Conformal Mapping

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Conformal Mapping *2023-10-25*

LUCA JAZMYN

Dirichlet's Principle, Conformal Mapping, and Minimal Surfaces Courier Corporation
This book provides a comprehensive look at the Schwarz-Christoffel transformation, including its history and foundations, practical computation, common and less common variations, and many applications in fields such as electromagnetism, fluid flow, design and inverse problems, and the solution of linear systems of equations. It is an accessible resource for engineers, scientists, and applied mathematicians who seek more experience with theoretical or computational conformal mapping techniques. The most important theoretical results are stated and proved, but the emphasis throughout remains on concrete understanding and implementation, as evidenced by the 76 figures based on quantitatively correct illustrative examples. There are over 150 classical and modern reference works cited for readers needing more details. There is also a brief appendix illustrating the use of the Schwarz-Christoffel Toolbox for MATLAB, a package for computation of these maps.
Handbook of Conformal Mapping with Computer-Aided Visualization John Wiley & Sons
This book is an introduction to the theory of spatial quasiregular mappings intended for the uninitiated reader. At the same time the book also addresses specialists in classical analysis and, in particular, geometric function theory. The text leads the reader to the frontier of current research and covers some most recent developments in the subject, previously scatterd through the literature. A major role in this monograph is played by certain conformal invariants which are solutions of extremal problems related to extremal lengths of curve families. These invariants are then applied to prove sharp distortion theorems for quasiregular mappings. One of these extremal problems of conformal geometry generalizes a classical two-dimensional problem of O. Teichmüller. The novel feature of the exposition is the way in which conformal invariants are applied and the sharp results obtained should be of considerable interest even in the two-dimensional particular case. This book combines the features of a textbook and of a research monograph: it is the first introduction to the subject available in English, contains nearly a hundred exercises, a survey of the subject as well as an extensive bibliography and, finally, a list of open problems.
Quasiconformal Mappings in the Plane American Mathematical Soc.
We study the boundary behaviour of a conformal map of the unit disk onto an arbitrary simply connected plane domain. A principal aim of the theory is to obtain a one-to-one correspondence between analytic properties of the function and geometrie properties of the domain. In the classical applications of conformal mapping, the domain is bounded by a piecewise smooth curve. In many recent applications however, the domain has a very bad boundary. It may have nowhere a tangent as is the case for Julia sets. Then the conformal map has many unexpected properties, for instance almost all the boundary is mapped onto almost nothing and vice versa. The book is meant for two groups of users. (1) Graduate students and others who, at various levels, want to learn about conformal mapping. Most sections contain exercises to test the understand ing. They tend to be fairly simple and only a few contain new material. Pre requisites are general real and complex analyis including the basic facts about conformal mapping (e.g. AhI66a). (2) Non-experts who want to get an idea of a particular aspect of confor mal mapping in order to find something useful for their work. Most chapters therefore begin with an overview that states some key results avoiding tech nicalities. The book is not meant as an exhaustive survey of conformal mapping. Several important aspects had to be omitted, e.g. numerical methods (see e.g.
Lectures on Conformal Mapping Cambridge University Press
Beginning with a brief survey of some basic mathematical concepts, this graduate-level text proceeds to discussions of a selection of mapping functions, numerical methods and mathematical models, nonplanar fields and nonuniform media, static fields in electricity and magnetism, and transmission lines and waveguides. Other topics include vibrating membranes and acoustics, transverse vibrations and buckling of plates, stresses and strains in an elastic medium, steady state heat conduction in doubly connected regions, transient heat transfer in isotropic and anisotropic media, and fluid flow. Revision of 1991 ed. 247 figures. 38 tables. Appendices.
Dirichlet's Principle, Conformal Mapping, and Minimal Surfaces Springer Science & Business Media
This book evolved out of a graduate course given at the University of New Orleans in 1997. The class consisted of students from applied mathematics andengineering. Theyhadthebackgroundofatleastafirstcourseincomplex analysiswithemphasisonconformalmappingandSchwarz-Christoffeltrans formation, a firstcourse in numerical analysis, and good to excellent working knowledgeofMathematica* withadditionalknowledgeofsomeprogramming languages. Sincetheclasshad nobackground inIntegralEquations, thechap tersinvolvingintegralequationformulations werenotcoveredindetail, except for Symm's integral equation which appealed to a subsetofstudents who had some training in boundary element methods. Mathematica was mostly used for computations. In fact, it simplified numerical integration and other oper ations very significantly, which would have otherwise involved programming inFortran, C, orotherlanguageofchoice, ifclassical numericalmethods were attempted. Overview Exact solutions of boundary value problems for simple regions, such as cir cles, squares or annuli, can be determined with relative ease even where the boundaryconditionsarerathercomplicated.

Green'sfunctionsforsuchsimple regions are known. However, for regions with complex structure the solution ofa boundary value problem often becomes more difficult, even for a simple problemsuchastheDirichletproblem.
Oneapproachtosolvingthesedifficult problems is to conformally transform a given multiply connected region onto *Mathematica is a registered trade mark of Wolfram Research, Inc. ix x PREFACE simpler canonical regions. This will, however, result in change not only in the region and the associated boundary conditions but also in the governing differential equation. As compared to the simply connected regions, confor mal mapping ofmultiply connected regions suffers from severe limitations, one of which is the fact that equal connectivity ofregions is not a sufficient condition to effect a reciprocally connected map ofone region onto another.

Numerical Conformal Mapping Courier Corporation
This monograph deals with the application of the method of the extremal metric to the theory of univalent functions. Apart from an introductory chapter in which a brief survey of the development of this theory is given there is therefore no attempt to follow up other methods of treatment. Nevertheless such is the power of the present method that it is possible to include the great majority of known results on univalent functions. It should be mentioned also that the discussion of the method of the extremal metric is directed toward its application to univalent functions, there being no space to present its numerous other applications, particularly to questions of quasiconformal mapping. Also it should be said that there has been no attempt to provide an exhaustive biblio graphy, reference normally being confined to those sources actually quoted in the text. The central theme of our work is the General Coefficient Theorem which contains as special cases a great many of the known results on univalent functions. In a final chapter we give also a number of appli cations of the method of symmetrization. At the time of writing of this monograph the author has been re ceiving support from the National Science Foundation for which he wishes to express his gratitude. His thanks are due also to Sister BARBARA ANN Foos for the use of notes taken at the author's lectures in Geo metric Function Theory at the University of Notre Dame in 1955-1956.

Construction and Applications of Conformal Maps Springer Nature
'I very much enjoyed reading this book ... Each chapter comes with well thought-out exercises, solutions to which are given at the end of the chapter. Conformal Maps and Geometry presents key topics in geometric function theory and the theory of univalent functions, and also prepares the reader to progress to study the SLE. It succeeds admirably on both counts.'MathSciNetGeometric function theory is one of the most interesting parts of complex analysis, an area that has become increasingly relevant as a key feature in the theory of Schramm-Loewner evolution.Though Riemann mapping theorem is frequently explored, there are few texts that discuss general theory of univalent maps, conformal invariants, and Loewner evolution. This textbook provides an accessible foundation of the theory of conformal maps and their connections with geometry.It offers a unique view of the field, as it is one of the first to discuss general theory of univalent maps at a graduate level, while introducing more complex theories of conformal invariants and extremal lengths. Conformal Maps and Geometry is an ideal resource for graduate courses in Complex Analysis or as an analytic prerequisite to study the theory of Schramm-Loewner evolution.

Harmonic Maps Between Surfaces World Scientific
Methods of classical analysis devised originally for the disc are here extended to more general plane regions by the use of Green's lines, the Green's mapping, and an ideal boundary structure generalizing the prime-end structure of Carathéodory. The regions admitted include all bounded finitely connected regions, as well as a broad class of infinitely connected regions. Since certain modifications in the Brelot-Choquet theory are needed to allow for singular Green's lines, an independent development of the theory of Green's lines is given, based on properties of the Green's mapping. These techniques make possible the introduction of a generalized Poisson kernel and integral defined in terms of Green's lines.

Univalent Functions and Conformal Mapping CRC Press
Translated from the fourth German edition by F. Steinhardt, with an expanded Bibliography.

Numerical Conformal Mapping Springer
Originally published: New York: Interscience Publishers, 1950, in series: Pure and applied mathematics (Interscience Publishers); v. 3.

Boundary Behaviour of Conformal Maps American Mathematical Soc.
This book is a guide on conformal mappings, their applications in physics and technology, and their computer-aided visualization. Conformal mapping (CM) is a classical part of complex analysis having numerous applications to mathematical physics. This modern handbook on CM includes recent results such as the classification of all triangles and quadrangles that can be mapped by elementary functions, mappings realized by elliptic integrals and Jacobian elliptic functions, and mappings of doubly connected domains. This handbook considers a wide array of applications, among which are the construction of a Green function for various boundary-value problems, streaming around airfoils, the impact of a cylinder on the surface of a liquid, and filtration under a dam. With more than 160 domains included in the catalog of mapping, Handbook of Conformal Mapping with Computer-Aided Visualization is more complete and useful than any previous volume covering this important topic. The authors have developed an interactive ready-to-use software program for constructing conformal mappings and visualizing plane harmonic vector fields. The book includes a floppy disk for IBM-compatible computers that contains the CONFORM program.

On Brennan's Conjecture in Conformal Mapping Courier Corporation
Conformal mapping is a field in which pure and applied mathematics are both involved. This book tries to bridge the gulf that many times divides these two disciplines by combining the theoretical and practical approaches to the subject. It will interest the pure mathematician, engineer, physicist, and applied mathematician. The potential theory and complex function theory necessary for a full treatment of conformal mapping are developed in the first four chapters, so the reader needs no other text on complex variables. These chapters cover harmonic functions, analytic functions, the complex integral calculus, and families of analytic functions. Included here are discussions of Green's formula, the Poisson formula, the Cauchy-Riemann equations, Cauchy's theorem, the Laurent series, and the Residue theorem. The final three chapters consider in detail conformal mapping of simply-connected domains, mapping properties of special functions, and conformal mapping of multiply-connected domains. The coverage here includes such topics as the Schwarz lemma, the Riemann mapping theorem, the Schwarz-Christoffel formula, univalent functions, the kernel function, elliptic functions, univalent functions, the kernel function, elliptic functions, the Schwarzian s-functions, canonical domains, and bounded functions. There are many problems and exercises, making the book useful for both self-study and classroom use. The author, former professor of mathematics at Carnegie-Mellon

University, has designed the book as a semester's introduction to functions of a complex variable followed by a one-year graduate course in conformal mapping. The material is presented simply and clearly, and the only prerequisite is a good working knowledge of advanced calculus.

Conformal Mapping CRC Press

This is a unique monograph on numerical conformal mapping that gives a comprehensive account of the theoretical, computational and application aspects of the problems of determining conformal modules of quadrilaterals and of mapping conformally onto a rectangle. It contains a detailed study of the theory and application of a domain decomposition method for computing the modules and associated conformal mappings of elongated quadrilaterals, of the type that occur in engineering applications. The reader will find a highly useful and up-to-date survey of available numerical methods and associated computer software for conformal mapping. The book also highlights the crucial role that function theory plays in the development of numerical conformal mapping methods, and illustrates the theoretical insight that can be gained from the results of numerical experiments.This is a valuable resource for mathematicians, who are interested in numerical conformal mapping and wish to study some of the recent developments in the subject, and for engineers and scientists who use, or would like to use, conformal transformations and wish to find out more about the capabilities of modern numerical conformal mapping.

Conformal Projections in Geodesy and Cartography Springer Science & Business Media

It has always been a temptation for mathematicians to present the crystallized product of their thoughts as a deductive general theory and to relegate the individual mathematical phenomenon into the role of an example. The reader who submits to the dogmatic form will be easily indoctrinated. Enlightenment, however, must come from an understanding of motives; live mathematical development springs from specific natural problems which can be easily understood, but whose solutions are difficult and demand new methods of more general significance. The present book deals with subjects of this category. It is written in a style which, as the author hopes, expresses adequately the balance and tension between the individuality of mathematical objects and the generality of mathematical methods. The author has been interested in Dirichlet's Principle and its various applications since his days as a student under David Hilbert. Plans for writing a book on these topics were revived when Jesse Douglas' work suggested to him a close connection between Dirichlet's Principle and basic problems concerning minimal sur faces. But war work and other duties intervened; even now, after much delay, the book appears in a much less polished and complete form than the author would have liked."

Conformal Geometry and Quasiregular Mappings Springer

The monograph is concerned with the modulus of families of curves on Riemann surfaces and its applications to extremal problems for conformal, quasiconformal mappings, and the extension of the modulus onto Teichmüller spaces. The main part of the monograph deals with extremal problems for compact classes of univalent conformal and quasiconformal mappings. Many of them are grouped around two-point distortion theorems. Montel's functions and functions with fixed angular derivatives are also considered. The last portion of problems is directed to the extension of the modulus varying the complex structure of the underlying Riemann surface that sheds some new light on the metric problems of Teichmüller spaces.

Conformal Mapping on Riemann Surfaces American Mathematical Soc.

This is a brief textbook on complex analysis intended for the students of upper undergraduate or beginning graduate level. The author stresses the aspects of complex analysis that are most important for the student planning to study algebraic geometry and related topics. The exposition is rigorous but elementary: abstract notions are introduced only if they are really indispensable. This approach provides a motivation for the reader to digest more abstract definitions (e.g., those of sheaves or line bundles, which are not mentioned in the book) when he/she is ready for that level of abstraction indeed. In the chapter on Riemann surfaces, several key results on compact Riemann surfaces are stated and proved in the first nontrivial case, i.e. that of elliptic curves.

Conformal Mapping Elsevier

Geometric Function Theory is that part of Complex Analysis which covers the theory of conformal and quasiconformal mappings. Beginning with the classical Riemann mapping theorem, there is a lot of existence theorems for canonical conformal mappings. On the other side there is an extensive theory of qualitative properties of conformal and quasiconformal mappings, concerning mainly a prior estimates, so called distortion theorems (including the Bieberbach conjecture with the proof of the Branges). Here a starting point was the classical Scharz lemma, and then Koebe's distortion theorem. There are several connections to mathematical physics, because of the relations to potential theory (in the plane). The Handbook of Geometric Function Theory contains also an article about constructive methods and further a Bibliography including applications eg: to electroxtatic problems, heat conduction, potential flows (in the plane). · A collection of independent survey articles in the field of GeometricFunction Theory · Existence theorems and qualitative properties of conformal and quasiconformal mappings · A bibliography, including many hints to applications in electrostatics, heat conduction, potential flows (in the plane).

Conformal Mappings and Boundary Value Problems Springer-Verlag

The subject of conformal mappings is a major part of geometric function theory that gained prominence after the publication of the Riemann mapping theorem — for every simply connected domain of the extended complex plane there is a univalent and meromorphic function that maps such a domain conformally onto the unit disk. The Handbook of Conformal Mappings and Applications is a compendium of at least all known conformal maps to date, with diagrams and description, and all possible applications in different scientific disciplines, such as: fluid flows, heat transfer, acoustics, electromagnetic fields as static fields in electricity and magnetism, various mathematical models and methods, including solutions of certain integral equations.

The Cauchy Transform, Potential Theory and Conformal Mapping Springer Science & Business Media

Lucid, insightful exploration reviews complex analysis, introduces Riemann manifold, shows how to define real functions on manifolds, and more. Perfect for classroom use or independent study. 344 exercises. 1967 edition.

Conformal Representation Springer Science & Business Media

This introduction to complex variable methods begins by carefully defining complex numbers and analytic functions, and proceeds to give accounts of complex integration, Taylor series, singularities, residues and mappings. Both algebraic and geometric tools are employed to provide the greatest understanding, with many diagrams illustrating the concepts introduced. The emphasis is laid on understanding the use of methods, rather than on rigorous proofs. Throughout the text, many of the important theoretical results in complex function theory are followed by relevant and vivid examples in physical

sciences. This second edition now contains 350 stimulating exercises of high quality, with solutions given to many of them. Material has been updated and additional proofs on some of the important theorems in complex function theory are now included, e.g. the Weierstrass–Casorati theorem. The book is highly suitable for students wishing to learn the elements of complex analysis in an applied context.