EMS Tracts in Mathematics 33

EMS Tracts in Mathematics

Editorial Board:

Michael Farber (Queen Mary University of London, 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. The *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.

For a complete listing see https://ems.press.

- 14 Steffen Börm, Efficient Numerical Methods for Non–local Operators. *#*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
- 18 Erich Novak and Henryk Woźniakowski, *Tractability of Multivariate Problems*. *Volume III: Standard Information for Operators*
- 19 Bogdan Bojarski, Vladimir Gutlyanskii, Olli Martio and Vladimir Ryazanov, *Infinitesimal Geometry of Quasiconformal and Bi–Lipschitz Mappings in the Plane*
- 20 Hans Triebel, Local Function Spaces, Heat and Navier–Stokes Equations
- 21 Kaspar Nipp and Daniel Stoffer, *Invariant Manifolds in Discrete and Continuous Dynamical Systems*
- 22 Patrick Dehornoy with François Digne, Eddy Godelle, Daan Kramer and Jean Michel, Foundations of Garside Theory
- 23 Augusto C. Ponce, Elliptic PDEs, Measures and Capacities. From the Poisson Equation to Nonlinear Thomas–Fermi Problems
- 24 Hans Triebel, Hybrid Function Spaces, Heat and Navier–Stokes Equations
- 25 Yves Cornulier and Pierre de la Harpe, Metric Geometry of Locally Compact Groups
- 26 Vincent Guedj and Ahmed Zeriahi, Degenerate Complex Monge–Ampère Equations
- 27 Nicolas Raymond, Bound States of the Magnetic Schrödinger Operator
- 28 Antoine Henrot and Michel Pierre, Shape Variation and Optimization. A Geometrical Analysis
- 29 Alexander Kosyak, Regular, Quasi-regular and Induced Representations of Infinitedimensional Groups
- 30 Vladimir G. Maz'ya, Boundary Behavior of Solutions to Elliptic Equations in General Domains
- 31 Igor V. Gel'man and Vladimir G. Maz'ya, Estimates for Differential Operators in Half-space
- 32 Shigeyuki Kondō, K3 Surfaces

Sergey I. Repin Stefan A. Sauter

Accuracy of Mathematical Models

Dimension Reduction, Homogenization, and Simplification



European Mathematical Society

Authors:

Sergey I. Repin Steklov Institute of Mathematics Russian Acadademy of Sciences Fontanka, 27 191023 St. Petersburg Russia Stefan A. Sauter Institut für Mathematik Universität Zürich Winterthurerstr. 190 8057 Zürich Switzerland

repin@pdmi.ras.ru

stas@math.uzh.ch

2010 Mathematical Subject Classification (primary; secondary): 35–02; 35J20, 35J50, 35J60, 35J88, 49M29, 65N15, 65N85, 74K20

Key words: Modelling error, *a posteriori* error majorant, model simplification, dimension reduction, homogenization, conversion of models

ISBN 978-3-03719-206-1

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, broad-casting, 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.

© 2020 European Mathematical Society

Contact address:

European Mathematical Society – EMS – Publishing House Institut für Mathematik Technische Universität Berlin Straße des 17. Juni 136 10623 Berlin Germany

info@ems.press https://ems.press

Typeset using the authors' T_EX files: le-tex publishing services GmbH, Leipzig, Germany Printing and binding: Beltz Bad Langensalza GmbH, Bad Langensalza, Germany ∞ Printed on acid-free paper 9 8 7 6 5 4 3 2 1 To our parents