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Spectral Theory and Partial Differential Equations

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Hecke's Theory of Modular Forms and Dirichlet Series

Introduction to $\lambda$-trees

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Automorphism Groups of Compact Bordered Klein Surfaces

Kleinian Groups and Hyperbolic 3-Manifolds

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Discontinuous Groups and Riemann Surfaces (AM-79), Volume 79

The Geometry of Discrete Groups

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Classical and Quantum Models and Arithmetic Problems

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Discontinuous Groups of Isometries in the Hyperbolic Plane

Geometric Group Theory: Volume 1

Riemann Surfaces

Advances in Complex Function Theory

Applying Mathematics Series

Asserting that a solid ball may be taken apart into many pieces that can be rearranged to form a ball twice as large as the original, the Banach-Tarski paradox is examined in relationship to measure and group theory, geometry and logic.
Combinatorial Group Theory Fuchsian groups play a central role in various important fields of mathematics. The current book is based on what became known as the famous Fenchel-Nielsen manuscript. Jakob Nielsen (1890-1959) started this project well before World War II, Werner Fenchel (1905-1988) joined later and overtook the much of the preparation of the manuscript. Professor Asmus Schmidt (University of Copenhagen) is the editor of this first publication in book form of the Fenchel-Nielsen notes. It is on his initiative that the long and difficult way of getting the original notes into the proper shape ready for publication succeeded.

The Poincaré Half-plane This book offers an easy and compact access to the theory of Teichmüller spaces, starting from the most elementary aspects to the most recent developments, e.g. the role this theory plays with regard to string theory. Teichmüller spaces give parametrization of all the complex structures on a given Riemann surface. This subject is related to many different areas of mathematics including complex analysis, algebraic geometry, differential geometry, topology in two and three dimensions, Kleinian and Fuchsian groups, automorphic forms, complex dynamics, and ergodic theory. Recently, Teichmüller spaces have begun to play an important role in string theory. Imayoshi and Taniguchi have attempted to make the book as self-contained as possible. They present numerous examples and heuristic arguments in order to help the reader grasp the ideas of Teichmüller theory. The book will be an excellent source of information for graduate students and researchers in complex analysis and algebraic geometry as well as for theoretical physicists working in quantum theory.

Sign and Subject Here is an unsurpassed resource—important accounts of a variety of dynamic systems topics related to number theory. Twelve distinguished mathematicians present a rare complete analytic solution of a geodesic quantum problem on a negatively curved surface and explicit determination of modular function growth near a real point ... applications of number theory to dynamical systems and applications of mathematical physics to number theory ... tributes to the often-unheralded pioneers in the field an examination of completely integrable and exactly solvable physical models ... and much more! Classical and Quantum
Models and Arithmetic Problems is certainly a major source of information, advancing the studies of number theorists, algebraists, and mathematical physicists interested in complex mathematical properties of quantum field theory, statistical mechanics, and dynamic systems. Moreover, the volume is a superior source of supplementary reading for graduate-level courses in dynamic systems and application of number theory.

A Short Course in Automorphic Functions Introduction to Riemann surfaces for graduates and researchers, giving refreshingly new insights into the subject.

Journal of Research of the National Bureau of Standards This textbook explores a selection of topics in complex analysis. From core material in the mainstream of complex analysis itself, to tools that are widely used in other areas of mathematics, this versatile compilation offers a selection of many different paths. Readers interested in complex analysis will appreciate the unique combination of topics and connections collected in this book. Beginning with a review of the main tools of complex analysis, harmonic analysis, and functional analysis, the authors go on to present multiple different, self-contained avenues to proceed. Chapters on linear fractional transformations, harmonic functions, and elliptic functions offer pathways to hyperbolic geometry, automorphic functions, and an intuitive introduction to the Schwarzian derivative. The gamma, beta, and zeta functions lead into L-functions, while a chapter on entire functions opens pathways to the Riemann hypothesis and Nevanlinna theory. Cauchy transforms give rise to Hilbert and Fourier transforms, with an emphasis on the connection to complex analysis. Valuable additional topics include Riemann surfaces, steepest descent, tauberian theorems, and the Wiener–Hopf method. Showcasing an array of accessible excursions, Explorations in Complex Functions is an ideal companion for graduate students and researchers in analysis and number theory. Instructors will appreciate the many options for constructing a second course in complex analysis that builds on a first course prerequisite; exercises complement the results throughout.

Modular Functions of One Variable V The subject of Kleinian groups and hyperbolic 3-manifolds
is currently undergoing explosively fast development, with many old problems and conjectures close to resolution. This volume, proceedings of the Warwick workshop in September 2001, contains expositions of many of these breakthroughs including Minsky's lectures on the first half of the proof of the Ending Lamination Conjecture, the Bers Density Conjecture by Brock and Bromberg, the Tameness Conjecture by Kleineidam and Souto, the state of the art in cone manifolds by Hodgson and Kerckhoff, and the counter example to Thurston's K=2 conjecture by Epstein, Marden and Markovic. It also contains Jørgensen's famous paper 'On pairs of once punctured tori' in print for the first time. The excellent collection of papers here will appeal to graduate students, who will find much here to inspire them, and established researchers who will find this valuable as a snapshot of current research.

Explorations in Complex Functions


Representations of Integers as Sums of Squares This text is intended to serve as an introduction to the geometry of the action of discrete groups of Mobius transformations. The subject matter has now been studied with changing points of emphasis for over a hundred years, the most recent developments being connected with the theory of 3-manifolds: see, for example, the papers of Poincare [77] and Thurston [101]. About 1940, the now well-known (but virtually unobtainable) Fenchel-Nielsen manuscript appeared. Sadly, the manuscript never appeared in print, and this more modest text attempts to display at least some of the beautiful geometrical ideas to be found in that manuscript, as well as some more recent material. The text has been written with the conviction that geometrical explanations are essential for a full understanding of the material and that however simple a matrix proof might seem, a geometric proof is almost certainly more profitable. Further, wherever
possible, results should be stated in a form that is invariant under conjugation, thus making the intrinsic nature of the result more apparent. Despite the fact that the subject matter is concerned with groups of isometries of hyperbolic geometry, many publications rely on Euclidean estimates and geometry. However, the recent developments have again emphasized the need for hyperbolic geometry, and I have included a comprehensive chapter on analytical (not axiomatic) hyperbolic geometry. It is hoped that this chapter will serve as a "dictionary" of formulae in plane hyperbolic geometry and as such will be of interest and use in its own right.

The Banach–Tarski Paradox This volume contains the proceedings of the Conference on Spectral Theory and Partial Differential Equations, held from June 17-21, 2013, at the University of California, Los Angeles, California, in honor of James Ralston's 70th Birthday. Papers in this volume cover important topics in spectral theory and partial differential equations such as inverse problems, both analytical and algebraic; minimal partitions and Pleijel's Theorem; spectral theory for a model in Quantum Field Theory; and beams on Zoll manifolds.

Elementary Theory of Groups and Group Rings, and Related Topics Part one of a two-volume collection exploring recent developments in number theory related to automorphic forms and Galois representations.

Automorphic Forms, Representation Theory and Arithmetic

Spectral Theory and Partial Differential Equations

Canadian Mathematical Bulletin For anyone whose interest lies in the interplay between groups and geometry, these books will be an essential addition to their library.

Hecke's Theory of Modular Forms and Dirichlet Series From the reviews: "This book [] defines the boundaries of the subject now called combinatorial group theory. [] it is a considerable
achievement to have concentrated a survey of the subject into 339 pages. [] a valuable and
counterpart to the literature, containing many results not previously available in a
book. It will undoubtedly become a standard reference." Mathematical Reviews

Introduction to [lambda]-trees During the academic year 1980-1981 I was teaching at the
Technion-the Israeli Institute of Technology-in Haifa. The audience was small, but consisted
of particularly gifted and eager listeners; unfortunately, their background varied widely.
What could one offer such an audience, so as to do justice to all of them? I decided to
discuss representations of natural integers as sums of squares, starting on the most
elementary level, but with the intention of pushing ahead as far as possible in some of the
different directions that offered themselves (quadratic forms, theory of genera,
generalizations and modern developments, etc.), according to the interests of the audience. A
few weeks after the start of the academic year I received a letter from Professor Gian-Carlo
Rota, with the suggestion that I submit a manuscript for the Encyclopedia of Mathematical
Sciences under his editorship. I answered that I did not have a ready manuscript to offer,
but that I could use my notes on representations of integers by sums of squares as the basis
for one. Indeed, about that time I had already started thinking about the possibility of such
a book and had, in fact, quite precise ideas about the kind of book I wanted it to be.

Topics on Riemann Surfaces and Fuchsian Groups An elementary account of many aspects of
classical complex function theory, including Mobius transformations, elliptic functions,
Riemann surfaces, Fuchsian groups and modular functions. The book is based on lectures given
to advanced undergraduate students and is well suited as a textbook for a second course in
complex function theory.

Automorphism Groups of Compact Bordered Klein Surfaces

Kleinian Groups and Hyperbolic 3-Manifolds Concise book offers expository account of theory
of modular forms and its application to number theory and analysis. Substantial notes at the
end of each chapter amplify the more difficult subjects. 1969 edition.

An Introduction to Teichmüller Spaces The present volume is the culmination of many years' work separately and jointly. The idea of writing this book began with a set of notes for a course given by one of the authors in 1970-1971 at the Hebrew University. The notes were refined several times and used as the basic content of courses given subsequently by each of the authors at the State University of New York at Stony Brook and the Hebrew University. In this book we present the theory of Riemann surfaces and its many different facets. We begin from the most elementary aspects and try to bring the reader up to the frontier of present-day research. We treat both open and closed surfaces in this book, but our main emphasis is on the compact case. In fact, Chapters III, V, VI, and VII deal exclusively with compact surfaces. Chapters I and II are preparatory, and Chapter IV deals with uniformization. All works on Riemann surfaces go back to the fundamental results of Riemann, Jacobi, Abel, Weierstrass, etc. Our book is no exception. In addition to our debt to these mathematicians of a previous era, the present work has been influenced by many contemporary mathematicians.

Lectures on Modular Forms

Lectures on Modular Forms This treatment of complex analysis focuses on function theory on a finitely connected planar domain. It emphasizes domains bounded by a finite number of disjoint analytic simple closed curves. 1983 edition.

Lie Groups, Lie Algebras, and Some of Their Applications This research monograph provides a self-contained approach to the problem of determining the conditions under which a compact bordered Klein surface S and a finite group G exist, such that G acts as a group of automorphisms in S. The cases dealt with here take G cyclic, abelian, nilpotent or supersoluble and S hyperelliptic or with connected boundary. No advanced knowledge of group theory or hyperbolic geometry is required and three introductory chapters provide as much background as necessary on non-euclidean crystallographic groups. The graduate reader thus
finds here an easy access to current research in this area as well as several new results obtained by means of the same unified approach.

Automorphic Forms on $SL_2(R)$ This book provides an introduction to some aspects of the analytic theory of automorphic forms on $G=SL_2(R)$ or the upper-half plane $X$, with respect to a discrete subgroup $G$ of $G$ of finite covolume. The point of view is inspired by the theory of infinite dimensional unitary representations of $G$; this is introduced in the last sections, making this connection explicit. The topics treated include the construction of fundamental domains, the notion of automorphic form on $G\backslash G$ and its relationship with the classical automorphic forms on $X$, Poincare series, constant terms, cusp forms, finite dimensionality of the space of automorphic forms of a given type, compactness of certain convolution operators, Eisenstein series, unitary representations of $G$, and the spectral decomposition of $L^2(G\backslash G)$. The main prerequisites are some results in functional analysis (reviewed, with references) and some familiarity with the elementary theory of Lie groups and Lie algebras. Graduate students and researchers in analytic number theory will find much to interest them in this book.

Canadian Journal of Mathematics Study 79 contains a collection of papers presented at the Conference on Discontinuous Groups and Riemann Surfaces at the University of Maryland, May 21-25, 1973. The papers, by leading authorities, deal mainly with Fuchsian and Kleinian groups, Teichmüller spaces, Jacobian varieties, and quasiconformal mappings. These topics are intertwined, representing a common meeting of algebra, geometry, and analysis.

Discontinuous Groups and Riemann Surfaces (AM-79), Volume 79 The theory of $\mathbb{R}$-trees has its origin in the work of Lyndon on length functions in groups. The first definition of an $R$-tree was given by Tits in 1977. The importance of $\mathbb{R}$-trees was established by Morgan and Shalen, who showed how to compactify a generalisation of Teichmüller space for a finitely generated group using $R$-trees. In that work they were led to define the idea of a $\mathbb{R}$-tree, where $\mathbb{R}$ is an arbitrary ordered abelian group. Since then there has been much progress in understanding the
structure of groups acting on R-trees, notably Rips' theorem on free actions. There has also
been some progress for certain other ordered abelian groups ?, including some interesting
connections with model theory. Introduction to ?-Trees will prove to be useful for
mathematicians and research students in algebra and topology.

The Geometry of Discrete Groups The proceedings of the conference are being published in two
parts, and the present volume is mostly algebraic (congruence properties of modular forms,
modular curves and their rational points, etc.), whereas the second volume will be more
analytic and also include some papers on modular forms in several variables.

Complex Functions

Classical and Quantum Models and Arithmetic Problems International Colloquium an Automorphic
Forms, Representation Theory and Arithmetic. Published for the Tata Institute of Fundamental
Research, Bombay

Automorphic Forms Concise book offers expository account of theory of modular forms and its
application to number theory and analysis. Substantial notes at the end of each chapter
amplify the more difficult subjects. 1969 edition.

The Banach-Tarski Paradox The Poincare Half-Plane provides an elementary and constructive
development of this geometry that brings the undergraduate major closer to current geometric
research. At the same time, repeated use is made of high school geometry, algebra,
trigonometry, and calculus, thus reinforcing the students' understanding of these disciplines
as well as enhancing their perception of mathematics as a unified endeavor.

Algebra and its Applications

Function Theory on Planar Domains Automorphic forms and Galois representations have played a
central role in the development of modern number theory, with the former coming to prominence via the celebrated Langlands program and Wiles' proof of Fermat's Last Theorem. This two-volume collection arose from the 94th LMS-EPSRC Durham Symposium on 'Automorphic Forms and Galois Representations' in July 2011, the aim of which was to explore recent developments in this area. The expository articles and research papers across the two volumes reflect recent interest in p-adic methods in number theory and representation theory, as well as recent progress on topics from anabelian geometry to p-adic Hodge theory and the Langlands program. The topics covered in volume one include the Shafarevich Conjecture, effective local Langlands correspondence, p-adic L-functions, the fundamental lemma, and other topics of contemporary interest.

Lectures on Modular Forms Automorphic forms are an important complex analytic tool in number theory and modern arithmetic geometry. They played for example a vital role in Andrew Wiles's proof of Fermat's Last Theorem. This text provides a concise introduction to the world of automorphic forms using two approaches: the classic elementary theory and the modern point of view of adeles and representation theory. The reader will learn the important aims and results of the theory by focussing on its essential aspects and restricting it to the 'base field' of rational numbers. Students interested for example in arithmetic geometry or number theory will find that this book provides an optimal and easily accessible introduction into this topic.

Automorphic Forms and Galois Representations An opening discussion of introductory concepts leads to explorations of the classical groups, continuous groups and Lie groups, and Lie algebras. Some simple but illuminating examples are followed by examinations of classical algebras, Lie algebras and root spaces, root spaces and Dynkin diagrams, real forms, and contractions and expansions.

Discontinuous Groups of Isometries in the Hyperbolic Plane Cyber security, encompassing both information and network security, is of utmost importance in today's information age. Cyber
Security Standards, Practices and Industrial Applications: Systems and Methodologies details the latest and most important advances in security standards. First, it introduces the differences between information security (covers the understanding of security requirements, classification of threats, attacks and information protection systems and methodologies) and network security (includes both security protocols as well as systems which create a security perimeter around networks for intrusion detection and avoidance). In addition, the book serves as an essential reference to students, researchers, practitioners, and consultants in the area of social media, cyber security and information, and communication technologies (ICT).

Geometric Group Theory: Volume 1 This proceedings volume documents the contributions presented at the conference held at Fairfield University and at the Graduate Center, CUNY in 2018 celebrating the New York Group Theory Seminar, in memoriam Gilbert Baumslag, and to honor Benjamin Fine and Anthony Gaglione. It includes several expert contributions by leading figures in the group theory community and provides a valuable source of information on recent research developments.

Riemann Surfaces The Banach–Tarski Paradox is a most striking mathematical construction: it asserts that a solid ball can be taken apart into finitely many pieces that can be rearranged using rigid motions to form a ball twice as large. This volume explores the consequences of the paradox for measure theory and its connections with group theory, geometry, set theory, and logic. This new edition of a classic book unifies contemporary research on the paradox. It has been updated with many new proofs and results, and discussions of the many problems that remain unsolved. Among the new results presented are several unusual paradoxes in the hyperbolic plane, one of which involves the shapes of Escher's famous 'Angel and Devils' woodcut. A new chapter is devoted to a complete proof of the remarkable result that the circle can be squared using set theory, a problem that had been open for over sixty years.
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