIROKOV AND I.V. VIDENSKII, *An extremal problem in the Wiener algebra*, Algebra i Analiz, 11 (1999), no. 6, 122–138 (Russian); English transl.: St. Petersburg Math. J., 11 (2000), no. 6, 1035–1049.
- [ST] J. SHOHAT AND J. TAMARKIN, *The problem of moments*, Math. Surveys I, Amer. Math. Soc., Providence, RI, 1943.
- [Sib1] R. SIBILËV, *Théorèmes d'unicité pour les séries de Wolff-Denjoy, et des opérateurs normaux*, Thèse, Université de Bordeaux, 1995.
- [Sib2] ——— *A uniqueness theorem for Wolff-Denjoy series*, Algebra i Analiz, 7 (1995), no. 1, 170–199 (Russian); English transl.: St. Petersburg Math. J., 7 (1996), no. 1, 145–168.
- [Si1] B. SIMON, *Trace ideals and their applications*, Lect. Notes London Math. Soc., Cambridge Univ. Press, Cambridge, 1979.
- [Si2] ——— *Pointwise domination of matrices and comparison of  $\mathfrak{S}_p$  norms*, Pacif. J. Math., 97 (1981), no. 2, 471–475.
- [Sim1] I.B. SIMONENKO, *Riemann boundary problem with measurable coefficients*, Doklady Akad. Nauk SSSR, 135 (1960), 538–541 (Russian); English transl.: Soviet Math. Dokl., 1 (1960), 1295–1298.
- [Sim2] ——— *A new general method for studying linear operator equations of the type of singular integral equations*, Doklady Akad. Nauk SSSR, 158 (1964), 790–793 (Russian); English transl.: Soviet Math. Dokl., 5 (1964), 1323–1326.
- [Simo] A. SIMONIC, *An extension of Lomonosov's techniques to non-compact operators*, Trans. Amer. Math. Soc., 348 (1996), no. 3, 975–995.
- [Sin] I. SINGER, *Bases in Banach spaces. I&II*, Springer-Verlag, Heidelberg, 1970, 1981.
- [Sm1] V.I. SMIRNOV, *Sur la théorie des polynômes orthogonaux à une variable complexe*, J. Leningrad Fiz.-Mat. Obsch., 2 (1928), no. 1, 155–179.
- [Sm2] ——— *Sur les valeurs limites des fonctions régulières à l'intérieur d'un cercle*, J. Leningrad Fiz.-Mat. Obsch., 2 (1928), no. 2, 22–37.
- [Sm3] ——— *Sur les formules de Cauchy et Green et quelques problèmes qui s'y rattachent*, Izvestia AN SSSR, ser. fiz.-mat., 3 (1932), 338–372.
- [So1] B.M. SOLOMYAK, *Spectral multiplicity of analytic Toeplitz operators*, Doklady Akad. Nauk SSSR, 286 (1986), no. 6, 1308–1311 (Russian); English transl.: Soviet Math. Dokl., 33 (1986), no. 1, 286–290.
- [So2] ——— *A functional model for dissipative operators. A coordinate-free approach*, Zapiski Nauchn. Seminarov LOMI, 178 (1989), 57–91 (Russian); English transl.: J. Soviet Math. 61 (1992), no. 2, 1981–2002.
- [So3] ——— *Scattering theory for almost unitary operators and the functional model*, Zapiski Nauchn. Seminarov LOMI, 178 (1989), 92–119 (Russian); English transl.: J. Soviet Math. 61 (1992), no. 2, 2002–2020.
- [SoV1] B.M. SOLOMYAK AND A.L. VOLBERG, *Multiplicity of analytic Toeplitz operators*, pp. 87–192 in: Toeplitz Operators and Spectral Function Theory (ed. N. Nikolski), Operator Theory: Adv. and Appl., 42, Birkhäuser, 1989.
- [SoV2] ——— *Operator of multiplication by an analytic matrix valued function*, pp. 193–208 in: Toeplitz Operators and Spectral Function Theory (ed. N. Nikolski), Operator Theory: Adv. and Appl., 42, Birkhäuser, 1989.

- [Sp] I.M. SPITKOVSKY, *Singular integral operators with PC symbols on the spaces with general weights*, J. Funct. Anal., 105 (1992), 129–143.
- [Ste] S.B. STECHKIN, *On bilinear forms*, Dokl. Akad. Nauk SSSR, 71 (1950), no. 2, 237–240 (Russian).
- [St1] E. STEIN, *Singular integrals and differentiability properties of functions*, Princeton Univ. Press, Princeton, N.J., 1970.
- [St2] ——— *Harmonic analysis*, Princeton Univ. Press, Princeton, N.J., 1993
- [StW] E.M. STEIN AND G. WEISS, *Introduction to analysis on Euclidean spaces*, Princeton Univ. Press, Princeton, NJ, 1971.
- [Sti] W.F. STINESPRING, *Positive functions on  $C^*$ -algebras*, Proc. Amer. Math. Soc., 6 (1955), 211–216.
- [StWa] J.C. STRIKWERDA AND B.A. WADE, *A survey of the Kreiss matrix theorem for power bounded families of matrices and its extensions*, pp. 339–360 in: Banach Center Publications, 38 (eds. J. Janas, F.H. Szafraniec, and J. Zemanek), Warszawa, 1997.
- [Stro] K. STROETHOFF, *The Berezin transform and operators on spaces of analytic functions*, pp. 361–380 in: *Banach Center Publications*, Vol.38 (Eds. J. Janas, F.H. Szafraniec and J. Zemanek), Warszawa.
- [Str] E. STROUSE, *Finite rank intermediate Hankel operators*, Archiv Math., 67 (1996), 142–149.
- [SV] I. SUCIU AND I. VALUDESCU, *Factorization theorems and prediction theory*, Rev. Roumaine Math. Pures Appl., 23 (1978), 1393–1423.
- [SW] C. SUNDBERG AND TH. WOLFF, *Interpolating sequences for  $QA_B$* , Trans. Amer. Math. Soc., 276 (1983), no. 2, 551–581.
- [Sza] O. SZASZ, *Über die Approximation stetiger Funktionen durch lineare Aggregate von Potenzen*, Math. Ann., 77 (1916), 482–496.
- [Sz1] G. SZEGÖ, *Beiträge zur Theorie der Toeplitzschen Formen, I*, Math. Zeit., 6 (1920), Heft 3/4, 167–202.
- [Sz2] ——— *Über die Entwicklung einer analytischen Funktion nach den Polynomen eines Orthogonalsystems*, Math. Ann., 82 (1921), 188–212.
- [Sz3] ——— *Über die Randwerte einer analytischen Funktion*, Math. Ann., 84 (1921), Heft 3/4, 232–244.
- [Sz4] ——— *Orthogonal polynomials*, Amer. Math. Soc. Colloquium Publ., vol. XXIII, AMS, N.Y., 1959.
- [SzN1] B. SZÖKEFALVI-NAGY, *On uniformly bounded linear transformations in Hilbert space*, Acta Sci. Math. Szeged, 11 (1947), 152–157.
- [SzN2] ——— *A moment problem for self-adjoint operators*, Acta Math. Acad. Sci. Hungarica, 3 (1952), 285–293.
- [SzN3] ——— *Sur les contractions de l'espace de Hilbert*, Acta Sci. Math. Szeged, 15 (1953), 87–92.
- [SzN4] ——— *Completely continuous operators with uniformly bounded iterates*, Publ. Math. Inst. Hung. Acad. Sci., 4 (1959), 89–92.
- [SzN5] ——— *Unitary dilations of Hilbert space operators and related topics*, CBMS conf. series, 19, Amer. Math. Soc., Providence, 1974.
- [SzN6] ——— *A problem on operator valued bounded analytic function*, Zapiski Nauchn. Semin. LOMI (Steklov Inst. Math., Leningrad), 81 (1978), p. 99; see also J. Soviet Math., 26 (1984), no. 5.
- [SzNF1] B. SZÖKEFALVI-NAGY AND C. FOIAS, *Modèles fonctionnels des contractions de l'espace de Hilbert. La fonction caractéristique*, C.R. Acad. Sci. Paris, 256 (1963), 3236–3239.
- [SzNF2] ——— *Propriétés des fonctions caractéristiques, modèles fonctionnels et une classification des contractions*, C.R. Acad. Sci. Paris, 258 (1963), 3413–3415.
- [SzNF3] ——— *Sur les contractions de l'espace de Hilbert. X. Contractions similaires à des transformations unitaires*, Acta Sci. Math. Szeged, 26 (1965), 79–91.
- [SzNF4] ——— *Analyse harmonique des opérateurs de l'espace de Hilbert*, Akadémiai Kiado, Budapest, 1967; English transl.: *Harmonic analysis of operators on Hilbert space*, North Holland, New York, 1970.
- [SzNF5] ——— *On the structure of intertwining operators*, Acta Sci. Math. Szeged, 35 (1973), 225–254.

- [SzNF6] ——— *On contractions similar to isometries and Toeplitz operators*, Ann. Acad. Sci. Fenn., A I, 2 (1976), 553–564.
- [SzNF7] ——— *Contractions without cyclic vectors*, Proc. Amer. Math. Soc., 87 (1983), no. 4, 671–674.
- [SzK1] B. SZÖKEFALVI-NAGY AND A. KORANYI, *Relations d'un problème de Nevanlinna et Pick avec la théorie des opérateurs de l'espace hilbertien*, Acta Math. Acad. Sci. Hungar., 7 (1957), 295–302.
- [SzK2] ——— *Operatortheoretische Behandlung und Verallgemeinerung eines Problemkreises in der komplexen Funktionentheorie*, Acta Math., 100 (1958), 171–202.
- [Tch] P.L. TCHEBYCHEV, *On mean values*, Matem. Sbornik, vol. 2 (1867) (Russian).
- [T] J.E. THOMSON, *Approximation in the mean by polynomials*, Ann. of Math. (2) 133 (1991), no. 3, 477–507.
- [Ti] E.C. TITCHMARSH, *The theory of functions*, Oxford, 1939.
- [Tit] ——— *The theory of the Riemann  $\zeta$ -function*, Oxford, 1951.
- [Toe] O. TOEPLITZ, *Zur Theorie der quadratischen und bilinearen Formen von unendlichvielen Veränderlichen*, Math. Ann., 70 (1911), 351–376.
- [To1] V. TOLOKONNIKOV, *Estimates in Carleson's corona theorem and finitely generated ideals in the algebra  $H^\infty$* , Funkcionalnyi Analiz i Prilozh., 14 (1980), 85–86 (Russian); English transl.: Funct. Anal. Appl., 14 (1980), no. 4, 320–321.
- [To2] ——— *Estimates in Carleson's corona theorem. Ideals of the algebra  $H^\infty$ , the problem of Szökefalvi-Nagy*, Zapiski Nauchn. Semin. LOMI, 113 (1981), 178–198 (Russian); English transl.: J. Soviet Math., 22 (1983), 1814–1828.
- [To3] ——— *The corona theorem in algebras of bounded analytic functions*, A paper deposited at VINITI (Moscow), No 251-84 Dep. (1984), 1–61 (Russian); English transl.: Amer. Math. Soc. Transl. (2), 149 (1991), 61–95.
- [To4] ——— *Hankel and Toeplitz operators on Hardy spaces*, Zapiski Nauchn. Semin. LOMI, 141 (1985), 165–175 (Russian); English transl.: J. Soviet Math., 37 (1987), 1359–1364.
- [Tom] YU. TOMILOV, *Resolvent approach to stability of operator semigroups*, J. Operator Theory, to appear.
- [Tre1] S.R. TREIL, *An operator theory approach to weighted norm inequalities for singular integrals*, Zapiski Nauchn. Semin. LOMI, 135 (1984), 150–174 (Russian).
- [Tre2] ——— *The Adamyan-Arov-Krein theorem: a vector version*, Zapiski Nauchn. Semin. LOMI, 141 (1985), 56–71 (Russian); English transl.: J. Sov. Math., 37 (1987), 1297–1306.
- [Tre3] ——— *Moduli of Hankel operators and the V.V. Peller–S.V. Khrushchev problem*, Dokl. Akad. Nauk SSSR, 283 (1985), no. 5, 1095–1099 (Russian); English transl.: Soviet Math. Dokl., 32 (1985), 293–297.
- [Tre4] ——— *A spacially compact system of eigenvectors forms a Riesz basis if it is uniformly minimal*, Doklady Akad. Nauk SSR, 288 (1986), 308–312 (Russian); English transl.: Soviet Math. Dokl., 33 (1986), 675–679.
- [Tre5] ——— *Extreme points of the unit ball of the operator Hardy space  $H^\infty(E \rightarrow E)$* , Zapiski Nauchn. Semin. LOMI, 149 (1986), 160–164 (Russian); English transl.: J. Soviet Math., 42 (1988), no. 2, 1653–1656.
- [Tre6] ——— *The invertibility of a Toeplitz operator does not imply its invertibility by the projection method*, Dokl. Akad. Nauk SSSR, 292 (1987), no. 3, 563–567 (Russian); English transl.: Soviet Math. Dokl., 35 (1987), no. 1, 103–107.
- [Tre7] ——— *The resolvent of a Toeplitz operator may have an arbitrary growth*, Zapiski Nauchn. Semin. LOMI, 157 (1987), 175–177 (Russian); English transl.: J. Soviet Math., 44 (1989), no. 6, 868–869.
- [Tre8] ——— *Angles between coinvariant subspaces and an operator valued corona problem. A question of Szökefalvi-Nagy*, Doklady Akad. Nauk SSR, 302 (1988), no. 5, 1063–1068 (Russian); English transl.: Soviet Math. Dokl., 38 (1989), no. 2, 394–399.
- [Tre9] ——— *Geometric methods in spectral theory of vector valued function: some recent results*, pp. 209–280 in: Toeplitz Operators and Spectral Function Theory (ed., N. Nikolski), Operator Theory: Adv. and Appl., 42, Basel, Birkhäuser-Verlag, 1989.
- [Tre10] ——— *Hankel operators, imbedding theorems, and bases of invariant subspaces of the multiple shift*, Algebra i Analiz, 1 (1989), no. 6, 200–234 (Russian); English transl.: Leningrad Math. J., 1 (1990), no. 6, 1515–1548.

- [Tre11] ——— *An inverse spectral problem for moduli of Hankel operators, and balanced realizations*, Algebra i Analiz, 2 (1990), no. 2, 158–182 (Russian); English transl.: Leningrad Math. J., 2 (1991), no. 2, 353–375.
- [Tre12] ——— *The stable rank of the algebra  $H^\infty$  equals 1*, J. Functional Analysis, 109 (1992), no. 1, 130–154.
- [Tre13] ——— *On the uniqueness of the best approximation by rational functions (Schur-Takagi problem)*, manuscript, 2000.
- [Tre14] ——— *Estimates in the corona theorem and ideals of  $H^\infty$ : a problem of T. Wolff*, to appear in J. Analyse Math.
- [TVa] S.R. TREIL AND V.I. VASYUNIN, *An inverse spectral problem for the modulus of a Hankel operators*, Algebra i Analiz, 1 (1989), no. 4, 54–66; (Russian); English transl.: Leningrad Math. J., 1 (1990), no. 4, 859–870.
- [TV1] S. TREIL AND A. VOLBERG, *A fixed point approach to Nehari’s problem and its applications*, pp. 165–186 in: Toeplitz operators and related topics, The Harold Widom anniversary volume, Workshop on Toeplitz and Wiener-Hopf operators, Santa Cruz, CA, USA, September 20–22, 1992, ed. E.L. Basor, Operator Theory: Adv. and Appl., 71, Basel, Birkhäuser, 1994.
- [TV2] ——— *Wavelets and the angle between past and future*, J. Funct. Analysis, 143 (1997), no. 2, 269–308.
- [TV3] ——— *Continuous frame decomposition and a vector Hunt-Muckenhoupt-Wheeden theorem*, Ark. Mat., 35 (1997), 363–386.
- [TV4] ——— *A simple proof of the Hunt-Muckenhoupt-Wheeden theorem*, Preprint, Mich. State Univ., 1997.
- [TV5] ——— *Completely regular multivariate stationary processes and Muckenhoupt condition*, Pacif. J. Math., 190 (1999), no. 2, 361–382.
- [Tren] T.T. TRENT *A new estimate for the vector valued corona problem*, to appear in J. Funct. Analysis.
- [Tr] H. TRIEBEL, *Spaces of Besov–Hardy–Sobolev type*, Leipzig, Teubner Verlag, 1978.
- [Ts] O.D. TSERETELI, *Metric properties of conjugate functions*, pp. 18–57 in: Itogi Nauki i Techniki Sovrem. Probl. Mat., 7, VINITI, Moscow, 1975 (Russian); English transl.: J. Soviet Math. 7 (1977), 309–414.
- [Tum] G.TS. TUMARKIN, *A description of a class of functions permitting approximation by fractions with preassigned poles*, Izvestia Akad. Nauk Armyan. SSR, Ser. Fiz. Mat., 1 (1966), no. 2, 89–105.
- [Us] I.V. UŠAKOVA [USHAKOVA], *A uniqueness theorem for holomorphic functions bounded in the unit circle*, Doklady Akad. Nauk SSSR, 130 (1960), 29–32 (Russian); English transl.: Soviet Math. Doklady, 1 (1960), 19–22.
- [VanC1] J.A. VAN CASTEREN, *Operators similar to unitary or selfadjoint ones*, Pacific J. Math., 104 (1983), no. 1, 241–255.
- [VanC2] ——— *Boundedness properties of resolvents and semigroups of operators*, pp. 59–74 in: Banach Center Publications, 38 (eds. J. Janas, F.H. Szafraniec, and J. Zemanek), Warszawa, 1997.
- [VanN] J.M.A.M. VAN NEERVEN, *Asymptotic behaviour of semigroups of linear operators*, Operator Theory: Adv. Appl., 88, Birkhäuser Verlag, Basel, 1996.
- [Var1] N.TH. VAROPOULOS, *Ensembles pics et ensembles d’interpolation pour les algèbres unimodulaires*, C.R. Acad. Sci. Paris, Sér. A, 272 (1971), 866–867.
- [Var2] ——— *Some remarks on  $Q$ -algebras*, Ann. Inst. Fourier, 22 (1972), 1–11.
- [Var3] ——— *Sur une inégalité de von Neumann*, C.R. Acad. Sci. Paris, ser. A-B, 277 (1973), A19–A22.
- [Vasil] F.-H. VASILESCU, *Analytic functional calculus*, Editura Academiei (Bucharest) and Reidel Publ. Co (Dordrecht), 1982.
- [Vas1] V.I. VASYUNIN, *Unconditionally convergent spectral decompositions and nonclassical interpolation*, Doklady Akad. Nauk SSSR, 227 (1976), no. 1, 11–14 (Russian); English transl.: Soviet Math. Dokl., 17 (1976), no. 2, 309–313.
- [Vas2] ——— *Construction of the function model of B. Sz.-Nagy and C. Foias*, Zapiski Nauchn. Semin. LOMI, 73 (1977), 6–23 (Russian); English transl.: J. Soviet Math., 34 (1986), no. 6, 2028–2033.

- [Vas3] ——— *Unconditionally convergent spectral decompositions and interpolation problems*, Trudy Math. Inst. Steklova, 130 (1978), 5–49 (Russian); English transl.: Proc. Steklov Math. Inst. (1979), no. 4, 1–53.
- [Vas4] ——— *Traces of bounded analytic functions on finite unions of Carleson sets*, Zapiski Nauchn. Semin. LOMI, 126 (1983), 31–34 (Russian); English transl.: J. Soviet Math., 27 (1984), no. 1, 2448–2450.
- [Vas5] ——— *Formula for multiplicity of contractions with finite defect indices*, pp. 281–304 in: Toeplitz Operators and Spectral Function Theory (ed., N. Nikolski), Operator Theory: Adv. and Appl., 42, Birkhäuser, 1989.
- [Vas6] ——— *On a biorthogonal function system related to the Riemann hypothesis*, Algebra i Analiz, 7 (1995), no. 3, 113–135 (Russian); English transl.: St. Petersburg Math. J., 7 (1996), no. 3, 405–419.
- [MV\*] V.I. VASYUNIN AND N.G. MAKAROV, *see* N.G. Makarov and V.I. Vasyunin.
- [NVa\*] V.I. VASYUNIN AND N.K. NIKOLSKI, *see* N.K. Nikolski and V.I. Vasyunin.
- [TVa] V.I. VASYUNIN AND S.R. TREIL, *see* S.R. Treil and V.I. Vasyunin.
- [GHVid] I.V. VIDENSKII, E.M. GAVURINA AND V.P. HAVIN [KHAVIN], *see* E.M. Gavurina, V.P. Havin [Khavin] and I.V. Videnskii.
- [ShV] I.V. VIDENSKII AND N.A. SHIROKOV, *see* N.A. Shirokov and I.V. Videnskii.
- [Vid] V.S. VIDENSKII, *On normally increasing functions*, Uspehi Matem. Nauk, 9 (1954), no. 2, 212–213.
- [Vinn] V. VINNIKOV, *Commuting operators and function theory on a riemann surface*, pp. 445–476 in: Holomorphic Spaces, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Vin1] S.A. VINOGRADOV, *On interpolation and zeros of power series with coefficients in  $l^p$* , Doklady AN SSSR, 160 (1965), no. 2, 262–266 (Russian); English transl.: Soviet Math. Dokl., 6 (1965), 57–60.
- [Vin2] ——— *Interpolation theorems of Banach-Rudin-Carleson type, and norm estimates of embeddings of certain classes of analytic functions*, Zapiski Nauchn. Semin. LOMI, 19 (1970), 6–54 (Russian); English transl.: Seminars in Mathematics, V.A. Steklov Math. Inst., Leningrad, 19 (1972), 1–28.
- [Vin3] ——— *Properties of multipliers of Cauchy-Stieltjes integrals, and some factorization problems for analytic functions*, pp. 5–39 in: Function theory and functional analysis, Proc. Seventh Winter School, Drogobych, 1974 (ed. B.S. Mityagin), C.E.M.I. AN SSSR, Moscow, 1976 (Russian); English transl.: Transl. Amer. Math. Soc. (2), 115 (1980), 1–32.
- [Vin4] ——— *A refinement of Kolmogorov's theorem on the conjugate function and interpolation properties of uniformly convergent power series*, Trudy Mat. Inst. Steklova, 155 (1983), 7–40 (Russian); English transl.: Proc. Steklov Inst. Math. 155 (1983), 3–37.
- [Vin5] ——— *Some remarks on free interpolation by bounded and slowly growing analytic functions*, Zapiski Nauchn. Semin. LOMI, 126 (1983), 35–46 (Russian); English transl.: J. Soviet Math. 27 (1984), 2450–2458.
- [GHVin] S.A. VINOGRADOV, E.A. GORIN AND S.V. HRUSCHEV [KHRUSCHEV], *see* E.A. Gorin, S.V. Hruschev [Khruschev] and S.A. Vinogradov.
- [HVin] S.A. VINOGRADOV AND V.P. HAVIN [KHAVIN], *see* V.P. Havin [Khavin] and S.A. Vinogradov.
- [RuVin] S.A. VINOGRADOV AND S.E. RUKSHIN, *see* S.E. Rukshin and S.A. Vinogradov.
- [Vit1] P. VITSE, *A tensor product approach to the operator corona problem*, to appear in Journal Operator Theory.
- [Vit2] ——— *Smooth operators in the commutant*, Preprint, Université Laval, Québec, 2001.
- [Voi] D. VOICULESCU, *A note on quasitriangularity and trace class self-commutators*, Acta Sci. Math. Szeged, 42 (1980), 195–201.
- [V1] A.L. VOLBERG, *The simultaneous approximation by polynomials on the circle and in the interior of the disc*, Zapiski Nauchn. Semin. LOMI, 92 (1979), 60–84 (Russian).
- [V2] ——— *Thin and thick families of rational functions*, Lect. Notes Math., 864 (1981), 440–480.
- [V3] ——— *Two remarks concerning the theorem of S. Axler, S.-Y. A. Chang and D. Sarason*, J. Operator Theory, 7 (1982), 209–218.



- [V4] ——— *Weighted density of polynomials on the line for strongly nonsymmetric weights*, Zapiski Nauchn. Semin. LOMI, 126 (1983), 47–54 (Russian); English transl.: J. Soviet Math., 27 (1984), 2458–2462.
- [V5] ——— *Matrix  $A_p$  weights via  $S$ -functions*, J. Amer. Math. Soc., 10 (1997), no. 2, 445–466.
- [V6] ——— *Carleson measures for  $K_\Theta$  cannot be checked on reproducing kernels*, Address to IWOTA 2000, Bordeaux.
- [Vu] Q. PH. VŨ [VŨ, QUỐC PHÔNG], *Theorems of Katznelson–Tzafriri type for semigroups of operators*, J. Funct. Anal., 103 (1992), 74–84.
- [Wa] J.-K. WANG, *Note on a theorem of Nehari on Hankel forms*, Proc. Amer. Math. Soc., 24 (1970), 103–105.
- [Wei] G. WEISS,  *$L^p$ -stability of a linear semigroup on a Hilbert space implies exponential stability*, J. Diff. Equations, 76 (1988), 269–285.
- [We1] J. WERMER, *On invariant subspaces of normal operators*, Proc. Amer. Math. Soc., 3 (1952), 270–277.
- [We2] ——— *On restrictions of operators*, Proc. Amer. Math. Soc., 4 (1953), no. 6, 860–865.
- [Wey1] H. WEYL, *Über beschränkte quadratische Formen, deren Differenz vollstetig ist*, Rend. Circolo Mat. Palermo, 27 (1909), 373–392.
- [Wey2] ——— *Inequalities between the two kinds of eigenvalues of a linear transformation*, Proc. Acad. Sci. USA, 35 (1949), 408–411.
- [Whi1] E.T. WHITTAKER, *On the functions, which are represented by expansions of the interpolation theory*, Proc. Roy. Soc. Edinburgh, 35 (1915), 181.
- [Whi2] ——— *Fourier theory of cardinal series*, 1935.
- [Wid1] H. WIDOM, *Inversion of Toeplitz matrices. II*, Illinois J. Math., 4 (1960), 88–99.
- [Wid2] ——— *Inversion of Toeplitz matrices. III*, Notices Amer. Math. Soc., 7 (1960), p. 63.
- [Wid3] ——— *Hankel matrices*, Trans. Amer. Math. Soc., 127 (1966), 179–203.
- [Wi1] N. WIENER, *On the closure of certain assemblages of trigonometric functions*, Proc. Nat. Acad. Sci. USA, 13 (1927), 27.
- [Wi2] ——— *Generalized harmonic analysis*, Acta Math., 55 (1930), 117–258.
- [Wi3] ——— *The Fourier integral and certain of its applications*, New York, Cambridge Univ. Press, 1933.
- [Wi4] ——— *Extrapolation, interpolation, and smoothing of stationary time series. With engineering applications*, Cambridge, Mass., MIT Press; New York, Wiley&Sons, 1949.
- [WH] N. WIENER AND E. HOPF, *Über eine Klasse singulärer Integralgleichungen*, S.-B. Preuss Akad. Wiss. Berlin, Phys.-Math. Kl., 30/32 (1931), 696–706.
- [MW\*] N. WIENER AND P.R. MASANI, *see P.R. Masani and N. Wiener*.
- [Wog1] W.R. WOGEN, *On some operators with cyclic vectors*, Indiana Univ. Math. J., 27 (1978), no. 1, 163–171.
- [Wog2] ——— *On cyclicity of commutants*, Integral Equat. and Operator Theory, 5 (1982), 141–143.
- [Woj] P. WOJTAŚCZYK, *Banach spaces for analysts*, Cambridge Univ. Press, 1991.
- [Wol] H. WOLD, *A study in the analysis of stationary time series*, Almqvist och Wiksell, Uppsala, 1938.
- [HWo] H. WOLF AND V.P. HAVIN [KHAVIN], *see V.P. Havin [Khavin] and H. Wolf*.
- [WolF] J. WOLFF, *Sur les séries  $\sum \frac{A_n}{z-z_n}$* , C.R. Acad. Sci. Paris, 173 (1921), 1056–1059, 1327–1328.
- [Wolff1] TH.H. WOLFF, *Counterexamples to two variants of the Helson-Szegő theorem*, manuscript, 1980.
- [Wolff2] ——— *Two algebras of bounded functions*, Duke Math. J., 49 (1982), 321–328.
- [Wolff3] ——— *A refinement of the corona theorem*, pp. 399–400 in: *Linear and complex analysis problem book. 199 research problems* (Eds., N. Nikolski, V. Havin and S. Hruschew), Lect. Notes Math., 1043, Springer Verlag, 1984.
- [Wo] W.M. WONHAM, *Linear multivariable control: a geometric approach*, Springer-Verlag, Heidelberg, 1979.
- [Wr] V. WROBEL, *Analytic functions into Banach spaces and a new characterization for isomorphic embeddings*, Proc. Amer. Math. Soc., 85 (1982), 539–543.

- [Wu] ZH. WU, *Function theory and operator theory on the Dirischlet space*, pp. 179–199 in: *Holomorphic Spaces*, eds. Sh. Axler, J. McCarthy and D. Sarason, MSRI Publications, 33, Cambridge Univ. Press, 1998.
- [Xia] D. XIA, *Spectral theory of hyponormal operators*, *Operator Theory: Advances and Appl.*, 10, Birkhäuser–Verlag, 1983.
- [Yaf] D.R. YAFAEV, *Mathematical scattering theory*, St. Petersburg University, St. Petersburg, 1994 (Russian); English transl.: *Transl. Math. Monographs series*, 105, Amer. Math. Soc., Providence, RI, 1992.
- [Yak1] D.V. YAKUBOVICH, *Riemann surface models of Toeplitz operators*, pp. 305–415 in: *Operator theory: Advances and applications*, 42, Basel, Birkhäuser, 1989.
- [Yak2] ——— *Spectral multiplicity of Toeplitz operators with smooth symbols*, *Amer. J. Math.*, 115 (1993), no. 6, 1335–1346.
- [Yak3] ——— *Subnormal operators of finite type, I and II.*, *Revista Mat. Iberoamericana*, 14 (1998), no. 1, 95–115, 14 (1998), no. 3, 623–681.
- [You] N.J. YOUNG, *Balanced realizations in infinite dimensions*, pp. 449–471 in: *Operator Theory: Adv. Appl.*, 19, Birkhäuser Verlag, Basel, 1976.
- [Y1] R.M. YOUNG, *An introduction to nonharmonic Fourier series*, London, Academic Press, 1980.
- [Y2] ——— *On complete biorthogonal systems*, *Proc. Amer. Math. Soc.*, 83 (1981), no. 3, 537–540.
- [Zab] J. ZABCZYK, *A note on  $C_0$ -semigroups*, *Bull. Acad. Polon. Sci. Sér. Math.*, 23 (1975), 895–898.
- [JZ] V.P. ZAKHARYUTA AND V.I. JUDOVICH, see V.I. Judovich and V.P. Zakharyuta.
- [Zas] V.N. ZASUKHIN. *On the theory of multivariate stationary processes*, *Doklady Akad. Nauk SSSR*, 33 (1941), 435–437 (Russian).
- [Zhu] K.H. ZHU, *Operator theory in function spaces*, *Monographs and Textbooks in Pure and Appl. Math.*, 139, Marcel Dekker Inc, N.Y., 1990.
- [Z] A. ZYGMUND, *Trigonometric series, Vol. I and II.*, Cambridge University Press, 1959.

## Author Index

- Abakumov, viii, 18, 83, 90, 295, 305, 306, 396  
Adamyán, 183, 205, 207, 213, 217, 224, 225, 241, 333, 337, 348, 349  
Agler, 241  
Aizenberg, 60  
Akhiezer, 75, 77, 87, 140, 240, 325, 326, 329, 374  
Aleksandrov, viii, 18, 20, 83, 90, 136, 137, 139, 141, 194, 207, 208  
Aleman, 16, 18, 19  
Allan, 390, 391, 399  
Alpay, 326, 327  
Amar, 327  
Anderson, 374  
Ando, 327, 349  
Apostol, 18  
Arakelian, 61  
Arazy, 364, 373, 375  
Arendt, 61  
Arocena, 204  
Aronszajn, 18, 317–320, 326, 327  
Arov, 183, 205, 207, 213, 217, 224, 225, 241, 333, 337, 348, 349  
Arsene, 205  
Arveson, 208, 278, 347, 385, 398  
Atkinson, 329  
Avetisyan, 375  
Avram, 277  
Axler, 131, 198, 202, 222, 224, 225, 254, 268, 271, 301, 302, 374  
  
Babenko, 130  
Bachelis, 347  
Badea, 209  
Baez–Duarte, 171  
Bagemihl, 59  
Balazard, 171  
Ball, 161, 204, 239–241, 329  
Banach, 94, 100, 139  
Baranov, viii  
Baratchart, 60  
Bari, 104, 140  
Barth, 59  
Baumgärtel, 306  
Baxter, 276  
Beatrous, 240  
  
Beckenbach, vii  
Bellman, vii  
Bercovici, 18, 19, 29, 171  
Berenstein, 89  
Berg, 325, 326, 374  
Bergh, 138  
Bergman, 18, 326  
Bernstein, 77, 87  
Besov, 374  
Beurling, 9, 14, 17–19, 29, 58, 89, 141, 171, 216  
Bhatia, 349, 350  
Bishop, 398  
Blasco, 62, 135, 210  
Bloomfeld, 396  
Boas, 91, 347  
Bochner, 325, 326, 390, 399  
Bonami, 269, 278, 327  
Bonsall, 196, 204, 220, 224, 225, 241, 273  
Boole, 137  
Borel, 141  
Borichev, viii, 18, 77, 78, 87, 90, 162  
Böttcher, 224, 225, 265, 269–272, 274–277  
Bourgain, 119, 134, 137, 139, 193, 208, 209  
Bram, 75, 89  
Bratteli, 194  
Bridges, 398  
Brodsii, 62  
Brown, 139, 141, 269, 270  
Browning, vii  
Brudnyi, 374  
Bruna, 269, 278  
Bukhvalov, 62, 134  
Burbea, 240  
Burkholder, 134  
Butz, 305, 348, 349  
  
Cantor, 306  
Carathéodory, 237, 239, 324  
Carleman, 141, 341, 350  
Carleson, 115, 130, 137, 140, 156, 162, 388, 397  
Cassier, 209  
Chang, 224, 225, 254, 268, 271, 272  
Christensen, 325, 326  
Cima, 20, 60, 90  
Clancey, 270, 275

- Clark, 136, 278, 300, 307, 349  
 Coburn, 224, 258, 269, 272, 274  
 Cohen, 398  
 Cohn, 139, 201  
 Coifman, 131, 132, 135, 138, 140, 360, 363,  
     372, 374, 375  
 Cole, 241  
 Collingwood, 59  
 Conway, 17, 28  
 Cotlar, 132, 133, 136, 201, 204, 241  
 Cowen, 170, 171
- Danilevich, 62  
 David, 132  
 Davidson, 139, 194, 209, 241, 278, 347, 349,  
     350  
 Davis, 209, 350  
 de Branges, v, 19, 58, 78, 87, 171, 320,  
     326–328.  
 de Leeuw, 85, 88  
 Denjoy, 141  
 Devinatz, 86, 88, 250, 263, 270, 272, 273  
 DeVore, 140, 210  
 Dijkma, 242  
 Djrbashian, 60  
 Dolzhenko, 374  
 Donoghue, 240  
 Dostal, 89  
 Douglas, 29, 44, 61, 81, 83, 86, 88, 90, 170,  
     171, 185, 224, 253, 254, 259, 267,  
     269–275, 285, 302, 305  
 Dovbysh, 105, 129, 140  
 Duncan, 241  
 Dunford, 46, 48, 61, 346, 350  
 Duren, 18, 57, 58, 91, 363, 375, 397  
 Dyakonov, 195, 210, 271  
 Dym, 240, 326, 396  
 Dyn'kin, 132, 134, 136–138, 140, 375
- Edwards, H., 171  
 Edwards, R., 139, 140, 210, 275  
 Ehrenpreis, 89  
 Eiderman, 61  
 El-Fallah, 266, 275, 398  
 Enflo, 347  
 Esterle, 17  
 Exel, 205
- Faddeev, 171  
 Fatou, 39, 57, 58  
 Fefferman, 126, 139, 206  
 Fejér, 237, 315  
 Feldman, 269, 272–276  
 Ferguson, 139, 193, 208  
 Ferrier, 89  
 Fillmore, 209  
 Fischer, 364, 373, 375  
 Foguel, 208
- Foias, 18, 19, 61, 85, 88, 151, 161, 171, 205,  
     208, 230, 239–241, 385, 398  
 Frazho, 161, 205, 239–241  
 Fredholm, 342  
 Fricain, 171  
 Friedrichs, 129  
 Frobenius, 301  
 Frostman, 45, 58, 61  
 Fuglede, 188  
 Fuhrmann, 300, 307, 388, 397  
 Fulton, 350
- Gabriel, 151  
 Gaier, 17  
 Gamal, viii  
 Gamelin, 17, 162  
 Gantmacher, 205, 304, 347, 349, 350  
 Garcia-Cuerva, 132  
 Garnett, 61, 132, 139, 162, 206, 225, 239,  
     241, 272, 274, 305, 327, 348, 397, 398  
 Gasparov, vii  
 Gaudry, 139, 140, 275  
 Gauthier, 61  
 Gavurina, 60  
 Gelfand, 273, 326  
 Gershgorin, 302, 307  
 Gheondea, 205  
 Gillespie, 135, 273  
 Ginzburg, 62  
 Gohberg, 62, 161, 239–241, 269–276, 278,  
     329, 342–350  
 Goldberg, 269, 275, 278, 346  
 Goluzin, 58, 60, 224  
 Gonchar, 141, 374  
 Graham, 152, 206, 273, 275, 375  
 Grenander, 269, 277, 325  
 Gribov, 90  
 Grigoryan, 375  
 Grudsky, 272, 275  
 Gurarii, 171
- Hadamard, 302  
 Hall, 77, 87  
 Halmos, 208, 269, 270, 376  
 Hamburger, 129, 310, 325, 327  
 Hankel, 309  
 Hardy, 124, 171, 195, 209, 210, 340, 349  
 Hartman, 214, 224, 248, 270  
 Hartmann, viii  
 Hasumi, 18  
 Hausdorff, 325  
 Havin, 17, 19, 29, 59, 60, 90, 130, 139, 162,  
     272, 375, 397, 398  
 Hayashi, 271, 396  
 Hayman, 61  
 Hedenmalm, 16, 18–20, 60, 90, 131, 162,  
     224  
 Helson, 9, 12, 17, 19, 29, 61, 75, 86, 88, 91,  
     130, 151, 396

- Helton, 204, 240  
 Herglotz, 42, 58, 239, 315, 324, 327  
 Herrero, 209  
 Hilbert, 131, 195, 209, 325, 341, 350  
 Hildebrandt, 209  
 Hille, 46, 49, 61, 151, 342  
 Hitt, 18  
 Hoffman, 140, 162, 224, 272  
 Holbrook, 350  
 Hopf, 270, 273, 275  
 Hörmander, 275  
 Horn, 340, 349  
 Howland, 302–305, 372, 397  
 Hruschev, 128, 137, 141, 201, 221, 222, 224,  
     368, 372, 375–378, 381, 396  
 Hunt, 112, 119, 130, 140  
  
 Ibragimov, 396  
 Iokhvidov, 204, 205  
 Ismagilov, 278  
 Izumi, 77, 87  
  
 Jacob, 131  
 Jakobsson, 16  
 Janson, 203, 373, 393, 396  
 Jensen, 55  
 Jewell, 396  
 Johnson, 349  
 Jones, 61, 327  
 Jöricke, 29, 59, 90, 162, 375  
 Judovich, 362, 363, 375  
 Julia, 186, 206  
  
 Kaashoek, 240, 241, 269, 275, 278, 346  
 Kac, I., 326, 329  
 Kac, M., 157  
 Kaczmarz, 375  
 Kahane, 206, 350  
 Kakutani, 397  
 Kapustin, viii  
 Karlovich, 272, 275  
 Kashin, 210  
 Kato, 61, 347, 349  
 Katsnel'son, 240  
 Katznelson, 326  
 Kawata, 77, 87  
 Keldysh, 89  
 Khavinson, vii, 16, 20, 60, 327  
 Kheifets, 240  
 Kislyakov, viii, 90, 206, 207, 376  
 Klemeš, 210  
 Klyachko, 350  
 Knutson, 350  
 Kolmogorov, 11, 26, 28, 65, 87, 88, 97, 100,  
     114, 130, 139, 140, 151, 210, 396  
 König, 346  
 Konyagin, 195, 210  
 Koosis, 19, 59, 77, 78, 87, 133, 136, 138,  
     139, 206, 241, 327, 397  
  
 Koranyi, 323, 328  
 Korenblum, 18–20, 60, 89, 131, 224  
 Kovalishina, 240  
 Krein, 28, 62, 78, 86–88, 138, 151, 183, 205,  
     207, 213, 217, 224, 225, 237, 239, 241,  
     269, 272, 273, 278, 324–326, 329, 333,  
     337, 345–350  
 Kriete, 28, 87  
 Kronecker, 217, 225  
 Krupnik, 269–272, 274, 275  
 Krylov, 60, 151  
 Kupin, viii  
 Kuroda, 344, 350  
 Ky Fan, 204, 339, 341  
  
 Lacey, 279  
 Lance, 16, 20  
 Lavrentiev, 13, 17, 75  
 Lax, 14, 19, 149, 151  
 Lebedev, 328  
 Lebesgue, 11, 116  
 Leblond, 60  
 Leech, 393  
 Lehto, 59  
 Lévi, 52  
 Levin, 91  
 Levinson, 130, 140  
 Lidskii, 349  
 Lifshic, 350  
 Lin, 224, 399  
 Lindelöf, 305  
 Lindenstrauss, 129, 347, 399  
 Lions, 122, 141, 374  
 Littlewood, 56, 58, 124, 139, 210, 340, 349  
 Litvinchuk, 269, 270, 275  
 Livshic, 62, 325  
 Lizorkin, 374  
 Löfström, 138, 374  
 Lohwater, 59  
 Lorentz, 140, 210  
 Lowdenslager, 19, 86, 88, 151  
 Luecking, 131, 198, 204, 373  
 Lusin, 19, 59, 131, 140  
 Lyubarskii, 60  
 Lyubich, 325  
  
 MacLane, 59  
 Magnus, 303  
 Makarov, 128, 141  
 Malgrange, vii  
 Mandelbrojt, 87  
 Marcinkiewicz, 120, 121, 141  
 Marcus, 307, 328, 347  
 Markus, 104, 128, 129, 141, 276, 342, 350,  
     390, 399  
 Marshall, 61, 272, 349  
 Martinez-Avenidaño, 296, 306, 396  
 Masani, 29, 86, 88, 90, 160, 396  
 Matsaev, 136, 278

- Matveev, 86, 88, 90  
 McGehee, 152, 195, 206, 210, 273, 275, 375  
 McIntosh, 350  
 McKean, 396  
 Megretskii, 293, 299, 305, 306, 377, 384, 396  
 Mercer, 326  
 Mergelyan, 77, 87, 374, 376  
 Meyer, 132, 135, 138  
 Mikhlín, 269, 270, 276  
 Milin, 328  
 Minc, 307, 328, 347  
 Montel, 54  
 Moore, 317, 326  
 Mourre, 304  
 Muckenhoupt, 112, 119, 130, 140  
 Muirhead, 349  
 Murphy, 17, 285, 305  
 Murray, 17  
  
 Naimark, 326, 328  
 Nakazi, 133, 196, 205  
 Natanson, 128, 141  
 Nazarov, 130–133, 135, 207, 306, 376  
 Nehari, 182, 205  
 Nevanlinna, F., 58  
 Nevanlinna, O., 375  
 Nevanlinna, R., 58, 234, 237, 239, 241, 324  
 Newman, 61, 115, 120, 161  
 Nicolau, 61  
 Nieto, 122, 123, 141  
 Nikodym, 11  
 Nikolski, 17–20, 28, 29, 58, 61, 62, 83–85,  
     88–91, 105, 128–132, 139–141, 152,  
     162, 171, 205, 207, 224, 225, 241, 266,  
     269–275, 302, 303, 326–328, 348, 349,  
     375, 396–399  
 Nikol'sky, 374  
 Noshiro, 59  
 Nudel'man, 236, 239, 242, 325  
 Nyman, 161, 170, 171  
  
 O'Neill, 61  
 Ober, 396  
 Olkin, 349  
 Ostrovski, 340, 350  
  
 Page, 134, 189, 196, 207  
 Paley, 129, 130, 139, 146, 151, 191, 206  
 Papoulis, 160  
 Parodi, 307  
 Parrott, 205  
 Parter, 277  
 Partington, 60, 131, 372  
 Patil, 60  
 Pau, 61  
 Paulsen, 139, 193, 194, 208, 209  
 Pavlov, 171  
 Percy, 18, 19  
 Pedersen, viii  
  
 Peetre, 122, 141, 201, 203, 363, 364,  
     373–375  
 Pekarskii, 374, 375  
 Pelczynski, 119, 137, 162  
 Peller, 139, 194, 200, 202, 206–208, 221,  
     222, 224, 278, 299, 302, 305, 306, 344,  
     347, 348, 350, 352, 361, 364–368, 370,  
     372–375, 377–384, 396  
 Perron, 301  
 Petermichl, 114, 132, 140, 207  
 Petersen, 137  
 Petunin, 138  
 Phillips, 46, 49, 61, 390, 399  
 Pick, 233, 237, 239, 324  
 Pietsch, 346, 347  
 Pigno, 195, 210  
 Piranian, 141  
 Pisier, 131, 194, 207, 208  
 Pitts, 241  
 Plessner, 58  
 Poltoratski, 137  
 Polya, 49, 91, 171, 210, 327, 340, 349  
 Pommerenke, 58  
 Potapov, 62, 240  
 Pott, 135  
 Power, 196, 204, 205, 220, 224, 225, 293,  
     300, 302, 303, 305–307, 348, 372, 374,  
     396  
 Privalov, 19, 59, 305  
 Pták, 205  
 Putinar, 325  
 Putnam, 188, 304  
  
 Quiggin, 241  
  
 Radjavi, 28  
 Radon, 11  
 Raikov, 273, 326  
 Reed, 304  
 Rehtman, 237, 239, 324  
 Reich, 276  
 Reinhard, 160  
 Ressel, 325, 326  
 Richter, 15, 16, 18, 19  
 Riemann, 171  
 Riesz, F., 26, 42, 57–59, 205, 239, 315, 324,  
     327  
 Riesz, M., 26, 58, 59, 115, 117, 138, 140,  
     310, 325  
 Ringrose, 278  
 Robinson, 194  
 Rochberg, 131, 196, 202–204, 224, 225, 360,  
     363, 372–375  
 Rodman, 161, 239–241, 329  
 Romberg, 363, 375  
 Rosay, 61  
 Rosenblum, 61, 88, 103, 139, 196, 205, 207,  
     209, 237, 239–242, 269, 275, 278, 302,  
     303, 326, 372, 388, 393, 394, 397, 398

- Rosenthal, 28, 209  
 Ross, 18, 20, 90  
 Rota, 209  
 Rovnyak, 19, 61, 88, 237, 239–242, 269,  
     275, 278, 302, 326, 327  
 Rozanov, 29, 86, 88, 90, 269, 396  
 Rubio de Francia, 132  
 Rudin, 18, 44, 48, 49, 61, 85, 88, 90, 115,  
     140, 156, 161, 162, 206, 238, 241, 285,  
     305, 326, 346, 375, 376  
 Saakyan, 210  
 Sadosky, 132, 133, 136, 201, 204, 241  
 Saias, 171  
 Saitoh, 18, 326  
 Sarason, 17, 18, 130, 136, 207, 221, 224,  
     225, 229, 230, 240, 241, 253–255, 267,  
     268, 271, 272, 327, 396  
 Schaefer, 49  
 Schatten, 346  
 Schmidt, 170, 171, 341, 347, 349, 350  
 Schneider, 59  
 Schubert, 385, 398  
 Schur, 232, 234, 238, 239, 303, 319, 327  
 Schwartz, vii, 46, 48, 61, 346, 350  
 Seidel, 59  
 Seip, 60  
 SeLegue, 277  
 Semenov, 138  
 Sementsul, 390, 399  
 Semmes, 201, 366, 372, 375  
 Senichkin, 130  
 Seybold, 275  
 Shamoyan, 60, 90  
 Shannon, 160  
 Shapiro, vii, 58, 80, 81, 83, 89, 90, 394, 395,  
     398  
 Sherman, viii  
 Shevchuk, 62  
 Shields, 81, 83, 89, 90, 139, 141, 363, 375  
 Shilov, 271, 273  
 Shimorin, viii, 15, 16, 19, 20  
 Shimbrot, 270  
 Shirokov, 18, 60  
 Shohat, 325  
 Sibilev, 17, 129, 141  
 Silbermann, 224, 225, 265, 269–272,  
     274–277  
 Simon, 304, 347, 371, 376  
 Simonenko, 271, 272  
 Singer, 129, 224, 272  
 Smirnov, 17, 19, 23, 29, 42, 57, 67, 87, 90,  
     91, 100, 139  
 Smith, 195, 210  
 Sodin, 78, 87  
 Spitkovsky, 269, 270, 272, 275  
 Srinivasan, 17, 18  
 Stechkin, 264, 275  
 Stein, 57, 123, 126, 132, 135–141, 206, 374  
 Steinhaus, 375  
 Stessin, 16, 20, 60  
 Stieltjes, 309  
 Stolz, 39  
 Stone, 13  
 Stroethoff, 224  
 Strouse, 225  
 Sudakov, 105, 129, 140  
 Sundberg, 16, 18, 19  
 Sz.-Nagy, 19, 61, 85, 88, 151, 205, 207, 208,  
     230, 323, 328, 385, 388, 397, 398  
 Szegő, 19, 23, 26, 28, 49, 58, 65, 87, 91,  
     130, 151, 171, 269, 277, 304, 320, 325,  
     327, 328  
 Tamarkin, 151, 325, 342  
 Tao, 350  
 Taylor, 89, 274  
 Tchebyshev, 121, 138  
 Thiele, 279  
 Thomas, 61  
 Thomson, 28, 87  
 Thorin, 138  
 Titchmarsh, 171  
 Toeplitz, 239, 269, 309, 324  
 Tolokonnikov, 200, 201, 205, 266, 275, 388,  
     397, 398  
 Totaro, 350  
 Treil, 85, 88, 105, 108, 110, 113, 130–136,  
     140, 198, 199, 201, 202, 204, 207, 266,  
     275, 276, 296, 299, 305, 306, 348, 377,  
     378, 384, 396–398  
 Trent, 398  
 Triebel, 374  
 Tsereteli, 115, 136, 137  
 Tumarkin, 83, 90  
 Tzafiriri, 129, 347, 399  
 Uchiyama, 397  
 Ushakova, 60  
 Vasilescu, 325  
 Vasyunin, viii, 19, 58, 83–85, 88, 90, 171,  
     305, 326–328, 388, 396, 397  
 Verbitskii, 139, 201  
 Videnskii, 60, 77, 87  
 Vinogradov, 105, 127, 130, 137, 141, 161,  
     201, 206, 368, 370, 375, 376  
 Vitali, 124  
 Vitse, viii, 399  
 Volberg, 17, 28, 78, 87, 90, 91, 105, 107,  
     108, 110, 113, 130–136, 140, 198, 199,  
     201, 202, 204, 207, 224, 254, 268, 271,  
     396  
 von Neumann, 13, 17, 344, 346, 350  
 Vrbová, 205  
 Wang, 205  
 Weierstrass, 13

- Weiss, 123, 131, 140, 141, 363, 375  
Wermer, 13, 15, 17, 19, 241  
Weyl, 339, 341, 349  
Wheeden, 112, 119, 130, 140  
Widom, 250, 263, 270, 272, 312, 313, 327  
Wiener, 8, 17, 29, 86, 88, 90, 129, 130, 146,  
    151, 154, 155, 160, 185, 270, 271, 273,  
    275, 396  
Williams, 208  
Wintner, 248, 270  
Witter, 114, 132, 140  
Wojtaszczyk, 206, 347, 350  
Wold, 11, 88  
Wolf, 272  
Wolff, J., 14, 17, 141  
Wolff, Th., 222, 224, 266, 275, 398  
Wright, 171  
Wrobel, 61  
Wu, 202  
  
Yakubovich, 278  
Yamamoto, 133  
Yang, 28  
Young, 129, 130, 210, 241  
Yuditskii, 240  
  
Zakharyuta, 362, 363, 375  
Zaremba, 326  
Zarrabi, 266, 275, 398  
Zasukhin, 86, 88  
Zeller, 139, 141  
Zheng, 131  
Zhu, 18–20, 60, 131, 202, 204, 224, 225,  
    372–374, 398  
Zygmund, 57, 59, 120, 125, 139, 206, 275,  
    350, 375



# Subject Index

- $(A_2), (A_p)$ , *see also* Muckenhoupt condition
- AAK, *see also* Theorem, Lemma,
  - Adamyan–Arov–Krein, 205, 241
  - formula, 348
  - step-by-step extension, 183, 189
- Adamyan–Arov–Krein, *see also* AAK
- admittance, 155
- algebra
  - almost periodic functions, 393
  - $C^*$ , 286
  - disk, *see also* disk algebra
  - Douglas, *see also* Douglas
  - generated by  $f$  and  $H^\infty$ , 254
  - Toeplitz, *see also* Toeplitz, algebra
  - triangular, 387
  - Wiener, *see also* Wiener
- all-pass, *see also* filter
- almost
  - orthogonal, *see also* asymptotically orthogonal
  - periodic function, *see also* algebra
- amplitude
  - distortion, 155
  - spectrum, 153
- analytic
  - function, *see also* vector valued
  - measure, *see also* measure
- angle
  - between past and future, 29, 379
  - between subspaces,  $\alpha = \langle L, M \rangle$ , 95, 104, 379
  - operator, 380
- approximate
  - solution ( $\epsilon$ -), 380
- approximation, *see also* completeness
  - by Blaschke products, 44, 61
  - by inner functions, 44
  - polynomial, 87, 374
    - weighted, 22, 88
  - property, (AP), 218, 347, 399
  - rational (best), 378
    - rate of, 367
- (ARN), *see also* Radon–Nikodym property (analytic)
- asymptotically
  - orthogonal, 381
  - stable, *see also* stable
- (B), *see also* Blaschke condition
- B.Ph.A.M.S, *see also* Bochner–Phillips–Allan–Markus–Sementsul theory
- backward shift, *see also* shift
- Banach
  - function space, *see also* Space, function class
  - generalized limit, 268
    - weak, 388
  - lattice, 62, 368
  - theorem, *see also* Theorem, Lemma
- bandpass, *see also* filter
- basic sequence, *see also* sequence, 94
- basis, *see also* sequence
  - Abel–Poisson, 103
  - conditional, 130
  - generalized, 103
  - Markushevich, 129
  - non-symmetric, 94
  - Riesz, *see also* Riesz
  - symmetric, 94
  - unconditional, 103
  - uniformly minimal, *see also* sequence
- Berezin, *see also* transform
- best rational approximation, *see also* approximation, rational
- Bezout equation
  - (generalized) and Toeplitz operators, 393
  - and local power bounds, 388
  - left, *see also* invertibility, left
  - right, *see also* invertibility, right
  - with separated singularities, 394
- biorthogonal, 93, 200
- Blaschke
  - condition (B), 37, 165
    - on  $C_+$ , 147
  - factor, 37, 165
  - product, 37, 147
    - approximation by, *see also* approximation
- Blaschke–Potapov product, 62
- Bochner
  - integrable, *see also* integrable

- integral, 47
- Bochner–Phillips–Allan–Markus–Sementsul theory, *see also* invertibility, left; Theorem, Lemma
- Bohr mean motion, 274
- boundary
  - limit
    - of  $f \in H^p$ , 34
    - of  $f \in H^p(\mathbb{T}, E)$ , 51
- (C), *see also* Carleson, condition
- Calderon–Zygmund, *see also* singular integral
- Calkin algebra, 212, 218
- canonical anticommutation relation, (CAR), 194
- canonical factorization, *see also* factorization
- (CAR), *see also* canonical anticommutation relation, 208
- Carathéodory–Fejér problem, *see also* interpolation
- Carleson
  - condition, 273, 296
  - measure, 105, 109, 151, 199, 202, 206, 314, 327
  - vanishing, 314, 327
  - sequence, *see also* Carleson condition
  - window, 314
- Cauchy, *see also* transform
  - integral, kernel
    - in  $\mathbb{C}_+$ , 150
  - transform, *see also* transform
- causal, *see also* filter
- center (of an algebra), 390
- class of functions, *see also* Space, function class
- class of operators
  - Hilbert–Schmidt, *see also* Hilbert–Schmidt
  - Schatten–Lorentz, *see also* Schatten–Lorentz
  - Schatten–von Neumann, *see also* Schatten–von Neumann
  - trace, *see also* trace
- $\text{clos } E$ , 7
- cluster set, 58
- (c.n.u.), *see also* completely nonunitary
- commutant, 229
  - in a RKHS, 322
  - lifting, *see also* Theorem, Lemma, commutant lifting
- commutator, 135, 215, 253
  - ideal, 274
- commuting, *see also* operator
- complementary spaces, 319, 327
- complete
  - hereditarily (HC), 103, 104
  - sequence, *see also* sequence
- completely
  - nonunitary, 11
  - polynomially bounded, *see also* operator
- completeness, *see also* approximation, *see also* translates
  - of polynomials, 65, 75
  - of vector valued polynomials, 84
- completion (extension), *see also* matrix composition
  - operator, 56
- compression, 228
- condition number, 277
- conformally equivalent, 73
- conjecture
  - Szökefalvi-Nagy–Halmos, 208
- conjugation, *see also* harmonic conjugate
- constant of uniform minimality, *see also* sequence, uniformly minimal
- contraction, 186
  - c.n.u., *see also* completely nonunitary
- contractive, 62
- convolution, 33, 184
- convolutor, 155, 161
- coordinate
  - functional, 93, 94, 104
  - projection, 94
- corona, *see also* Theorem, Lemma, Carleson, 389
  - problem, 385, 388, 389
- cross norm, *see also* normed ideal
- Cyc, 66
- cyclic, *see also* cyclicity, 8, 66, 75, 79–81, 88
  - 1-cyclic, 66
  - 2-cyclic, 66
  - function, vector, 66
  - $S$ -cyclic,  $S \subset \mathbb{R}$ , 161
- cyclicity, *see also* cyclic
  - splitting of, *see also* splitting
- de Branges formula, 319
- describable (in terms of  $BMO$  rational approximations), 368
- design problem, *see also* filter
- determining boundedness, 48
- determining set, 46
- deterministic, *see also* process
- dilation, 228
  - step-by-step, *see also* AAK
  - unitary, 206
- Dirichlet kernel, 33
- disk algebra, 18, 71, 171, 371
- distance
  - function (formula), 164
  - dual, 164
  - local, *see also* local
- distortion, *see also* amplitude
- distribution
  - function, 114
  - tempered, 262

- Divisibility (of inner functions), 24
- divisor, 216, 223
- domain
  - frequency, *see also* frequency
  - time, *see also* time
- dominating subset, 61, 127
- doubling condition, 133
- Douglas algebra, 272
- DTRA, *see also* describable
- dual operator algebra approach, 19
- duality
  - $H_{\text{Re}}^1$  and  $BMO$ , 190
  - $\mathfrak{S}_1$  and  $L(H)$ , 343
  - $\mathfrak{S}_p$  and  $\mathfrak{S}_{p'}$ , 343
  - of  $H^p$ , 127, 182
  - of  $\mathcal{H}\mathfrak{S}_p$ , 373
  - of Bergman, Besov and Bloch spaces, 362
- embedding theorem, *see also* Theorem, Lemma, Carleson (embedding)
  - weighted, 110
- energy
  - density, 153
  - spectrum, 155
- entropy, 155, 159
- essential
  - norm, 212
  - range, 247
  - spectrum, 212
- Euler–Gamma function, 169
- exponential
  - type, 150
- exponentials
  - nonharmonic, 130
- exposed point, 130
- extension, step-by-step, *see also* AAK
- extreme point, 85
- factorable weight, *see also* weight
- factorization
  - canonical (Riesz–Smirnov), 29, 57, 62, 147, 148, 155, 182, 275
    - in  $\mathbb{D}$ , *see also* Theorem, Riesz–Smirnov
    - in  $\mathbb{C}_+$ , *see also* Theorem, Lemma
  - inner-outer, 23, 29, 57, 236
    - in  $\mathbb{C}_+$ , 148
  - operator valued, 14, 62
- Fejér kernel, 33
- filter, 153
  - all-pass, 155
  - bandpass, 155
  - causal recursion, 157
  - causal, physically realizable, 153
  - continuous time, 159, 160
  - design problem, 155
  - identification problem, 161
  - linear, 153
  - matched, 156
  - minimal phase, 155
  - optimal, 156
  - stable, 159, 161
  - stationary, 153
  - synthesis, 155
  - time-invariant, 153
- final space, 187, 300
- “finite defect” basis property, 273
- finite differences, 352
- finite section method, 275, *see also* Toeplitz operator, 294
  - invertible by, 276
- Foguel
  - Hankel operator, *see also* operator
  - operator, *see also* operator
- Fourier
  - coefficients
    - of Lipschitz functions, 342
  - multiplier, 263
  - series, 9, 94, 161
    - component (projection on the  $n$ -th), 94
    - generalized, 129
    - majorization property, 347
  - transform, *see also* transform
- Fredholm
  - operator, *see also* operator
  - spectrum, 219
- Fredholm–Riesz–Schauder theory, 346
- free
  - interpolation, *see also* interpolation
- frequency
  - characteristic, 155
  - domain, 153
  - response, 155
- Frostman
  - Theorem, *see also* Theorem, Lemma
- function
  - countably valued, 46
  - distance, *see also* distance
  - Green’s, *see also* Green
  - Hardy–Littlewood maximal, *see also* Hardy–Littlewood
  - inner, *see also* inner
  - Littlewood–Paley, *see also* Littlewood–Paley
  - Lusin, 138
  - nontangential maximal, 138
  - outer, *see also* outer
  - piecewise continuous, *see also* piecewise continuous
    - quasi-continuous, *see also* quasi-continuous
  - radial maximal, *see also* radial maximal
  - singular, *see also* singular
  - transfer, *see also* transfer
  - weighting, *see also* weighting
- functional
  - calculus, *see also*  $H^\infty$  functional calculus

- Gamma function, *see also* Euler–Gamma function
- Garsia norm, 131, 190, 206
- Gaussian, *see also* process, stationary
- GCD, *see also* greatest common divisor
- Gelfand theory, 389
- generalized
- Fourier series, *see also* Fourier series limit, *see also* Banach
- Gershgorin's circles, 301
- Goluzin–Krylov formula, 59
- greatest common divisor, GCD, 24, 55, 231, 334
- Green
- formula, 109, 125
  - function, 91
- $H^2$ ,  $H^p$ , *see also* Space, function class, Hardy
- Hadamard, *see also* lacunary test, 301
- Hankel
- equation, 181, 189, 196, 202, 203
  - matrix, 180, 192
    - Simon's, 371
  - operator, 179, 192, 273
    - $(S_1, S_2)$ , 196, 223
    - $(X_1, X_2)$ -, 196
    - and moment problems, 359
    - associated with measure  $\mu$ , 262, 309, 327, 359
    - big, 197, 373
    - big finite rank, 223
    - compact,  $\mathfrak{S}_\infty \cap \mathcal{H}$ , 212
    - essential spectrum, 288
    - finite rank, 212, 217, 223
    - generalized, 205
    - higher order, 202
    - in  $\mathfrak{S}_p$ , 364
    - in the upper half plane, 261
    - inverse of, 231
    - inverse spectral problem, 296, 306, 377
    - little, 197, 199, 373
    - modulo kernel, 300
    - nilpotent, 293
    - normal, 300
    - $n$ -th finite section of, 371
    - on  $H^2(\mathbb{C}_+)$ , 261
    - projection onto, 192, 207, 364, 366, 370, 373
    - quasi-nilpotent, 293
    - quasi-nilpotent (essentially), 292
    - singular number, *see also* singular number
    - symbol of, 179, 181, 221
    - trace class, 351
    - vector valued, 188, 207
    - with kernel, 262, 273, 383
- symbol, 196
- Sym  $\mathcal{H}(H^2(\mu), H^2(\nu); P)$ , 201
  - Sym  $\mathcal{H}(H^p, H^q_-)$ , 200
  - Sym  $\mathcal{H}(l^2_A(w_n), (L^2(\mathbb{D}, \mu))^-)$ , 201
  - Sym  $\mathcal{H}(l^2_A(w_n), (L^2(\mathbb{D}, \mu))_-)$ , 198
  - Sym  $\mathcal{H}\mathfrak{S}_p(X, Y)$ , 372
- Hardy
- inequality, 195
    - vector valued, 210
  - space, *see also* Space, function class
- Hardy–Littlewood
- maximal function, 124
  - maximal operator, 119
- harmonic conjugate, 98, 114, 189
- (HC), *see also* complete, hereditarily
- Helson–Szegö condition (HS), 99, 103, 113, 201
- hereditary, *see also* complete
- Herglotz, *see also* Schwarz–Herglotz
- Hermitian
- modulus, 377
- Hilbert
- inequality, 195
  - matrix, 195, 283
  - tensor product, 321
  - transform, *see also* transform
- Hilbert–Schmidt
- class, 192, 360
  - operator, *see also* operator
- Hilbertian tensor product, 319
- $H^\infty$  functional calculus
- of Sz.-Nagy and Foias, 229
- holomorphic, *see also* vector valued
- homogeneous of Lebesgue type, 293
- Horn conjecture, 350
- (HS), *see also* Helson–Szegö
- hypercyclic, 90
- ideal
- Matsaev, *see also* Matsaev
  - normed, *see also* normed ideal
  - Schatten–von Neumann, *see also* Schatten–von Neumann
- impedance, 155
- impulse response, 155
- index
- of a function, *see also* winding number
  - of a subspace, 18
  - of an operator, 218
- inequality
- Hardy, *see also* Hardy
  - Hilbert, *see also* Hilbert
  - Jensen, *see also* Jensen
  - Jensen–Young, *see also* Jensen–Young
  - John–Nirenberg, *see also* John–Nirenberg
  - Lebedev–Milin, *see also* Lebedev–Milin
  - Littlewood–Paley, *see also* Littlewood–Paley

- Mourre, *see also* Mourre  
 Tchebyshev, *see also* Tchebyshev  
 von Neumann, *see also* von Neumann  
 weak-type (1,1), *see also* Kolmogorov  
 Weyl, *see also* Weyl
- initial  
 space, 187, 300
- inner, 10, 23, 334  
 arithmetic, 24  
 co-inner, \*-inner, 14  
 operator valued, 14  
 part, 43  
 singular, 42, 80  
 two-sided, 14
- inner-outer factorization, *see also*  
 factorization
- input  
 pulse, *see also* signal, finite energy
- integrable, 47  
 Bochner integrable, 47  
 SOT, 47  
 weakly (Pettis), 47  
 WOT, 47
- integral, *see also* integrable
- interpolating, *see also* interpolation  
 Blaschke product, 61  
 polynomial (Lagrange), 394
- interpolation, *see also* interpolating  
 asymptotic, 233  
 basic, 240  
 between  $L^p$  spaces, 121  
 boundary, 240  
 Carathéodory–Fejér, 237, 323  
 constrained, 239  
 free, 241  
 meromorphic, 337  
 multiple, 233  
 Nevanlinna–Pick, 232, 239, 323  
 tangential, 329  
 Nudel'man, 236  
 of a function  
 with respect to  $\Theta$ , 233  
 of an operator, 233  
 operator valued, 240  
 tangential Nevanlinna–Pick, 240  
 Pick–Akhiezer, 348  
 Schur, 232, 323  
 Schur–Takagi, 157, 337, 348
- invariant  
 unitary, *see also* unitary
- invariant subspace, 7  
 1-(simply) invariant, 8  
 character, 148  
 translation, 148  
 2-(doubly) invariant, 8  
 character, 148  
 translation, 148  
 absolutely continuous, 11  
 common zeros, 168  
 of finite codimension, 222  
 problem, 18  
 related to the  $\zeta$ -function, 169  
 singular, 11  
 strange shift-invariant operator ranges,  
 19  
 z-invariant operator ranges, 19
- inverse spectral problem, *see also* Hankel
- invertibility  
 left, 387  
 and outer functions, 387  
 Bochner–Phillips–Allan–Markus–  
 Sementsul theory,  
 389  
 in finite dimensions, 387  
 right, 385  
 in the triangular algebra, 387
- involution, 285
- isometry  
 partial, 187, 300  
 pure, 189
- Jensen  
 –Young geometric mean inequality, 41,  
 54, 68, 108  
 inequality, formula, 35, 55  
 generalized, 36
- John–Nirenberg inequality, 206
- Jordan  
 domain, 73
- Julia matrix, 186, 319
- Keldysh method (extended), 89
- kernel  
 Cauchy, *see also* Cauchy  
 Dirichlet, *see also* Dirichlet  
 Fejér, *see also* Fejér  
 generalized Toeplitz, 204  
 Poisson, *see also* Poisson  
 positive definite, *see also* positive definite  
 reproducing, *see also* reproducing kernel
- Kolmogorov, *see also* Theorem, Lemma  
 inequality, 114, 137
- Krein  
 space, *see also* space  
 structure, 204
- lacunary, 82, 206  
 function, 220, 369  
 series, 191  
 2-lacunary, 83
- Lagrange interpolating polynomial, *see also*  
 interpolating
- Laplace transform, *see also* transform
- Lat, *see also* lattice
- lattice, Lat, 27  
 type holomorphic space, LTHS, 79, 322
- LCM, *see also* least common multiple

- least common multiple, LCM, 24, 55  
 Lebedev–Milin inequality, 320  
 Lebesgue  
   decomposition, 11, 39, 66  
   point, 39, 48, 116  
 Lidskii  
   Theorem, *see also* Theorem, Lemma  
   trace  
     formula, 350  
 lifting of the commutant, *see also*  
   Theorem, Lemma, commutant lifting  
 Lipschitz condition (for integral kernels),  
   342  
 Littlewood  
   problem, 195  
   subordination principle, 56  
 Littlewood–Paley  
   function, 125, 138, 191  
   inequality, 366  
   norm, 111  
 local distance, 254  
 Loewner  
   matrix function (monotone), 240  
   theorem, *see also* Theorem, Lemma  
 logarithmic residue, 70, 170  
   in  $\mathbb{C}_+$ , 148  
 LTHS, *see also* lattice type holomorphic  
   space  
 Lusin  
   function, *see also* function  
   problem, 140  
 Lyapunov equations, 383  
 majorization  
   problem, 347  
   property, 349  
     for Fourier series, *see also* Fourier  
     series  
 matrix  
   completion (extension) problem, *see also*  
     AAK, 183, 205  
   Hankel, *see also* Hankel  
   Hilbert, *see also* Hilbert  
   Julia, *see also* Julia  
   Toeplitz, *see also* Toeplitz  
 Matsaev ideal, 62, 278, 373  
 maximal  
   function, 138  
     Hardy–Littlewood, *see also*  
       Hardy–Littlewood  
     nontangential, *see also* function  
     radial, *see also* radial  
   ideal space, 389  
   operator  
     Hardy–Littlewood, *see also*  
       Hardy–Littlewood  
     of the Cauchy transform, 137  
     radial, *see also* radial  
   transform, 138  
   maximum principle, *see also* Theorem,  
     Lemma, 251, 259  
     vector valued, *see also* Theorem, Lemma  
   measurable  
     SOT, 46  
     strongly, 46  
     weakly, 46  
     WOT, 46  
   measure  
     absolutely continuous, 11  
     analytic, 26  
     arc length, 13  
     Carleson, *see also* Carleson  
     Möbius invariant, 363  
     orthogonal to polynomials, 127  
     singular, 11  
     spectral (of a process), *see also* process  
     symmetric, 199, 202  
   Mellin transform, 166  
   meromorphic, *see also* Nevanlinna function  
   minimal, *see also* sequence  
   Möbius invariant, *see also* measure  
   model  
     de Branges–Rovnyak, 326  
     operator, 228, 239, 381  
     space, 228  
       de Branges, 321, 326  
       de Branges–Rovnyak, 137, 240  
     von Neumann, 384  
   modulus of continuity, 80  
   moment  
     problem, 309, 324  
     and Hankel operators, *see also* Hankel  
       operator  
       Hausdorff, 325  
       Stieltjes, 325  
       trigonometric, 315  
   Mourre inequality, 304  
   Muckenhoupt condition,  $A_2, A_p$ , 105, 107,  
     119, 130, 139, 272, 274, 275  
     discrete, 119  
     for matrices, 134  
   multicyclicity, 90  
   multiplicative integral, 63  
   multiplicity  
     function, 293, 384  
     of a holomorphic function, 38  
     global, 89  
     local, 89  
     of the spectrum, *see also* multicyclicity  
   multiplier, 79, 199, 264  
     Fourier, *see also* Fourier  
     Schur, *see also* Schur  
     small  $l^p$ -, 264  
     space,  $\text{Mult}(\mathcal{X})$ , 126  
 Nehari  
   -Hankel equation, *see also* Hankel  
   problem, 196

- Nevanlinna  
 characteristic, 60  
 class, *see also* Space, function class
- Nevanlinna function  
 meromorphic, 81
- Nevanlinna–Pick, *see also* interpolation
- Newton formula, 296
- nilpotent, 286  
 Hankel, *see also* Hankel operator
- non-quasianalytic, *see also* quasi-analytic
- nonharmonic exponentials, *see also*  
 exponentials
- nontangential  
 limit, 39, 58, 145  
 vector valued, 50–54  
 maximal, *see also* function
- norm  
 essential, *see also* essential  
 Garsia, *see also* Garsia  
 range, *see also* range  
 symmetric, cross, *see also* normed ideal
- normal  
 operator, *see also* operator
- normed ideal  
 quasi-normed, 306  
 symmetric (cross) norm, 344  
 symmetrically, 344, 347
- nuclear, *see also* operator
- Nudel'man, *see also* interpolation
- numerical  
 range, 209
- operator  
 c-concave, *see also* operator, concave  
 Carleman integral, 303  
 class, *see also* class of operators  
 commuting with the shift, 154, 160, 185  
 compact, 378  
 completely polynomially bounded, 208  
 composition, *see also* composition  
 concave, 15  
 c-concave, 16  
 derivation, 193, 208  
 derivation-integration  
 Weyl fractional, *see also* Weyl  
 expanding, 204  
 finite rank, 218  
 Foguel, 192, 208  
 Foguel–Hankel, 193, 208, 209  
 Fredholm, 218, 257  
 Hankel, *see also* Hankel  
 Hardy–Littlewood maximal, *see also*  
 Hardy–Littlewood  
 Hilbert–Schmidt, 117, 192, 203, 211, 338,  
 341  
 homotopic, 219  
 hypercyclic, *see also* hypercyclic  
 ideal, *see also* normed ideal; class of  
 operators  
 integral, 342  
 local type, 271  
 lower triangular, 387  
 maximal, *see also* maximal  
 model, *see also* model  
 normal, 89, 188  
 nuclear, 338, 351  
 polynomially bounded, 193, 207  
 positive, 186, 231  
 power bounded, 208, 373  
 radial maximal, *see also* radial maximal  
 Schrödinger, 304  
 sectorial, *see also* sectorial  
 shift, *see also* shift  
 similar, *see also* similar  
 singular Cauchy integral, 274  
 singular integral, *see also* singular  
 integral  
 square root of, *see also* square root  
 sublinear, 122  
 Toeplitz, *see also* Toeplitz  
 trace class, *see also* trace class  
 translation, 148  
 unitary, 11  
 partial, 300  
 Volterra (type), *see also* Volterra;  
 Volterra type  
 Volterra Hankel, 294  
 weak-type, 112, 114, 344, 365  
 Wiener–Hopf, 262, 273  
 Wold–Kolmogorov type, *see also*  
 Wold–Kolmogorov  
 Wolff's diagonal, 14  
 orthogonal subspaces, 95
- outer, 15, 17, 23, 43, 67, 72, 79, 201, 250,  
 277  
 at a point, 68  
 co-outer, \*-outer, 15  
 exposed, rigid, 396  
 in  $\Omega$ , 73  
 in  $\mathbb{C}_+$ , 147  
 locally, 68  
 part, 43
- Paley–Wiener  
 condition, 160  
 theorem, *see also* Theorem, Lemma
- parametrization, 241, 348
- partial  
 isometry, *see also* isometry
- PDK, *see also* positive definite kernel
- Pettis, *see also* integrable
- phase  
 delay, 155  
 minimal, *see also* filter
- Phragmén–Lindelöf  
 majorant, 73  
 principle, 29, 91

- principle (generalized), *see also*
  - Theorem, Lemma
- Pick body, 241
- piecewise continuous, 262, 281
- Poisson, 80
  - integral, formula, 39
    - on  $\mathbb{C}_+$ , 147
  - kernel, 33
    - on  $\mathbb{R}$ , 316
- polar
  - decomposition, 187
- polynomially
  - bounded, *see also* operator
  - convex hull, 28
- polynomials
  - analytic,  $\mathcal{P}ol_+$ , 9
  - trigonometric,  $\mathcal{P}ol$ , 8
- positive definite
  - function, 317
  - kernel, 317
    - subordinated, 317
- prediction
  - $n$ -step, 23, 379
  - one-step, 23, 88
- principal value integral, 116
- problem
  - Carathéodory–Fejér, 277
  - design, *see also* filter
  - filter identification, *see also* filter
  - invariant subspace, *see also* invariant subspace
  - inverse spectral, *see also* Hankel
  - Littlewood, *see also* Littlewood
  - Lusin, *see also* Lusin
  - majorization, *see also* majorization
  - moment, *see also* moment
  - Nehari, *see also* Nehari
  - Nevanlinna–Pick, *see also* interpolation, Nevanlinna–Pick
  - Nudel'man, *see also* interpolation, Nudel'man
  - Riemann–Hilbert, *see also* Riemann–Hilbert
  - Schur, *see also* interpolation, Schur, 277
  - Schur–Takagi, *see also* interpolation, Schur–Takagi
- process
  - deterministic, 23
  - future of, 23, 379
  - non-deterministic, 23, 379
  - past of, 23, 379
  - regular, 88, 379
    - completely, 379
  - spectral measure, 23
  - stationary, 28, 379
    - gaussian, 378
  - stochastic, 23
- projection
  - Bergman, 203, 362
    - on the  $n$ -th component of a Fourier series, *see also* Fourier series
    - onto Hankel operators, *see also* Hankel operator
    - onto Toeplitz operators, *see also* Toeplitz operators
  - Riesz, 97, 99, 114, 158, 181, 200
    - of a measure, 137
    - on  $L^2(\mathbb{T}, E)$ , 189
  - skew, 95
  - pseudo
    - continuable, 81
  - pseudohyperbolic disk, 169, 198, 360
  - pulse input, *see also* signal, finite energy
- QC, *see also* quasi-continuous
- quasi
  - analytic, 87
    - non-quasianalytic weight, 162
  - continuous function, 215, 221, 252
  - normed ideal, *see also* normed ideal
- radial maximal
  - function, 124
  - operator, 119, 125
- Radon–Nikodym
  - derivative, 11, 66
  - property
    - analytic (ARN), 62
  - theorem, *see also* Theorem, Lemma
- range
  - essential, *see also* essential norm, 318
- reducing, 8, 13, 22, 188
- regularizer, 219, 257, 259, 267
- removable singularity property, 223
- reproducing kernel, 164, 190, 216, 221, 222, 228, 317
  - Hilbert space, RKHS, *see also* Space, functions class
  - normalized, 294, 381
  - of  $H^2(\mathbb{C}^+)$ , 166
  - thesis, RKT, 131, 204, 224, 246, 398
    - for Toeplitz operator, 398
- residue, logarithmic, *see also* logarithmic
- resolvent, 249
  - map, 237
- Riemann
  - $\zeta$ -function, 163
    - functional equation, 169
  - hypothesis, 163
- Riemann–Hilbert problem, 274
- Riesz
  - basis, 296
    - property, 273
  - projection, *see also* projection
- RKHS, *see also* Space, function class, reproducing kernel Hilbert space



- RKT, *see also* reproducing kernel thesis  
 “rolling a disk”, 146  
 $\mathcal{R}$ -subset, 29  
 running mean, 159
- Schatten–Lorentz class  $\mathfrak{S}_{pq}$ , 372  
 Schatten–von Neumann  
   class  $\mathfrak{S}_p$ , 207, 211, 360
- Schmidt  
   decomposition, 331  
   of normal operators, 349  
   pair, 333  
   vector, 333
- Schur, *see also* interpolation  
   multiplier, 202, 373  
   procedure, 241  
   product (of matrices), 319  
   test, *see also* Theorem, Lemma, Schur  
     test, *see also* Vinogradov–Senichkin,  
     191, 192, 282, 301, 362
- Schwarz–Herglotz  
   kernel, 41  
   outer, 58  
   in  $\mathbb{C}_+$ , 147  
   transform, 137
- section, *see also* Toeplitz operator  
 sectorial, 248  
 semicommutator, 131, 253  
 separated, *see also* sparse  
   singularities, *see also* Bezout equation  
 separating, 48  
 sequence  
   basic, *see also* basic  
   complete, 104  
    $\Lambda(p)$ , 90  
   minimal, 93, 104, 200  
   stationary, 23, 28  
   unconditional, *see also* Riesz, sequence  
   uniformly minimal, 93  
     constant of uniform minimality, 139  
 shape of a drum, 157  
 shift, 5, 7, 28, 154, 180, 192, 196, 222, 228,  
   387  
   backward, 81, 90, 181, 192, 222, 228, 237  
   periodic, 371  
   simple, 197
- signal, 153  
   finite energy, 153  
   input, output, 153  
   plus-, 153
- similar, *see also* similarity, 193  
 similarity, *see also* similar  
   to a contraction, 193, 207  
   to a unitary, 207
- singular  
   inner, *see also* inner  
   integral operator, 117, 131  
     Calderon–Zygmund, 133  
   number, 211, 224, 333, 338, 351, 378  
     of a Hankel operator, 331  
   singularities, *see also* Bezout equation  
   SIO, *see also* singular integral operator  
    $s$ -number, *see also* singular number  
   SOT, *see also* measurable  
 Space, function class  
   analytic functions (vector valued), 48  
   Banach function, 88, 196, 223  
   Bergman, 18, 89, 131, 197, 202, 225, 320  
      $p$ -Bergman, 197  
     Peller’s form, 366  
     weighted, 16, 80, 361  
   Besov class, 352, 369  
     analytic, 354, 361  
   Bloch, 198, 361  
   Bounded Mean Oscillation, *BMO*, 189,  
     206  
   Bounded Mean Oscillation, analytic,  
     *BMOA*, 139, 189, 206  
   derivative space  $(H^p)'$ , 126  
   Dirichlet, 131, 198, 202, 320, 361  
   -type, 16  
   disk algebra, *see also* disk algebra  
   Hardy, 9, 32  
     on an annulus, 18  
     on the right half-plane, 166  
     on the upper half-plane, 145  
     operator valued, 189  
     real  $H_{\mathbb{R}e}^1$ , 190  
     vector valued, 46, 188  
     weighted, 137, 201, 274, 322  
     with respect to measure  $\mu$ , 22  
    $H^\infty + C$ , 214  
   Krein, 204  
    $L^p$   
     vector valued, 47  
   Nevanlinna, Nev, 54, 72  
   *QC*, *see also* quasi-continuous  
   reproducing kernel Hilbert space, RKHS,  
     240, 317, 362  
     commutant of the shift, *see also*  
     commutant  
     generated by  $K$ , 317  
   Smirnov, 72  
   Vanishing Mean Oscillation, *VMO*, 220,  
     225  
   Vanishing Mean Oscillation, analytic,  
     *VMOA*, 220  
   Wiener class, 155, 161
- span, 8  
 sparse, 60, 360  
 spectral  
   measure, 384  
   multiplicity, *see also* multicyclicity  
     function, *see also* multiplicity function  
   radius, 187  
   of  $T_\varphi$ , 246  
   synthesis, 103

- spectrum, 27, 187, 246  
 amplitude, *see also* amplitude  
 continuous, 247  
 energy, 155  
 essential, *see also* essential, 246  
   left, 247  
   right, 247  
 Fredholm, *see also* Fredholm  
 left, 247  
 limit distribution (of finite sections), 277, 305  
 of an inner function, *see also* spectrum of  
   an operator-valued function  
 of an operator valued function, 71  
 point, 249  
 right, 247  
 with respect to  $\Gamma_n[1]$ , 304  
 splitting  
   of cyclicity, 89  
   of subspaces, 27, 28  
 splitting (of subspaces), 27  
 square root of a positive operator, 186  
 stable, *see also* filter  
   asymptotically, 383  
   rank problem, 397  
 stationary, *see also* process  
   filter, *see also* filter  
   sequence, *see also* sequence  
 step-by-step extension, *see also* AAK  
 stochastic  
   matrix, 349  
   process, *see also* process  
 Stolz angle, 39, 127, 138, 145  
 strictly normed, 50  
 strong  $H^2$ -function, 14  
 subordination principle, *see also* Littlewood  
 summation method, 103  
   Abel–Poisson, 103  
*s*-vector, *see also* Schmidt vector  
 symbol, 269  
   matrix, 275  
   of a Hankel operator, *see also* Hankel  
   of a Toeplitz operator, *see also* Toeplitz  
 symmetric norm, *see also* normed ideal  
 symplectic matrix, 294, 371  
 Szegő  
   condition, 135  
   uniform, 136  
   infimum, 23, 28, 65  
   vector valued, 86  
 Tauberian, *see also* Theorem, Lemma  
 Tchebyshev inequality, 121  
 tensor product, *see also* Hilbert  
 test, *see also* Schur; Vinogradov–Senichkin  
 Theorem, Lemma  
   Adamyán–Arov–Krein, *see also* AAK,  
     213, 217, 333, 337  
   Agler, 241  
   All Stationary Filters, 158  
   Allan, 391  
   anonymus, 253  
   Arveson–Sz.-Nagy–Foiás–Schubert, 385  
   Axler–Chang–Sarason–Volberg, 131, 254  
    $B$  valued  $C_A$  functions, 392  
    $B$  valued  $H^\infty$  functions, 391  
   B.Ph.A.M.S., *see also* invertibility, left,  
     *see also* Theorem, Lemma, Bochner–  
       Phillips–Allan–Markus–Sementsul  
   Banach, 94, 220  
   Beurling, 10, 164, 216, 335, 337  
   Beurling–Helson, 9, 149, 161, 169, 170  
   Beurling–Lax (vector valued), 14, 204  
   Bochner, 326  
   Bochner–Phillips–Allan–Markus–  
     Sementsul,  
       390  
   Bohr, 393  
   Bonsall–Power, 131  
   boundary uniqueness, 36, 59  
     on  $C_+$ , 147  
   Bourgain, 208  
   Bourgain’s Lemma, 208  
   Bram, 75, 89  
   Burkholder–Gundy–Silverstein, 138  
   Canonical factorization  
     in  $\mathbb{D}$ , *see also* Theorem,  
       Riesz–Smirnov, 165  
     in  $C_+$ , 147  
   Carleson (corona), 388, 394  
   Carleson (embedding), 105, 130, 145,  
     151, 312  
   Carleson (free interpolation), 241  
   Causal Filters, 158  
   Coburn, 258, 270, 275, 293, 382  
   Coifman–Rochberg, 360  
   commutant lifting, 229, 230, 381, 386  
   compact operators, 378  
   Cotlar–Sadosky, 136  
   Devinatz–Widom, 250  
   Dijksma, 242  
   dominated convergence (vector valued),  
     47  
   Douglas, 185, 259  
   Douglas–Rudin, 44  
   Douglas–Sarason, 254, 255  
   embedding, *see also* Theorem, Lemma,  
     Carleson  
   Fabry gap, 90  
   Fatou, 39, 46, 127, 145  
     vector valued, 50  
   Fefferman–Stein, 126, 208  
   Fejér–Riesz, 315  
   Frostman, 45  
   Fubini (vector valued), 47  
   Fuglede–Putnam, 188  
   Gelfand–Pettis, 46

- Generalized Maximum Principle, 73  
 Generalized Phragmén–Lindelöf Principle, 73  
 Hamburger, 310  
 Hartman, 214, 220, 224, 253, 292, 327  
 Hartman–Wintner, 248  
 Helson, 12  
 Helson–Sarason, 380  
 Helson–Szegő, 99  
 Herglotz, 42  
 Hruschev–Peller, 381  
 Hunt–Muckenhoupt–Wheeden, 132  
 Jackson–Bernstein, 352, 374  
 Julia, 186  
 Kolmogorov, 97  
 Krein–Shmulyan, 49  
 Kronecker, 217, 225, 369, 382  
 Lavrentiev, 13, 75  
 Lax, 149  
 Lax–Halmos, 386  
 Lidskii, 349  
 Lindelöf, 140, 285, 292  
 Loewner, 240, 326  
 Magnus, 287  
 Marcinkiewicz, 121, 138, 344  
 Matsaev, 278  
 Maximum Principle  
   generalized, 72  
   vector/operator valued, 50  
 Mean Value, 14  
 Megretskii–Peller–Treil, 306, 384  
 Montel, 183  
 Muirhead, 349  
 Naimark, 286  
 Natanson, 141  
 Nazarov–Volberg, 133  
 Nehari, 182, 217, 230, 327, 369  
 Nevanlinna, 234  
 Nyman, 170  
 operator valued  $H^\infty$  functions, 392  
 Ostrovski, 340  
 Page, 224  
 Paley–Wiener, 146, 150, 262  
 Peller, 352, 361  
 Perron–Frobenius, 301  
 Phragmén–Lindelöf (generalized),  
   *see also* Theorem, Lemma,  
   Generalized Phragmén–Lindelöf;  
   and Phragmén–Lindelöf principle  
 Pick, 233  
 Plessner, 58  
 Power, 288  
 Radon–Nikodym, 11  
 Riesz Brothers, 26, 29, 35, 75, 157  
   in  $\mathbb{R}$ , 151  
 Riesz, M., 310  
 Riesz–Herglotz, 315, 316, 328  
 Riesz–Markov, 311  
 Riesz–Smirnov, 42, *see also* factorization,  
   canonical; Theorem, Lemma,  
   canonical factorization  
 Riesz–Thorin, 138  
 Rosenblum, 103  
 Rouché, 260, 295  
 Rudin–Carleson, 156, 161  
 Sarason, 229, 255  
 Sarason–Sz.-Nagy–Foiás, 230  
 Schmidt, 331  
 Schur, 232, 234, 238  
 Schur test, *see also* Schur test, 282  
 Sidon, 207  
 Singular Inner Functions, 42  
 Smirnov, 23, 67  
 Smirnov–Kolmogorov, 100  
 Spectral mapping, 187  
 Stechkin, 264  
 Stone–Weierstrass, 187  
 Structure of Outer Functions, 43, 158  
 Szegő–Kolmogorov, 26, 65  
   vector valued, 84  
 Tauberian, 152, 161  
 Treil, 378  
 Uniqueness theorem, *see also* Theorem,  
   Lemma, boundary uniqueness, 10,  
   37, 60, 159, 258  
   for vector valued functions, 170,  
   *see also* Theorem, Lemma -  
   Maximum Principle, vector/operator  
   valued  
 Vitali Covering, 124  
 Vitse, 392  
 von Neumann spectral, 123, 235, 384  
 Weierstrass, 214  
 Widom, 270, 312, 313  
 Wiener, *see also* Theorem, Lemma,  
   Tauberian, 8, 17, 149, 154, 155, 161,  
   185, 245, 264  
   continuous time, 159  
 Wold–Kolmogorov, *see also*  
   Wold–Kolmogorov, 11, 86, 189  
 time domain, 153  
 Toeplitz  
   algebra, 256, 301  
   matrix, 232, 238, 243  
   Simon’s, 371  
   operator, 221, 243, 273, 385  
   aggregated, 257  
   finite section method, *see also* finite  
   section method, invertible by, 275  
   in the upper half plane, 261  
    $n$ -th section of, 238, 371  
   on  $l^p(\mathbb{Z}_+)$ , 264  
   on  $\mathcal{F}l^p(\mathbb{Z}_+)$ , 264  
   projection onto, 268  
   resolvent growth, 265  
   symbol of, 244

- total, 95
- trace, 48, 338, 355
  - class  $\mathfrak{S}_1$ , 211, 338, 351
  - formula
    - Lidskii, *see also* Lidskii
    - Lifshic–Krein, 350
- transfer function, 155
- transform
  - Berezin, 131, 224, 246, 373
  - Cauchy
    - normalized, 136
    - of a measure, 316
  - Fourier, *see also* Fourier, 144, 185
  - Hilbert, 98, 114, 115, 189
    - discrete, 117, 264
    - two-weighted estimates, 133
    - weighted estimates, *see also* Theorem, Lemma, Hunt–Muckenhoupt–Wheeden
  - Laplace, 262
  - Mellin, *see also* Mellin
  - Schwarz–Herglotz, *see also* Schwarz–Herglotz
- translates
  - completeness, 149, 152, 161
  - integer ( $\mathbb{Z}$ -cyclicity), 162
- translation, *see also* operator
- triangular, *see also* operator, lower triangular
- type (of an entire function), 150
- UMD, *see also* unconditional martingale differences
- unconditional
  - basis, *see also* basis
  - martingale differences (UMD), 134
  - sequence, *see also* Riesz, sequence
- uniformly
  - minimal, *see also* sequence; basis
- unimodular, 234
- uniqueness, *see also* Theorem, Lemma, uniqueness and boundary uniqueness
- unitary
  - invariants, 384
  - operator, *see also* operator
- variation, 26
- vector valued
  - function
    - analytic, holomorphic, 48
    - integrable, *see also* integrable
    - measurable, *see also* measurable
    - weakly holomorphic, 48
  - $HP$ -spaces, *see also* Space, function class, Hardy
- Vinogradov–Senichkin test, *see also* Schur test, 106, 131, 302
- Vitali covering, *see also* Theorem, Lemma
- voltage ratio, 155
- von Neumann
  - inequality, 193
  - spectral theorem, *see also* Theorem, Lemma
- wandering subspace, 10, 189
- weak- $F$  equality, 237
- weak-type, *see also* operator
- weight
  - Bernstein, 87
  - factorable, 86, 88
  - summable, 134
- weighted estimates, *see also* transform, Hilbert
- weighting function, 155
- Weyl
  - fractional derivative, 372
  - fractional integration-derivation operator, 201, 376
  - inequality, 339, 341, 347
- white noise, 156
- Wiener
  - algebra, 264, 367, 370, 398
  - $B$  valued, 392
- Wiener–Hopf
  - factorization, 270
  - method, 270
  - operator, *see also* operator
- winding number, 258
- WK-type, *see also* Wold–Kolmogorov type operator
- Wold–Kolmogorov
  - type operator, 15
  - decomposition, *see also* Theorem, Lemma, 15
- Wolff–Denjoy series, 141
- WOT, *see also* measurable
- (Wtt), *see also* Theorem, Lemma, Tauberian
- zero divisor, 38, 55
- zero multiplicity, 38
- zero, localization of, 166, 171

## Symbol Index

- $\langle L, M \rangle$ , 95  
 $(x, y)^{col}$ , 319  
 $\ll$ , 317  
 $A \leq B$ , 185  
 $A^{1/2}$ , 186  
 $A^\#$ , 212  
 $E^\perp$ , 164  
 $L \perp M$ , 95  
 $[P_+, f]$ , 215  
 $[T_f, T_g]$ , 253  
 $[T_f, T_g]$ , 253  
 $[\Gamma]$ , 179  
 $[t]$ , 167  
 $\|[\cdot]^{-1}\|_t$ , 390  
 $\|\cdot\|_{\mathfrak{S}_2}$ , 192  
 $\|\cdot\|_{Mult}$ , 79  
 $\|\cdot\|^*$ , 206  
 $\|\cdot\|_{*VMO}$ , 220  
 $\|\cdot\|_{VMO}$ , 220  
 $\|\cdot\|_{ess}$ , 212  
 $\|\varphi\|^*$ , 198  
 $\ominus, \oplus$ , 11  
 $\otimes$ , 390  
 $|A|$ , 187  
 $\varphi^*$ , 253  
 $f * g$ , 32  
  
 $A(1/w)$ , 80  
 $(A_2), (A_p)$ , 119, 274  
 $A_\alpha$ , 354  
 $\text{alg}(X)$ , 254  
 $\text{alg } \mathcal{T}_{H^\infty+C}$ , 258  
 $\text{alg } \mathcal{T}_X$ , 256  
 $\text{alg } \mathcal{T}_{L^\infty(\mathbb{T})}$ , 256  
  
 $\mathcal{B}$ , 198  
 $BDA_p$ , 198  
 $b_\lambda$ , 37  
 $BMO$ , 189  
 $BMOA$ , 189  
 $\mathcal{B}_\alpha^p$ , 361  
 $B_p^s$ , 352  
 $B_p^s A$ , 354  
 $B_1^1 = B_{1,1}^1$ , 352  
 $B_{pq}^s$ , 352  
 $C_A$ , 71, 171  
  
 $\text{Cap}(f)$ , 83  
 $C_+$ , 143  
 $C_-$ , 150  
 $C^+$ , 163, 166  
 $\text{clos}$ , 7  
 $C_\mu$ , 136, 316  
 $\text{Com } \mathcal{T}_X$ , 274  
 $\text{conv}(A)$ , 100  
 $c(X, \delta), c\mathcal{H}(X, \delta)$ , 265  
 $\text{Cyc}(T)$ , 66  
 $\text{Cyc}(X)$ , 79  
  
 $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ , 27  
 $\mathcal{D}$ , 72, 90  
 $D_{H^\infty}(\zeta)$ , 241  
 $d_A(x)$ , 384  
 $D_A(\zeta)$ , 241  
 $d_E$ , 164  
 $\text{deg}(\Theta)$ , 333  
 $\delta$ , 203, 204  
 $\Delta_t$ , 352  
 $\mathcal{D}(f)$ , 256  
 $d_\gamma$ , 167  
 $\text{dist}$ , 22  
 $d\lambda$ , 363  
 $d_\lambda(f, g)$ , 254  
 $d_\lambda(f, M)$ , 254  
 $\mathcal{D}^p(\mu)$ , 198  
  
 $E_f$ , 8  
 $\mathcal{E}$ , 150, 235  
 $E_-, E_+, E_-^p$ , 23  
 $\varepsilon_F$ , 165  
  
 $\mathcal{F}, \mathcal{F}^{-1}$ , 144  
 $f_{inn}, f_{out}$ , 23  
 $\mathcal{F}_*$ , 166  
 $\Phi_W$ , 154, 159  
 $f(M_\Theta)$ , 229  
 $\text{Fred}(X, Y)$ , 218  
 $\mathcal{F}(X, Y)$ , 218  
 $\mathcal{F}_n(H, K)$ , 331  
  
 $[\Gamma]$ , 179  
 $\Gamma$ , 169  
 $\tilde{\Gamma}_\psi$ , 261  
 $\tilde{\Gamma}_K$ , 262

- $\Gamma[\mu]$ , 309  
 $\Gamma_\varphi$ , 252  
 GCD, 24  
 GLIM, 268  
  
 $H^0$ , 264  
 $\mathcal{H}\text{ank} = \mathcal{H} = \mathcal{H}(H^2, H^2)$ , 192  
 $H_\varphi$ , 181  
 $\tilde{H}_\psi$ , 261  
 $\mathcal{H}\mathcal{F}_n$ , 212  
 $\mathcal{H}^n(X_1, X_{2+})$ , 203  
 $\mathcal{H}\mathcal{P}_n$ , 212  
 $\mathcal{H}\mathfrak{S}_\infty$ , 212  
 $\mathcal{H}(S_1, S_{2-}; P_-)$ , 196  
 $\mathcal{H}(X_1, X_{2-}; P_-)$ , 196  
 $\mathcal{H}(X_1, X_{2-})$ , 196  
 $H^2$ , 9  
 $H^2_+$ , 181  
 $H^2(E), H^2_-(E); H^2(\mathbb{T}, E)$ , 188  
 $H^2(\mu), H^p(\mu)$ , 22, 79  
 $H^2(\mathbb{C}^+)$ , 166  
 $(H^p)'$ , 126  
 $H^p_+$ , 145  
 $H^p(\mathbb{D})$ , 31  
 $H^p(\mathbb{D}, X)$ , 50  
 $H^\infty$ , 31  
 $H^\infty + C$ , 213, 214  
 $H^\infty(F \rightarrow E)$ , 189  
 $H^\infty[f]$ , 254  
 $H_\varepsilon$ , 132  
 $\text{Hol}(\mathbb{D})$ , 31  
 $\text{Hol}(\Omega)$ , 38  
 $\text{Hol}(\Omega, X)$ , 48  
  
 $\text{idl}(f_1, \dots, f_n)$ , 389  
 $i(E)$ , 18  
 $\text{Ind}(\varphi)$ , 258  
 $\text{ind } T$ , 218  
  
 $\mathcal{J}f(z) = \bar{z}f(\bar{z})$ , 181  
 $\mathcal{J}_0$ , 261  
  
 $K_{cb}$ , 208  
 $k_\lambda$ , 164  
 $\mathcal{K}_\Theta$ , 216, 228  
  
 $\lambda_f(t)$ , 114  
 $\Lambda(p)$ , 90  
 $\text{Lat}$ , 27  
 $\text{LCM}$ , 24  
 $L^2(E), L^2(\mu, F)$ , 13  
 $L^2(\mathbb{T}, E)$ , 188  
 $L^2, L^2(\mu)$ , 7  
 $L^p(\Omega, X)$ , 47  
 $L^p(\mathbb{R}, w)$ , 75  
 $L^p_\alpha(w)$ , 80, 81  
 $L^\infty(F \rightarrow E)$ , 189  
 $l^2$ , 9  
 $l^2(\mathbb{Z}_+, w_n^2)$ , 16  
  
 $l^2_A(w_n)$ , 198  
 $l^p_A$ , 225  
 $L_\varphi$ , 191  
 $\text{LIM}(\Lambda)$ , 61  
 $\mathcal{L}\text{in}$ , 8  
 $(\text{Lip}(\frac{1}{p} - \frac{1}{q}))_+$ , 201  
 $\text{LTHS}$ , 79, 89  
  
 $\mathfrak{M}(\mathbb{T})$ , 34  
 $\{M_\Theta\}'$ , 229  
 $|\mu|$ , 26  
 $\text{Mult}(X)$ , 79, 126, 264  
 $\text{mult}(X)$ , 264  
  
 $\text{Nev}$ , 54, 72  
 $\text{Nev}_+$ , 72, 90  
 $N_p(\varphi)$ , 198  
  
 $w_\mu(t)$ , 80  
  
 $P_+$ , 97  
 $P_{L||M}$ , 95  
 $PC$ , 281  
 $\text{pch}$ , 28  
 $\Pi((e_n)_{n \geq 0})$ , 276  
 $P_n$ , 94  
 $Pol$ , 8  
 $Pol_n$ , 214  
 $Pol_+$ , 9  
 $P_\Theta$ , 228  
  
 $QC$ , 215  
  
 $\mathcal{R}$ , 29  
 $r(A)$ , 187  
 $\text{Range}(\varphi)$ , 247  
 $R_\mu$ , 249  
 $R_X$ , 192, 208  
 $\mathcal{R}_\xi$ , 285  
  
 $S$ , 7  
 $\sigma(T)$ , 27  
 $S^*$ , 90, 181  
 $\mathfrak{S}_2, \mathfrak{S}_p$ , 192, 203, 207, 211  
 $\mathfrak{S}_2\mathcal{H}^n$ , 203  
 $\mathfrak{S}_\infty$ , 211  
 $\mathfrak{S}_M$ , 278  
 $s(f, x)$ , 281  
 $\sigma(A)$ , 187  
 $\sigma^i(T)$ , 247  
 $\sigma^r(T)$ , 247  
 $\sigma_c(T)$ , 247  
 $\sigma_{ess}(A)$ , 212  
 $\sigma_{ess}^l(T)$ , 247  
 $\sigma_{ess}^r(T)$ , 247  
 $\sigma_F(T)$ , 219  
 $\sigma_p(T)$ , 249  
 $SM$ , 373  
 $s_n(A)$ , 211  
 $\text{SOT}$ , 46

span, 8  
 $\text{Sym } \mathcal{H}(X_1, X_{2-}; P_-)$ , 196  
 $\text{Sym } \mathcal{H} = \text{Sym } \mathcal{H}(X_1, X_{2-})$ , 196  
 $\text{Sym}(T)$ , 257  
 $\mathbb{T} = \{z \in \mathbb{C} : |z| = 1\}$ , 7  
 $\tau_s$ , 148  
 $T_\varphi$ , 244  
 $\tilde{T}_\psi$ , 261  
 $\Theta$ , 10  
 $\theta_E$ , 164  
Trace, 338, 351, 355  
Traj, 306  
 $\mathcal{T}(X)$ , 256  
 $U_2$ , 143  
Var, 264  
VMO, 220  
VMOA, 220  
 $V_X$ , 192  
 $\mathcal{W}$ , 161  
WOT, 46  
 $W_\psi$ , 262  
 $X(\Lambda)$ , 206  
 $\zeta$ , 163

## Selected Titles in This Series

*(Continued from the front of this publication)*

- 60 **Iain Raeburn and Dana P. Williams**, Morita equivalence and continuous-trace  $C^*$ -algebras, 1998
- 59 **Paul Howard and Jean E. Rubin**, Consequences of the axiom of choice, 1998
- 58 **Pavel I. Etingof, Igor B. Frenkel, and Alexander A. Kirillov, Jr.**, Lectures on representation theory and Knizhnik-Zamolodchikov equations, 1998
- 57 **Marc Levine**, Mixed motives, 1998
- 56 **Leonid I. Korogodski and Yan S. Soibelman**, Algebras of functions on quantum groups: Part I, 1998
- 55 **J. Scott Carter and Masahico Saito**, Knotted surfaces and their diagrams, 1998
- 54 **Casper Goffman, Togo Nishiura, and Daniel Waterman**, Homeomorphisms in analysis, 1997
- 53 **Andreas Kriegl and Peter W. Michor**, The convenient setting of global analysis, 1997
- 52 **V. A. Kozlov, V. G. Maz'ya, and J. Rossmann**, Elliptic boundary value problems in domains with point singularities, 1997
- 51 **Jan Malý and William P. Ziemer**, Fine regularity of solutions of elliptic partial differential equations, 1997
- 50 **Jon Aaronson**, An introduction to infinite ergodic theory, 1997
- 49 **R. E. Showalter**, Monotone operators in Banach space and nonlinear partial differential equations, 1997
- 48 **Paul-Jean Cahen and Jean-Luc Chabert**, Integer-valued polynomials, 1997
- 47 **A. D. Elmendorf, I. Kriz, M. A. Mandell, and J. P. May (with an appendix by M. Cole)**, Rings, modules, and algebras in stable homotopy theory, 1997
- 46 **Stephen Lipscomb**, Symmetric inverse semigroups, 1996
- 45 **George M. Bergman and Adam O. Hausknecht**, Cogroups and co-rings in categories of associative rings, 1996
- 44 **J. Amorós, M. Burger, K. Corlette, D. Kotschick, and D. Toledo**, Fundamental groups of compact Kähler manifolds, 1996
- 43 **James E. Humphreys**, Conjugacy classes in semisimple algebraic groups, 1995
- 42 **Ralph Freese, Jaroslav Ježek, and J. B. Nation**, Free lattices, 1995
- 41 **Hal L. Smith**, Monotone dynamical systems: an introduction to the theory of competitive and cooperative systems, 1995
- 40.4 **Daniel Gorenstein, Richard Lyons, and Ronald Solomon**, The classification of the finite simple groups, number 4, 1999
- 40.3 **Daniel Gorenstein, Richard Lyons, and Ronald Solomon**, The classification of the finite simple groups, number 3, 1998
- 40.2 **Daniel Gorenstein, Richard Lyons, and Ronald Solomon**, The classification of the finite simple groups, number 2, 1995
- 40.1 **Daniel Gorenstein, Richard Lyons, and Ronald Solomon**, The classification of the finite simple groups, number 1, 1994
- 39 **Sigurdur Helgason**, Geometric analysis on symmetric spaces, 1994
- 38 **Guy David and Stephen Semmes**, Analysis of and on uniformly rectifiable sets, 1993
- 37 **Leonard Lewin, Editor**, Structural properties of polylogarithms, 1991
- 36 **John B. Conway**, The theory of subnormal operators, 1991
- 35 **Shreeram S. Abhyankar**, Algebraic geometry for scientists and engineers, 1990
- 34 **Victor Isakov**, Inverse source problems, 1990

For a complete list of titles in this series, visit the  
AMS Bookstore at [www.ams.org/bookstore/](http://www.ams.org/bookstore/).



Together with the companion volume by the same author, *Operators, Functions, and Systems: An Easy Reading, Volume 2: Model Operators and Systems*, Mathematical Surveys and Monographs, Vol. 93, AMS, 2002, this unique work combines four major topics of modern analysis and its applications:

- A. Hardy classes of holomorphic functions,
- B. Spectral theory of Hankel and Toeplitz operators,
- C. Function models for linear operators and free interpolations, and
- D. Infinite-dimensional system theory and signal processing.

This volume contains Parts A and B.

*Hardy classes of holomorphic functions* is known to be the most powerful tool in complex analysis for a variety of applications, starting with Fourier series, through the Riemann  $\zeta$ -function, all the way to Wiener's theory of signal processing.

*Spectral theory of Hankel and Toeplitz operators* becomes the supporting pillar for a large part of harmonic and complex analysis and for many of their applications. In this book, moment problems, Nevanlinna-Pick and Carathéodory interpolation, and the best rational approximations are considered to illustrate the power of Hankel and Toeplitz operators.

The book is geared toward a wide audience of readers, from graduate students to professional mathematicians, interested in operator theory and functions of a complex variable. The two volumes develop an elementary approach while retaining an expert level that can be applied in advanced analysis and selected applications.

ISBN 978-0-8218-4933-0



9 780821 849330

**SURV/92.S**

**AMS on the Web**  
[www.ams.org](http://www.ams.org)