EMS Tracts in Mathematics 18

EMS Tracts in Mathematics

Editorial Board:

Carlos E. Kenig (The University of Chicago, USA)
Andrew Ranicki (The University of Edinburgh, Great Britain)
Michael Röckner (Universität Bielefeld, Germany, and Purdue University, USA)
Vladimir Turaev (Indiana University, Bloomington, USA)
Alexander Varchenko (The University of North Carolina at Chapel Hill, USA)

This series includes advanced texts and monographs covering all fields in pure and applied mathematics. *Tracts* will give a reliable introduction and reference to special fields of current research. The books in the series will in most cases be authored monographs, although edited volumes may be published if appropriate. They are addressed to graduate students seeking access to research topics as well as to the experts in the field working at the frontier of research.

- 1 Panagiota Daskalopoulos and Carlos E. Kenig, Degenerate Diffusions
- 2 Karl H. Hofmann and Sidney A. Morris, The Lie Theory of Connected Pro-Lie Groups
- 3 Ralf Meyer, Local and Analytic Cyclic Homology
- 4 Gohar Harutyunyan and B.-Wolfgang Schulze, *Elliptic Mixed, Transmission and Singular Crack Problems*
- 5 Gennadiy Feldman, Functional Equations and Characterization Problems on Locally Compact Abelian Groups
- 6 Erich Novak and Henryk Woźniakowski, *Tractability of Multivariate Problems. Volume I: Linear Information*
- 7 Hans Triebel. Function Spaces and Wavelets on Domains
- 8 Sergio Albeverio et al., The Statistical Mechanics of Quantum Lattice Systems
- 9 Gebhard Böckle and Richard Pink, Cohomological Theory of Crystals over Function Fields
- 10 Vladimir Turaev, Homotopy Quantum Field Theory
- 11 Hans Triebel, Bases in Function Spaces, Sampling, Discrepancy, Numerical Integration
- 12 Erich Novak and Henryk Woźniakowski, *Tractability of Multivariate Problems*. Volume II: Standard Information for Functionals
- 13 Laurent Bessières et al., Geometrisation of 3-Manifolds
- 14 Steffen Börm, Efficient Numerical Methods for Non-local Operators. \mathcal{H}^2 –Matrix Compression, Algorithms and Analysis
- 15 Ronald Brown, Philip J. Higgins and Rafael Sivera, *Nonabelian Algebraic Topology*. Filtered Spaces, Crossed Complexes, Cubical Homotopy Groupoids
- 16 Marek Janicki and Peter Pflug, Separately Analytical Functions
- 17 Anders Björn and Jana Björn, Nonlinear Potential Theory on Metric Spaces

Erich Novak Henryk Woźniakowski

Tractability of Multivariate Problems

Volume III: Standard Information for Operators



Authors:

Frich Novak Mathematisches Institut Universität Jena Ernst-Abbe-Platz 2 07743 Jena Germany

E-Mail: erich.novak@uni-jena.de

Henryk Woźniakowski Department of Computer Science Columbia University 1214 Amsterdam Avenue New York, NY 10027

USA

Institute of Applied Mathematics University of Warsaw

Banacha 2, 02-097

Warsaw Poland

E-Mail: henryk@cs.columbia.edu

2010 Mathematical Subject Classification: 65-02; 65Y20, 68Q17, 68Q25, 41A63, 65-02, 46E22, 28C20, 46E30, 65N99, 65R20

Key words: Multivariate approximation, linear problems, quasilinear problems, Poisson equation, Fredholm equation, power of function values, worst case setting, average case setting, randomized setting, high-dimensional numerical problems, Smolyak and weighted tensor product algorithms, weighted spaces, tractability, curse of dimension.

ISBN 978-3-03719-116-3

The Swiss National Library lists this publication in The Swiss Book, the Swiss national bibliography, and the detailed bibliographic data are available on the Internet at http://www.helveticat.ch.

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.

© European Mathematical Society 2012

Contact address:

European Mathematical Society Publishing House Seminar for Applied Mathematics ETH-Zentrum SEW A27 CH-8092 Zürich Switzerland

Phone: +41 (0)44 632 34 36 Email: info@ems-ph.org Homepage: www.ems-ph.org

Typeset using the authors' TFX files: I. Zimmermann, Freiburg Printed in Germany

987654321

For (für, dla) our IBC friends