

LONDON MATHEMATICAL SOCIETY LECTURE NOTE SERIES

Managing Editor: Professor Endre Süli, Mathematical Institute, University of Oxford,
Woodstock Road, Oxford OX2 6GG, United Kingdom

The titles below are available from booksellers, or from Cambridge University Press at
www.cambridge.org/mathematics

- 376 Permutation patterns, S. LINTON, N. RUŠKUC & V. VATTER (eds)
- 377 An introduction to Galois cohomology and its applications, G. BERHUY
- 378 Probability and mathematical genetics, N. H. BINGHAM & C. M. GOLDIE (eds)
- 379 Finite and algorithmic model theory, J. ESPARZA, C. MICHAUX & C. STEINHORN (eds)
- 380 Real and complex singularities, M. MANOEL, M.C. ROMERO FUSTER & C.T.C WALL (eds)
- 381 Symmetries and integrability of difference equations, D. LEVI, P. OLVER, Z. THOMOVA & P. WINTERNITZ (eds)
- 382 Forcing with random variables and proof complexity, J. KRAJÍČEK
- 383 Motivic integration and its interactions with model theory and non-Archimedean geometry I, R. CLUCKERS, J. NICAISE & J. SEBAG (eds)
- 384 Motivic integration and its interactions with model theory and non-Archimedean geometry II, R. CLUCKERS, J. NICAISE & J. SEBAG (eds)
- 385 Entropy of hidden Markov processes and connections to dynamical systems, B. MARCUS, K. PETERSEN & T. WEISSMAN (eds)
- 386 Independence-friendly logic, A.L. MANN, G. SANDU & M. SEVENSTER
- 387 Groups St Andrews 2009 in Bath I, C.M. CAMPBELL *et al* (eds)
- 388 Groups St Andrews 2009 in Bath II, C.M. CAMPBELL *et al* (eds)
- 389 Random fields on the sphere, D. MARINUCCI & G. PECCATI
- 390 Localization in periodic potentials, D.E. PELINOVSKY
- 391 Fusion systems in algebra and topology, M. ASCHBACHER, R. KESSAR & B. OLIVER
- 392 Surveys in combinatorics 2011, R. CHAPMAN (ed)
- 393 Non-abelian fundamental groups and Iwasawa theory, J. COATES *et al* (eds)
- 394 Variational problems in differential geometry, R. BIELAWSKI, K. HOUSTON & M. SPEIGHT (eds)
- 395 How groups grow, A. MANN
- 396 Arithmetic differential operators over the p -adic integers, C.C. RALPH & S.R. SIMANCA
- 397 Hyperbolic geometry and applications in quantum chaos and cosmology, J. BOLTE & F. STEINER (eds)
- 398 Mathematical models in contact mechanics, M. SOFONEA & A. MATEI
- 399 Circuit double cover of graphs, C.-Q. ZHANG
- 400 Dense sphere packings: a blueprint for formal proofs, T. HALES
- 401 A double Hall algebra approach to affine quantum Schur–Weyl theory, B. DENG, J. DU & Q. FU
- 402 Mathematical aspects of fluid mechanics, J.C. ROBINSON, J.L. RÓDRIGO & W. SADOWSKI (eds)
- 403 Foundations of computational mathematics, Budapest 2011, F. CUCKER, T. KRICK, A. PINKUS & A. SZANTO (eds)
- 404 Operator methods for boundary value problems, S. HASSI, H.S.V. DE SNOO & F.H. SZAFRANIEC (eds)
- 405 Torsors, étale homotopy and applications to rational points, A.N. SKOROBOGATOV (ed)
- 406 Appalachian set theory, J. CUMMINGS & E. SCHIMMERLING (eds)
- 407 The maximal subgroups of the low-dimensional finite classical groups, J.N. BRAY, D.F. HOLT & C.M. RONEY-DOUGAL
- 408 Complexity science: the Warwick master's course, R. BALL, V. KOLOKOLTSOV & R.S. MACKAY (eds)
- 409 Surveys in combinatorics 2013, S.R. BLACKBURN, S. GERKE & M. WILDON (eds)
- 410 Representation theory and harmonic analysis of wreath products of finite groups, T. CECCHERINI-SILBERSTEIN, F. SCARABOTTI & F. TOLLI
- 411 Moduli spaces, L. BRAMBILA-PAZ, O. GARCÍA-PRADA, P. NEWSTEAD & R.P. THOMAS (eds)
- 412 Automorphisms and equivalence relations in topological dynamics, D.B. ELLIS & R. ELLIS
- 413 Optimal transportation, Y. OLLIVIER, H. PAJOT & C. VILLANI (eds)
- 414 Automorphic forms and Galois representations I, F. DIAMOND, P.L. KASSAEI & M. KIM (eds)
- 415 Automorphic forms and Galois representations II, F. DIAMOND, P.L. KASSAEI & M. KIM (eds)
- 416 Reversibility in dynamics and group theory, A.G. O'FARRELL & I. SHORT
- 417 Recent advances in algebraic geometry, C.D. HACON, M. MUSTAŢĂ & M. POPA (eds)
- 418 The Bloch–Kato conjecture for the Riemann zeta function, J. COATES, A. RAGHURAM, A. SAIKIA & R. SUJATHA (eds)
- 419 The Cauchy problem for non-Lipschitz semi-linear parabolic partial differential equations, J.C. MEYER & D.J. NEEDHAM
- 420 Arithmetic and geometry, L. DIEULEFAIT *et al* (eds)
- 421 O-minimality and Diophantine geometry, G.O. JONES & A.J. WILKIE (eds)
- 422 Groups St Andrews 2013, C.M. CAMPBELL *et al* (eds)
- 423 Inequalities for graph eigenvalues, Z. STANIĆ
- 424 Surveys in combinatorics 2015, A. CZUMAJ *et al* (eds)
- 425 Geometry, topology and dynamics in negative curvature, C.S. ARAVINDA, F.T. FARRELL & J.-F. LAFONT (eds)

- 426 Lectures on the theory of water waves, T. BRIDGES, M. GROVES & D. NICHOLLS (eds)
- 427 Recent advances in Hodge theory, M. KERR & G. PEARLSTEIN (eds)
- 428 Geometry in a Fréchet context, C.T.J. DODSON, G. GALANIS & E. VASSILIOU
- 429 Sheaves and functions modulo p , L. TAELEMAN
- 430 Recent progress in the theory of the Euler and Navier–Stokes equations, J.C. ROBINSON, J.L. RODRIGO, W. SADOWSKI & A. VIDAL-LÓPEZ (eds)
- 431 Harmonic and subharmonic function theory on the real hyperbolic ball, M. STOLL
- 432 Topics in graph automorphisms and reconstruction (2nd Edition), J. LAURI & R. SCAPELLATO
- 433 Regular and irregular holonomic D-modules, M. KASHIWARA & P. SCHAPIRA
- 434 Analytic semigroups and semilinear initial boundary value problems (2nd Edition), K. TAIRA
- 435 Graded rings and graded Grothendieck groups, R. HAZRAT
- 436 Groups, graphs and random walks, T. CECCHERINI-SILBERSTEIN, M. SALVATORI & E. SAVA-HUSS (eds)
- 437 Dynamics and analytic number theory, D. BADZIAHIN, A. GORODNIK & N. PEYERIMHOFF (eds)
- 438 Random walks and heat kernels on graphs, M.T. BARLOW
- 439 Evolution equations, K. AMMARI & S. GERBI (eds)
- 440 Surveys in combinatorics 2017, A. CLAESON *et al* (eds)
- 441 Polynomials and the mod 2 Steenrod algebra I, G. WALKER & R.M.W. WOOD
- 442 Polynomials and the mod 2 Steenrod algebra II, G. WALKER & R.M.W. WOOD
- 443 Asymptotic analysis in general relativity, T. DAUDÉ, D. HÁFNER & J.-P. NICOLAS (eds)
- 444 Geometric and cohomological group theory, P.H. KROPHOLLER, I.J. LEARY, C. MARTÍNEZ-PÉREZ & B.E.A. NUCINKIS (eds)
- 445 Introduction to hidden semi-Markov models, J. VAN DER HOEK & R.J. ELLIOTT
- 446 Advances in two-dimensional homotopy and combinatorial group theory, W. METZLER & S. ROSEBROCK (eds)
- 447 New directions in locally compact groups, P.-E. CAPRACE & N. MONOD (eds)
- 448 Synthetic differential topology, M.C. BUNGE, F. GAGO & A.M. SAN LUIS
- 449 Permutation groups and cartesian decompositions, C.E. PRAEGER & C. SCHNEIDER
- 450 Partial differential equations arising from physics and geometry, M. BEN AYED *et al* (eds)
- 451 Topological methods in group theory, N. BROADDUS, M. DAVIS, J.-F. LAFONT & I. ORTIZ (eds)
- 452 Partial differential equations in fluid mechanics, C.L. FEFFERMAN, J.C. ROBINSON & J.L. RODRIGO (eds)
- 453 Stochastic stability of differential equations in abstract spaces, K. LIU
- 454 Beyond hyperbolicity, M. HAGEN, R. WEBB & H. WILTON (eds)
- 455 Groups St Andrews 2017 in Birmingham, C.M. CAMPBELL *et al* (eds)
- 456 Surveys in combinatorics 2019, A. LO, R. MYCROFT, G. PERARNAU & A. TREGLOWN (eds)
- 457 Shimura varieties, T. HAINES & M. HARRIS (eds)
- 458 Integrable systems and algebraic geometry I, R. DONAGI & T. SHASKA (eds)
- 459 Integrable systems and algebraic geometry II, R. DONAGI & T. SHASKA (eds)
- 460 Wigner-type theorems for Hilbert Grassmannians, M. PANKOV
- 461 Analysis and geometry on graphs and manifolds, M. KELLER, D. LENZ & R.K. WOJCIECHOWSKI
- 462 Zeta and L -functions of varieties and motives, B. KAHN
- 463 Differential geometry in the large, O. DEARRICOTT *et al* (eds)
- 464 Lectures on orthogonal polynomials and special functions, H.S. COHL & M.E.H. ISMAIL (eds)
- 465 Constrained Willmore surfaces, Á.C. QUINTINO
- 466 Invariance of modules under automorphisms of their envelopes and covers, A.K. SRIVASTAVA, A. TUGANBAEV & P.A. GUIL ASENSIO
- 467 The genesis of the Langlands program, J. MUELLER & F. SHAHIDI
- 468 (Co)end calculus, F. LOREGIAN
- 469 Computational cryptography, J.W. BOS & M. STAM (eds)
- 470 Surveys in combinatorics 2021, K.K. DABROWSKI *et al* (eds)
- 471 Matrix analysis and entrywise positivity preservers, A. KHARE
- 472 Facets of algebraic geometry I, P. ALUFFI *et al* (eds)
- 473 Facets of algebraic geometry II, P. ALUFFI *et al* (eds)
- 474 Equivariant topology and derived algebra, S. BALCHIN, D. BARNES, M. KEDZIOREK & M. SZYMIK (eds)
- 475 Effective results and methods for Diophantine equations over finitely generated domains, J.-H. EVERTSE & K. GYÖRY
- 476 An indefinite excursion in operator theory, A. GHEONDEA
- 477 Elliptic regularity theory by approximation methods, E.A. PIMENTEL
- 478 Recent developments in algebraic geometry, H. ABBAN, G. BROWN, A. KASPRZYK & S. MORI (eds)
- 479 Bounded cohomology and simplicial volume, C. CAMPAGNOLO, F. FOURNIER-FACIO, N. HEUER & M. MORASCHINI (eds)
- 480 Stacks Project Expository Collection (SPEC), P. BELMANS, W. HO & A.J. DE JONG (eds)
- 481 Surveys in combinatorics 2022, A. NIXON & S. PRENDIVILLE (eds)
- 482 The logical approach to automatic sequences, J. SHALLIT
- 483 Rectifiability: a survey, P. MATTILA
- 484 Discrete quantum walks on graphs and digraphs, C. GODSIL & H. ZHAN
- 485 The Calabi problem for Fano threefolds, C. ARAUJO *et al*

London Mathematical Society Lecture Note Series: 486

Modern Trends in Algebra and Representation Theory

Edited by

DAVID JORDAN
University of Edinburgh

NADIA MAZZA
Lancaster University

SIBYLLE SCHROLL
University of Cologne





Shaftesbury Road, Cambridge CB2 8EA, United Kingdom
One Liberty Plaza, 20th Floor, New York, NY 10006, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India
103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment,
a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of
education, learning and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781009097352

DOI: [10.1017/9781009097350](https://doi.org/10.1017/9781009097350)

© Cambridge University Press & Assessment 2023

This publication is in copyright. Subject to statutory exception and to the provisions
of relevant collective licensing agreements, no reproduction of any part may take
place without the written permission of Cambridge University Press & Assessment.

First published 2023

Printed in the United Kingdom by TJ Books Limited, Padstow Cornwall

A catalogue record for this publication is available from the British Library.

*A Cataloging-in-Publication data record for this book is available from the Library
of Congress.*

ISBN 978-1-009-09735-2 Paperback

Cambridge University Press & Assessment has no responsibility for the persistence
or accuracy of URLs for external or third-party internet websites referred to in this
publication and does not guarantee that any content on such websites is, or will
remain, accurate or appropriate.