

# Zurich Lectures in Advanced Mathematics

## Edited by

Erwin Bolthausen (Managing Editor), Freddy Delbaen, Thomas Kappeler (Managing Editor), Christoph Schwab, Michael Struwe, Gisbert Wüstholz

Mathematics in Zurich has a long and distinguished tradition, in which the writing of lecture notes volumes and research monographs plays a prominent part. The *Zurich Lectures in Advanced Mathematics* series aims to make some of these publications better known to a wider audience. The series has three main constituents: lecture notes on advanced topics given by internationally renowned experts, graduate text books designed for the joint graduate program in Mathematics of the ETH and the University of Zurich, as well as contributions from researchers in residence at the mathematics research institute, FIM-ETH. Moderately priced, concise and lively in style, the volumes of this series will appeal to researchers and students alike, who seek an informed introduction to important areas of current research.

# Previously published in this series:

Yakov B. Pesin, Lectures on partial hyperbolicity and stable ergodicity

Sun-Yung Alice Chang, Non-linear Elliptic Equations in Conformal Geometry

Sergei B. Kuksin, Randomly forced nonlinear PDEs and statistical hydrodynamics in 2 space dimensions

Pavel Etingof, Calogero-Moser systems and representation theory

Guus Balkema and Paul Embrechts, High Risk Scenarios and Extremes - A geometric approach

Demetrios Christodoulou, Mathematical Problems of General Relativity I

Camillo De Lellis, Rectifiable Sets, Densities and Tangent Measures

Paul Seidel, Fukaya Categories and Picard-Lefschetz Theory

Alexander H.W. Schmitt, Geometric Invariant Theory and Decorated Principal Bundles

Michael Farber, Invitation to Topological Robotics

Alexander Barvinok, Integer Points in Polyhedra

Christian Lubich, From Quantum to Classical Molecular Dynamics: Reduced Models and Numerical Analysis Shmuel Onn, Nonlinear Discrete Optimization – An Algorithmic Theory

Kenji Nakanishi and Wilhelm Schlag, Invariant Manifolds and Dispersive Hamiltonian Evolution Equations

Published with the support of the Huber-Kudlich-Stiftung, Zürich

# Erwan Faou

# Geometric Numerical Integration and Schrödinger Equations



### Author:

Erwan Faou INRIA & ENS Cachan Bretagne Département de mathématiques Avenue Robert Schumann Campus de Ker Lann 35170 Bruz France

2010 Mathematics Subject Classification: 65P10, 37M15, 35Q41

Key words: Geometric numerical integration, symplectic integrators, backward error analysis, Schrödinger equations, long time behavior

ISBN 978-3-03719-100-2

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.

© 2012 European Mathematical Society

Contact address:

European Mathematical Society Publishing House Seminar for Applied Mathematics ETH-Zentrum FLI C4 CH-8092 Zürich Switzerland

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

Printing and binding: Beltz Bad Langensalza GmbH, Bad Langensalza, Germany  $\infty$  Printed on acid free paper 9 8 7 6 5 4 3 2 1