

CONTEMPORARY MATHEMATICS

575

Quasiconformal Mappings, Riemann Surfaces, and Teichmüller Spaces

AMS Special Session in Honor of Clifford J. Earle
October 2–3, 2010
Syracuse University, Syracuse, New York

Yunping Jiang
Sudeb Mitra
Editors



American Mathematical Society

Quasiconformal Mappings,
Riemann Surfaces,
and Teichmüller Spaces

CONTEMPORARY MATHEMATICS

575

Quasiconformal Mappings, Riemann Surfaces, and Teichmüller Spaces

AMS Special Session in Honor of Clifford J. Earle
October 2–3, 2010
Syracuse University, Syracuse, New York

Yunping Jiang
Sudeb Mitra
Editors



American Mathematical Society
Providence, Rhode Island

EDITORIAL COMMITTEE

Dennis DeTurck, managing editor

George Andrews Abel Klein Martin J. Strauss

2000 *Mathematics Subject Classification*. Primary 30Fxx, 30C62, 30C65, 30C75, 30F40, 32G15, 32G13, 37F30, 30F10, 30F15.

Library of Congress Cataloging-in-Publication Data

Quasiconformal mappings, Riemann surfaces, and Teichmüller spaces : AMS special session in honor of Clifford J. Earle, October 2–3, 2010, Syracuse University, Syracuse, New York / Yunping Jiang, Sudeb Mitra, editors.

p. cm — (Contemporary mathematics ; v. 575)

Includes bibliographical references.

ISBN 978-0-8218-5340-5 (alk. paper)

1. Geometric analysis. 2. Quasiconformal mappings. 3. Riemann surfaces. 4. Teichmüller spaces. I. Jiang, Yunping. II. Mitra, Sudeb. III. American Mathematical Society.

QA360.Q38 2012
515'.93-dc23

2012012153

Copying and reprinting. Material in this book may be reproduced by any means for educational and scientific purposes without fee or permission with the exception of reproduction by services that collect fees for delivery of documents and provided that the customary acknowledgment of the source is given. This consent does not extend to other kinds of copying for general distribution, for advertising or promotional purposes, or for resale. Requests for permission for commercial use of material should be addressed to the Acquisitions Department, American Mathematical Society, 201 Charles Street, Providence, Rhode Island 02904-2294, USA. Requests can also be made by e-mail to reprint-permission@ams.org.

Excluded from these provisions is material in articles for which the author holds copyright. In such cases, requests for permission to use or reprint should be addressed directly to the author(s). (Copyright ownership is indicated in the notice in the lower right-hand corner of the first page of each article.)

© 2012 by the American Mathematical Society. All rights reserved.

The American Mathematical Society retains all rights
except those granted to the United States Government.

Copyright of individual articles may revert to the public domain 28 years
after publication. Contact the AMS for copyright status of individual articles.

Printed in the United States of America.

∞ The paper used in this book is acid-free and falls within the guidelines
established to ensure permanence and durability.

Visit the AMS home page at <http://www.ams.org/>

10 9 8 7 6 5 4 3 2 1 17 16 15 14 13 12

Contents

Preface	vii
Some remarks on singly degenerate Kleinian groups WILLIAM ABIKOFF	1
On a theorem of Kas and Schlessinger OMAR ANTOLÍN-CAMARENA and SARAH KOCH	13
Conformally scattered sets in the unit circle ARA BASMAJIAN	23
Finiteness conditions on translation surfaces JOSHUA P. BOWMAN	31
Holomorphic plumbing coordinates CLIFFORD J. EARLE and ALBERT MARDEN	41
On Böttcher coordinates and quasiregular maps ALASTAIR FLETCHER and ROB FRYER	53
Discontinuity of asymptotic Teichmüller modular group EGE FUJIKAWA	77
Extremal annuli on the sphere FREDERICK P. GARDINER and ZHE WANG	89
Lifting free subgroups of $PSL(2, \mathbb{R})$ to free groups JANE GILMAN and LINDA KEEN	109
An introduction to Beauville surfaces via uniformization GABINO GONZÁLEZ-DIEZ and DAVID TORRES-TEIGELL	123
Symmetry and moduli spaces for Riemann surfaces W. J. HARVEY and A. LLOYD-PHILIPPS	153
Conformally natural extensions of continuous circle maps: I. The case when the pushforward measure has no atom JUN HU and OLEG MUZICIAN	171
Normal and quasinormal families of quasiregular mappings XIAOJUN HUANG and JINSONG LIU	199
Symmetric invariant measures YUNPING JIANG	211

Douady-Earle section, holomorphic motions, and some applications YUNPING JIANG and SUDEB MITRA	219
Cook-hats and crowns YOHEI KOMORI	253
On cohomology of Kleinian groups V: b -groups IRWIN KRA	263
Fundamental inequalities of Reich-Strebel and triangles in a Teichmüller space ZHONG LI and YI QI	283
The Petersson series vanishes at infinity KATSUHIKO MATSUZAKI	299
On fiber spaces over Teichmüller spaces YULIANG SHEN	313
On the number of holomorphic families of Riemann surfaces HIROSHIGE SHIGA	331
Veech groups of flat structures on Riemann surfaces YOSHIHIKO SHINOMIYA	343
On families of holomorphic differentials on degenerating annuli SCOTT A. WOLPERT	363
Transformations of spheres without the injectivity assumption GUOWU YAO	371

Preface

Teichmüller theory originated as a specialized branch of geometric function theory. Over the last fifty years, it has blossomed into an important field of research, intersecting with many areas of mathematics, such as topology, geometry, dynamics, hyperbolic manifolds. Teichmüller theory has also found interesting applications in physics.

We organized an AMS Special Session on “Quasiconformal Mappings, Riemann Surfaces, and Teichmüller Spaces (in honor of Clifford J. Earle)”. This event was to celebrate the 75th birthday of Professor Earle, and was part of the 1062nd AMS meeting held at Syracuse University on October 2–3, 2010. The main goal was to survey some of the important developments in quasiconformal mappings, Riemann surfaces, Teichmüller spaces, Kleinian groups, and dynamics that are related to, or have been influenced by Earle’s research. Speakers included many of Earle’s collaborators, and also many other leading researchers in these fields.

The present volume contains papers on a broad range of topics. They illustrate interesting ideas and techniques, many of which originate in the works of Earle. Many papers in this volume present new results, and there are also some survey articles. We hope that this volume will be a good source of reference for professional researchers working in these areas. It should also be suitable for graduate students who aspire to learn these subjects and pursue their own research.

We want to thank all speakers at this meeting and all contributors to this volume. We are grateful to the anonymous referees for their careful work. Special thanks to Christine Thivierge and Sergei Gelfand of the AMS Editorial Division, and to Sam White, AMS Production Editor, for their generous help and valuable advice.

Yunping Jiang and Sudeb Mitra, Editors

This volume contains the proceedings of the AMS Special Session on Quasiconformal Mappings, Riemann Surfaces, and Teichmüller Spaces, held in honor of Clifford J. Earle, from October 2–3, 2010, in Syracuse, New York.

This volume includes a wide range of papers on Teichmüller theory and related areas. It provides a broad survey of the present state of research in quasiconformal mappings, Riemann surfaces, complex dynamical systems, Teichmüller theory, and geometric function theory. The papers in this volume reflect the directions of research in different aspects of these fields and also give the reader an idea of how Teichmüller theory intersects with other areas of mathematics.

ISBN 978-0-8218-5340-5



9 780821 853405

CONM/575

AMS on the Web
www.ams.org