

EM
S ■
PRESS

EMS Tracts in Mathematics

Edited by Yann Bugeaud (Université de Strasbourg), Camillo De Lellis (Institute for Advanced Study), Michael Farber (Queen Mary University of London), Michael Röckner (Universität Bielefeld and Purdue University), Alexander Varchenko (The University of North Carolina at Chapel Hill)

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.

Previously published in this series:

- 6 E. Novak, H. Woźniakowski, *Tractability of Multivariate Problems. Vol. I*
- 7 H. Triebel, *Function Spaces and Wavelets on Domains*
- 8 S. Albeverio, Y. Kondratiev, Y. Kozitsky, M. Röckner, *The Statistical Mechanics of Quantum Lattice Systems*
- 9 G. Böckle, R. Pink, *Cohomological Theory of Crystals over Function Fields*
- 10 V. Turaev, *Homotopy Quantum Field Theory*
- 11 H. Triebel, *Bases in Function Spaces, Sampling, Discrepancy, Numerical Integration*
- 12 E. Novak, H. Woźniakowski, *Tractability of Multivariate Problems. Vol. II*
- 13 L. Bessièeres, G. Besson, M. Boileau, S. Maillot, J. Porti, *Geometrisation of 3-Manifolds*
- 14 S. Börm, *Efficient Numerical Methods for Non-local Operators*
- 15 R. Brown, P.J. Higgins, R. Sivera, *Nonabelian Algebraic Topology*
- 16 M. Janicki, P. Pflug, *Separately Analytical Functions*
- 17 A. Björn, J. Björn, *Nonlinear Potential Theory on Metric Spaces*
- 18 E. Novak, H. Woźniakowski, *Tractability of Multivariate Problems. Vol. III*
- 19 B. Bojarski, V. Gutlyanskii, O. Martio, V. Ryazanov, *Infinitesimal Geometry of Quasiconformal and Bi-Lipschitz Mappings in the Plane*
- 20 H. Triebel, *Local Function Spaces, Heat and Navier–Stokes Equations*
- 21 K. Nipp, D. Stoffer, *Invariant Manifolds in Discrete and Continuous Dynamical Systems*
- 22 P. Dehornoy, F. Digne, E. Godelle, D. Kramer, J. Michel, *Foundations of Garside Theory*
- 23 A.C. Ponce, *Elliptic PDEs, Measures and Capacities*
- 24 H. Triebel, *Hybrid Function Spaces, Heat and Navier–Stokes Equations*
- 25 Y. Cornulier, P. de la Harpe, *Metric Geometry of Locally Compact Groups*
- 26 V. Guedj, A. Zeriahi, *Degenerate Complex Monge–Ampère Equations*
- 27 N. Raymond, *Bound States of the Magnetic Schrödinger Operator*
- 28 A. Henrot, M. Pierre, *Shape Variation and Optimization*
- 29 A. Kosyak, *Regular, Quasi-regular and Induced Representations of Infinite-dimensional Groups*
- 30 V.G. Maz'ya, *Boundary Behavior of Solutions to Elliptic Equations in General Domains*
- 31 I.V. Gel'man, V.G. Maz'ya, *Estimates for Differential Operators in Half-space*
- 32 S. Kondō, *K3 Surfaces*
- 33 S.I. Repin, S.A. Sauter, *Accuracy of Mathematical Models*
- 34 E. Ya. Khruslov, *Homogenized Models of Suspension Dynamics*
- 35 G. Rousseau, *Euclidean Buildings*
- 36 K. H. Hofmann, S. A. Morris, *The Structure of Pro-Lie Groups* (2nd ed.)



Fabrice Baudoin

Nizar Demni

Jing Wang

**Stochastic Areas, Horizontal
Brownian Motions, and
Hypoelliptic Heat Kernels**



Authors

Fabrice Baudoin
Department of Mathematics
Aarhus University
Ny Munkegade 118
8000 Aarhus C, Denmark
Email: fbaudoin@math.au.dk

Nizar Demni
Department of Mathematics
New York University Abu Dhabi
Saadiyat Island
P.O. Box 129188
Abu Dhabi, United Arab Emirates
Email: nizar.demni@nyu.edu

Jing Wang
Department of Mathematics and
Department of Statistics
Purdue University
150 N. University Street
West Lafayette, IN 47907, USA
Email: jingwang@purdue.edu

Mathematics Subject Classification 2020: 60-02 (primary); 58J65, 60B20, 60J65 (secondary).

Keywords: Brownian motion, stochastic area, horizontal Brownian motion, Jacobi process, magnetic Laplacian

ISBN 978-3-98547-079-2, eISBN 978-3-98547-579-7, DOI 10.4171/ETM/37

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie;
detailed bibliographic data are available on the Internet at <http://dnb.dnb.de>.

Published by EMS Press, an imprint of the
European Mathematical Society – EMS – Publishing House GmbH
Institut für Mathematik
Technische Universität Berlin
Straße des 17. Juni 136
10623 Berlin, Germany
<https://ems.press>

© 2024 EMS Press

Typeset by Alison Durham, Manchester, UK
Printed in Germany
© Printed on acid free paper