



Operator Theory: Advances and
Applications
Vol. 155

Editor:
I. Gohberg

Editorial Office:
School of Mathematical
Sciences
Tel Aviv University
Ramat Aviv, Israel

Editorial Board:
D. Alpay (Beer-Sheva)
J. Arazy (Haifa)
A. Atzmon (Tel Aviv)
J. A. Ball (Blacksburg)
A. Ben-Artzi (Tel Aviv)
H. Bercovici (Bloomington)
A. Böttcher (Chemnitz)
K. Clancey (Athens, USA)
L. A. Coburn (Buffalo)
K. R. Davidson (Waterloo, Ontario)
R. G. Douglas (College Station)
A. Dijksma (Groningen)
H. Dym (Rehovot)
P. A. Fuhrmann (Beer Sheva)
S. Goldberg (College Park)
B. Gramsch (Mainz)
G. Heinig (Chemnitz)
J. A. Helton (La Jolla)
M. A. Kaashoek (Amsterdam)

H. G. Kaper (Argonne)
S. T. Kuroda (Tokyo)
P. Lancaster (Calgary)
L. E. Lerer (Haifa)
B. Mityagin (Columbus)
V. V. Peller (Manhattan, Kansas)
L. Rodman (Williamsburg)
J. Rovnyak (Charlottesville)
D. E. Sarason (Berkeley)
I. M. Spitkovsky (Williamsburg)
S. Treil (Providence)
H. Upmeyer (Marburg)
S. M. Verduyn Lunel (Leiden)
D. Voiculescu (Berkeley)
H. Widom (Santa Cruz)
D. Xia (Nashville)
D. Yafaev (Rennes)

Honorary and Advisory
Editorial Board:
C. Foias (Bloomington)
P. R. Halmos (Santa Clara)
T. Kailath (Stanford)
P. D. Lax (New York)
M. S. Livsic (Beer Sheva)

Advances in Pseudo-Differential Operators

**Ryuichi Ashino
Paolo Boggiatto
M. W. Wong
Editors**

Springer Basel AG

Editors:

Ryuichi Ashino
Division of Mathematical Sciences
Osaka Kyoiku University
Kashiwara, Osaka 582-8582
Japan
e-mail: ashino@cc.osaka-kyoiku.ac.jp

M.W. Wong
Department of Mathematics and Statistics
York University
4700 Keele Street
Toronto, Ontario M3J 1P3
Canada
e-mail: mwwong@pascal.math.yorku.ca

Paolo Boggiatto
Dipartimento di Matematica
Università di Torino
Via Carlo Alberto, 10
10123 Torino
Italy
e-mail: boggiatto@dm.unito.it

2000 Mathematics Subject Classification: Primary 35J30, 35J55, 35Q40, 35S05, 35S50, 42B35, 42C40, 44A35, 46E35, 47B10, 47G30, 65T60; Secondary 35A27, 35B65, 35Q51, 46B50, 46F12, 47B37, 58J32, 93B30

A CIP catalogue record for this book is available from the
Library of Congress, Washington D.C., USA

Bibliographic information published by Die Deutsche Bibliothek
Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie; detailed
bibliographic data is available in the Internet at <<http://dnb.ddb.de>>.

ISBN 978-3-0348-9590-3 ISBN 978-3-0348-7840-1 (eBook)

DOI 10.1007/978-3-0348-7840-1

This work is subject to copyright. All rights are reserved, whether the whole or part of the
material is concerned, specifically the rights of translation, reprinting, re-use of
illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and
storage in data banks. For any kind of use permission of the copyright owner must be
obtained.

© 2004 Springer Basel AG
Originally published by Birkhäuser Verlag, Basel - Boston - Berlin in 2004
Softcover reprint of the hardcover 1st edition 2004

Printed on acid-free paper produced from chlorine-free pulp. TCF ∞
Cover design: Heinz Hiltbrunner, Basel

ISBN 978-3-0348-9590-3

Contents

<i>Preface</i>	vii
<i>E. Cordero, F. Nicola and L. Rodino</i> Microlocal Analysis and Applications	1
<i>T. Krainer and B.-W. Schulze</i> The Conormal Symbolic Structure of Corner Boundary Value Problems ..	19
<i>M. Ruzhansky and M. Sugimoto</i> A New Proof of Global Smoothing Estimates for Dispersive Equations ..	65
<i>G. De Donno</i> Gevrey Hypocoellipticity of p -Powers of Non-Hypoelliptic Operators	77
<i>G. Garello and A. Morando</i> Continuity in Weighted Sobolev Spaces of L^p Type for Pseudo-Differential Operators with Completely Nonsmooth Symbols	91
<i>M.W. Wong</i> Symmetry-Breaking for Wigner Transforms and L^p -Boundedness of Weyl Transforms	107
<i>E. Buzano and F. Nicola</i> Pseudo-Differential Operators and Schatten-von Neumann Classes	117
<i>E. Cordero and A. Tabacco</i> Localization Operators via Time-Frequency Analysis	131
<i>P. Boggiatto</i> Localization Operators with L^p Symbols on Modulation Spaces	149
<i>J. Toft</i> Convolutions and Embeddings for Weighted Modulation Spaces	165
<i>R. Ashino, S.J. Desjardins, C. Heil, M. Nagase and R. Vaillancourt</i> Pseudo-Differential Operators, Microlocal Analysis and Image Restoration	187
<i>R. Ashino, T. Mandai and A. Morimoto</i> Applications of Wavelet Transforms to System Identification	203
<i>M.A. Hajji, S. Melkonian and R. Vaillancourt</i> Two-Dimensional Wavelet Bases for Partial Differential Operators and Applications	219

Preface

The Fourth Congress of the International Society for Analysis, its Applications and Computation (ISAAC) was held at York University from August 11, 2003 to August 16, 2003. It was supported by the Academic Initiative Fund of the Faculty of Arts, NSERC grants from some members of the Department of Mathematics and Statistics and the Office of the Vice-President Academic of York University. In spite of two SARS outbreaks in Toronto in 2003, the ISAAC Congress was held as scheduled and was well attended by mathematicians from all over the world. There were nine plenary lectures and seventeen special sessions representing most major themes in analysis. Among these were two plenary lectures and a special session on pseudo-differential operators organized by Ryuichi Ashino of Osaka Kyoiku University, Paolo Boggiatto of Università di Torino and M. W. Wong of York University.

In the summer of 2003, M. W. Wong had the idea of putting together the lectures on pseudo-differential operators in a volume to be published in a series that advocates operator theory and its applications. In early August of 2003, when Israel Gohberg of Tel Aviv University was consulted about the possibility of publishing a volume entitled “Advances in Pseudo-Differential Operators” in his series “Operator Theory: Advances and Applications”, he replied immediately endorsing the proposal enthusiastically.

In this volume there are thirteen articles representing recent advances in pseudo-differential operators. Chapters 1 and 2 originate, respectively, from the plenary lectures of Luigi Rodino and B.-W. Schulze. In Chapters 3–5, pseudo-differential operators in the context of partial differential equations are studied. It is well-known that pseudo-differential operators arise in quantum mechanics, and as such, they are known as Weyl transforms. Weyl transforms are represented by Chapters 6 and 7. In recent years, pseudo-differential operators are used in signal analysis as filters or localization operators. Localization operators, which are also known as Wick operators in quantization, form the subject matter of Chapters 1, 6, 8 and 9. Modulation spaces, which form a critical mass in Chapters 8–10, are defined in terms of the short-time Fourier transform and are used in the analysis of pseudo-differential operators and their variants. Also important are the connections of pseudo-differential operators with wavelets, and these are dealt with in the last three chapters.