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Operator Theoretic Aspects of Ergodic Theory Tanja Eisner 2015-11-18 Stunning recent results by Host–Kra, Green–Tao, and others, highlight the timeliness of this systematic introduction to classical ergodic theory using the tools of operator theory. Assuming no prior exposure to ergodic theory, this book provides a modern foundation for introductory courses on ergodic theory, especially for students or researchers with an interest in functional analysis. While basic analytic notions and results are reviewed in several appendices, more advanced operator theoretic topics are developed in detail, even beyond their immediate connection with ergodic theory. As a consequence, the book is

also suitable for advanced or special-topic courses on functional analysis with applications to ergodic theory. Topics include: • an intuitive introduction to ergodic theory • an introduction to the basic notions, constructions, and standard examples of topological dynamical systems • Koopman operators, Banach lattices, lattice and algebra homomorphisms, and the Gelfand–Naimark theorem • measure-preserving dynamical systems • von Neumann's Mean Ergodic Theorem and Birkhoff's Pointwise Ergodic Theorem • strongly and weakly mixing systems • an examination of notions of isomorphism for measure-preserving systems • Markov operators, and the related concept of a factor of a measure preserving system • compact groups and semigroups, and a powerful tool in their study, the Jacobs–de Leeuw–Glicksberg decomposition • an introduction to the spectral theory of dynamical systems, the theorems of Furstenberg and Weiss on multiple recurrence, and applications of dynamical systems to combinatorics (theorems of van der Waerden, Gallai,and Hindman, Furstenberg's Correspondence Principle, theorems of Roth and Furstenberg–Sárközy) Beyond its use in the classroom, Operator Theoretic Aspects of Ergodic Theory can serve as a valuable foundation for doing research at the intersection of ergodic theory and operator theory

Recent Trends in Ergodic Theory and Dynamical Systems Siddhartha Bhattacharya 2015-01-26 This volume contains the proceedings of the International Conference on Recent Trends in Ergodic Theory and Dynamical Systems, in honor of S. G. Dani's 65th Birthday, held December 26-29, 2012, in Vadodara, India. This volume covers many topics of ergodic theory, dynamical systems, number theory and probability measures on groups. Included are papers on Teichmüller dynamics, Diophantine approximation, iterated function systems, random walks and algebraic dynamical systems, as well as two surveys on the work of S. G. Dani.

The Arithmetic of Elliptic Curves Joseph H. Silverman 2010-11-19 The theory of elliptic curves is distinguished by its long history and by the diversity of the methods that have been used in its study. This book treats the arithmetic approach in its modern formulation, through the use of basic algebraic number theory and algebraic geometry. Following a brief discussion of the necessary algebro-geometric results, the book proceeds with an exposition of the geometry and the formal group of elliptic curves, elliptic curves over finite fields, the complex numbers, local fields, and global fields. Final chapters deal with integral and rational points, including Siegels theorem and explicit computations for the curve $Y = X + DX$, while three appendices conclude the whole: Elliptic Curves in Characteristics 2 and 3, Group Cohomology, and an overview of more advanced topics.

Dynamics: Topology and Numbers Pieter Moree 2020-02-12 This volume contains the proceedings of the conference Dynamics: Topology and Numbers, held from July 2–6, 2018, at the Max Planck Institute for Mathematics, Bonn, Germany.? The papers cover diverse fields of mathematics with a unifying

theme of relation to dynamical systems. These include arithmetic geometry, flat geometry, complex dynamics, graph theory, relations to number theory, and topological dynamics. The volume is dedicated to the memory of Sergiy Kolyada and also contains some personal accounts of his life and mathematics.
Invitation to Dynamical Systems Edward R. Scheinerman 2013-05-13 This text is designed for those who wish to study mathematics beyond linear algebra but are unready for abstract material. Rather than a theorem-proof-corollary exposition, it stresses geometry, intuition, and dynamical systems. 1996 edition.
Advances in Ultrametric Analysis Alain Escassut 2018-03-26 Articles included in this book feature recent developments in various areas of non-Archimedean analysis: summation of -adic series, rational maps on the projective line over , non-Archimedean Hahn-Banach theorems, ultrametric Calkin algebras, -modules with a convex base, non-compact Trace class operators and Schatten-class operators in -adic Hilbert spaces, algebras of strictly differentiable functions, inverse function theorem and mean value theorem in Levi-Civita fields, ultrametric spectra of commutative non-unital Banach rings, classes of non-Archimedean Köthe spaces, -adic Nevanlinna theory and applications, and sub-coordinate representation of -adic functions. Moreover, a paper on the history of -adic analysis with a comparative summary of non-Archimedean fields is presented. Through a combination of new research articles and a survey paper, this book provides the reader with an overview of current developments and techniques in non-Archimedean analysis as well as a broad knowledge of some of the sub-areas of this exciting and fast-developing research area.
Research Directions in Number Theory Jennifer S. Balakrishnan 2019-08-01 These proceedings collect several number theory articles, most of which were written in connection to the workshop WIN4: Women in Numbers, held in August 2017, at the Banff International Research Station (BIRS) in Banff, Alberta, Canada. It collects papers disseminating research outcomes from collaborations initiated during the workshop as well as other original research contributions involving participants of the WIN workshops. The workshop and this volume are part of the WIN network, aimed at highlighting the research of women and gender minorities in number theory as well as increasing their participation and boosting their potential collaborations in number theory and related fields.
Pluripotential Theory Giorgio Patrizio 2013-05-16 Pluripotential theory is a very powerful tool in geometry, complex analysis and dynamics. This volume brings together the lectures held at the 2011 CIME session on "pluripotential theory" in Cetraro, Italy. This CIME course focused on complex Monge-Ampére equations, applications of pluripotential theory to Kahler geometry and algebraic geometry and to holomorphic dynamics. The contributions provide an extensive description of the theory and its very recent developments, starting from basic introductory materials and concluding with open questions in current research.
Frontiers in Complex Dynamics Araceli Bonifant 2014-03-16 John Milnor, best known for his work in differential topology, K-theory, and dynamical systems, is

one of only three mathematicians to have won the Fields medal, the Abel prize, and the Wolf prize, and is the only one to have received all three of the Leroy P. Steele prizes. In honor of his eightieth birthday, this book gathers together surveys and papers inspired by Milnor's work, from distinguished experts examining not only holomorphic dynamics in one and several variables, but also differential geometry, entropy theory, and combinatorial group theory. The book contains the last paper written by William Thurston, as well as a short paper by John Milnor himself. Introductory sections put the papers in mathematical and historical perspective, color figures are included, and an index facilitates browsing. This collection will be useful to students and researchers for decades to come. The contributors are Marco Abate, Marco Arizzi, Alexander Blokh, Thierry Bousch, Xavier Buff, Serge Cantat, Tao Chen, Robert Devaney, Alexandre Dezotti, Tien-Cuong Dinh, Romain Dujardin, Hugo García-Compeán, William Goldman, Rotislav Grigorchuk, John Hubbard, Yunping Jiang, Linda Keen, Jan Kiwi, Genadi Levin, Daniel Meyer, John Milnor, Carlos Moreira, Vincente Muñoz, Viet-Anh Nguyên, Lex Oversteegen, Ricardo Pérez-Marco, Ross Ptacek, Jasmin Raissy, Pascale Roesch, Roberto Santos-Silva, Dierk Schleicher, Nessim Sibony, Daniel Smania, Tan Lei, William Thurston, Vladlen Timorin, Sebastian van Strien, and Alberto Verjovsky.

Ergodic Theory Manfred Einsiedler 2010-09-11 This text is a rigorous introduction to ergodic theory, developing the machinery of conditional measures and expectations, mixing, and recurrence. Beginning by developing the basics of ergodic theory and progressing to describe some recent applications to number theory, this book goes beyond the standard texts in this topic. Applications include Weyl's polynomial equidistribution theorem, the ergodic proof of Szemeredi's theorem, the connection between the continued fraction map and the modular surface, and a proof of the equidistribution of horocycle orbits. Ergodic Theory with a view towards Number Theory will appeal to mathematicians with some standard background in measure theory and functional analysis. No background in ergodic theory or Lie theory is assumed, and a number of exercises and hints to problems are included, making this the perfect companion for graduate students and researchers in ergodic theory, homogenous dynamics or number theory.

Symmetry in Chaos Michael Field 2009-06-04 A striking full-colour book which explores how combining symmetry and chaos can lead to the construction of remarkable images. This book is an engaging look at the interplay of art and mathematics, and between symmetry and chaos. The underlying mathematics involved in the generation of the images is described.

Arakelov Geometry and Diophantine Applications Emmanuel Peyre 2021-03-10 Bridging the gap between novice and expert, the aim of this book is to present in a self-contained way a number of striking examples of current diophantine problems to which Arakelov geometry has been or may be applied. Arakelov geometry can be seen as a link between algebraic geometry and diophantine

geometry. Based on lectures from a summer school for graduate students, this volume consists of 12 different chapters, each written by a different author. The first chapters provide some background and introduction to the subject. These are followed by a presentation of different applications to arithmetic geometry. The final part describes the recent application of Arakelov geometry to Shimura varieties and the proof of an averaged version of Colmez's conjecture. This book thus blends initiation to fundamental tools of Arakelov geometry with original material corresponding to current research. This book will be particularly useful for graduate students and researchers interested in the connections between algebraic geometry and number theory. The prerequisites are some knowledge of number theory and algebraic geometry.

Dynamical Systems, Number Theory and Applications Thomas Hagen 2016-01-25 This volume consists of a selection of research-type articles on dynamical systems, evolution equations, analytic number theory and closely related topics. A strong emphasis is on a fair balance between theoretical and more applied work, thus spanning the chasm between abstract insight and actual application. Several of the articles are expected to be in the intersection of dynamical systems theory and number theory. One article will likely relate the topics presented to the academic achievements and interests of Prof. Leutbecher and shed light on common threads among all the contributions.
Contents:PrefaceBiographical Note on Armin Leutbecher (S Walcher)Das Jahr 1934 ... (J Fischer)Explicit Expressions for Equivariant Minimal Lagrangian Surfaces (J F Dorfmeister & H Ma)Rational Parameter Rays of the Multibrot Sets (D Eberlein, S Mukherjee & D Schleicher)The Matovich-Pearson Equations Revisited (T Hagen)Diffeomorphisms with Stable Manifolds as Basin Boundaries (S Hayes & Ch Wolf)A New Type of Functional Equations of Euler Products (B Heim)The Hexagonal Lattice and the Epstein Zeta Function (A Henn)On Putative q-Analogues of the Fano Plane (Th Honold & M Kiermaier)Integral Orthogonal Groups (A Krieg)The Role of Fourier Analysis in X-Ray Crystallography (F Rupp & J Scheurle)An Elementary Proof for Joint Continuity of Semiflows (S Schmitz)A Convergent String Method (H Schwetlick & J Zimmer)Variational Symmetries and Pluri-Lagrangian Systems (Y B Suris)
Readership: Researchers in algebra and number theory, dynamical systems and analysis and differential equations. Key Features:This versatile book covers state-of-the art work in dynamical systems, analytic number theory and applied analysisIt appeals to a wide audience due to its broad range of topics, highlighting both the breadth and the depth of modern analytical work without losing sight of a common coreKeywords:Dynamical Systems;Evolution Equations;Number Theory;Differential Geometry

An Introduction to Sequential Dynamical Systems Henning Mortveit 2007-11-27 This introductory text to the class of Sequential Dynamical Systems (SDS) is the first textbook on this timely subject. Driven by numerous examples and thought-provoking problems throughout, the presentation offers good foundational

material on finite discrete dynamical systems, which then leads systematically to an introduction of SDS. From a broad range of topics on structure theory - equivalence, fixed points, invertibility and other phase space properties - thereafter SDS relations to graph theory, classical dynamical systems as well as SDS applications in computer science are explored. This is a versatile interdisciplinary textbook.

Handbook of Dynamical Systems B. Fiedler 2002-02-21 This handbook is volume II in a series collecting mathematical state-of-the-art surveys in the field of dynamical systems. Much of this field has developed from interactions with other areas of science, and this volume shows how concepts of dynamical systems further the understanding of mathematical issues that arise in applications. Although modeling issues are addressed, the central theme is the mathematically rigorous investigation of the resulting differential equations and their dynamic behavior. However, the authors and editors have made an effort to ensure readability on a non-technical level for mathematicians from other fields and for other scientists and engineers. The eighteen surveys collected here do not aspire to encyclopedic completeness, but present selected paradigms. The surveys are grouped into those emphasizing finite-dimensional methods, numerics, topological methods, and partial differential equations. Application areas include the dynamics of neural networks, fluid flows, nonlinear optics, and many others. While the survey articles can be read independently, they deeply share recurrent themes from dynamical systems. Attractors, bifurcations, center manifolds, dimension reduction, ergodicity, homoclinicity, hyperbolicity, invariant and inertial manifolds, normal forms, recurrence, shift dynamics, stability, to name just a few, are ubiquitous dynamical concepts throughout the articles.

Berkovich Spaces and Applications Antoine Ducros 2014-11-21 We present an introduction to Berkovich's theory of non-archimedean analytic spaces that emphasizes its applications in various fields. The first part contains surveys of a foundational nature, including an introduction to Berkovich analytic spaces by M. Temkin, and to étale cohomology by A. Ducros, as well as a short note by C. Favre on the topology of some Berkovich spaces. The second part focuses on applications to geometry. A second text by A. Ducros contains a new proof of the fact that the higher direct images of a coherent sheaf under a proper map are coherent, and B. Rémy, A. Thuillier and A. Werner provide an overview of their work on the compactification of Bruhat-Tits buildings using Berkovich analytic geometry. The third and final part explores the relationship between non-archimedean geometry and dynamics. A contribution by M. Jonsson contains a thorough discussion of non-archimedean dynamical systems in dimension 1 and 2. Finally a survey by J.-P. Otal gives an account of Morgan-Shalen's theory of compactification of character varieties. This book will provide the reader with enough material on the basic concepts and constructions related to Berkovich spaces to move on to more advanced research articles on the subject. We also hope that the applications presented here will inspire the reader to discover new

settings where these beautiful and intricate objects might arise.
Ultrametric Pseudodifferential Equations and Applications Andre? I?U?r?evich Khrennikov 2018-04-26 Provides a novel interdisciplinary perspective on the state of the art of ultrametric pseudodifferential equations and their applications.
Advanced Topics in the Arithmetic of Elliptic Curves Joseph H. Silverman 2013-12-01 In the introduction to the first volume of The Arithmetic of Elliptic Curves (Springer-Verlag, 1986), I observed that "the theory of elliptic curves is rich, varied, and amazingly vast," and as a consequence, "many important topics had to be omitted." I included a brief introduction to ten additional topics as an appendix to the first volume, with the tacit understanding that eventually there might be a second volume containing the details. You are now holding that second volume. it turned out that even those ten topics would not fit Unfortunately, into a single book, so I was forced to make some choices. The following material is covered in this book: I. Elliptic and modular functions for the full modular group. II. Elliptic curves with complex multiplication. III. Elliptic surfaces and specialization theorems. IV. Neron models, Kodaira-Neron classification of special fibers, Tate's algorithm, and Ogg's conductor-discriminant formula. V. Tate's theory of q-curves over p-adic fields. VI. Neron's theory of canonical local height functions.
The Dynamical Mordell–Lang Conjecture Jason P. Bell 2016-04-20 The Dynamical Mordell-Lang Conjecture is an analogue of the classical Mordell-Lang conjecture in the context of arithmetic dynamics. It predicts the behavior of the orbit of a point x under the action of an endomorphism f of a quasiprojective complex variety X. More precisely, it claims that for any point x in X and any subvariety V of X, the set of indices n such that the n-th iterate of x under f lies in V is a finite union of arithmetic progressions. In this book the authors present all known results about the Dynamical Mordell-Lang Conjecture, focusing mainly on a p-adic approach which provides a parametrization of the orbit of a point under an endomorphism of a variety.
The Arithmetic of Polynomial Dynamical Pairs Charles Favre 2022-06-14 New mathematical research in arithmetic dynamics In The Arithmetic of Polynomial Dynamical Pairs, Charles Favre and Thomas Gauthier present new mathematical research in the field of arithmetic dynamics. Specifically, the authors study one-dimensional algebraic families of pairs given by a polynomial with a marked point. Combining tools from arithmetic geometry and holomorphic dynamics, they prove an “unlikely intersection” statement for such pairs, thereby demonstrating strong rigidity features for them. They further describe one-dimensional families in the moduli space of polynomials containing infinitely many postcritically finite parameters, proving the dynamical André-Oort conjecture for curves in this context, originally stated by Baker and DeMarco. This is a reader-friendly invitation to a new and exciting research area that brings together sophisticated tools from many branches of mathematics.
The Arithmetic of Dynamical Systems J.H. Silverman 2010-05-05 This book

provides an introduction to the relatively new discipline of arithmetic dynamics. Whereas classical discrete dynamics is the study of iteration of self-maps of the complex plane or real line, arithmetic dynamics is the study of the number-theoretic properties of rational and algebraic points under repeated application of a polynomial or rational function. A principal theme of arithmetic dynamics is that many of the fundamental problems in the theory of Diophantine equations have dynamical analogs.This graduate-level text provides an entry for students into an active field of research and serves as a standard reference for researchers.
Mathematics of Complexity and Dynamical Systems Robert A. Meyers 2011-10-05 Mathematics of Complexity and Dynamical Systems is an authoritative reference to the basic tools and concepts of complexity, systems theory, and dynamical systems from the perspective of pure and applied mathematics. Complex systems are systems that comprise many interacting parts with the ability to generate a new quality of collective behavior through self-organization, e.g. the spontaneous formation of temporal, spatial or functional structures. These systems are often characterized by extreme sensitivity to initial conditions as well as emergent behavior that are not readily predictable or even completely deterministic. The more than 100 entries in this wide-ranging, single source work provide a comprehensive explication of the theory and applications of mathematical complexity, covering ergodic theory, fractals and multifractals, dynamical systems, perturbation theory, solitons, systems and control theory, and related topics. Mathematics of Complexity and Dynamical Systems is an essential reference for all those interested in mathematical complexity, from undergraduate and graduate students up through professional researchers.
Fifth International Congress of Chinese Mathematicians Lizhen Ji 2012 This two-part volume represents the proceedings of the Fifth International Congress of Chinese Mathematicians, held at Tsinghua University, Beijing, in December 2010. The Congress brought together eminent Chinese and overseas mathematicians to discuss the latest developments in pure and applied mathematics. Included are 60 papers based on lectures given at the conference.
The Arithmetic of Elliptic Curves Joseph H. Silverman 2009-04-20 The theory of elliptic curves is distinguished by its long history and by the diversity of the methods that have been used in its study. This book treats the arithmetic approach in its modern formulation, through the use of basic algebraic number theory and algebraic geometry. Following a brief discussion of the necessary algebro-geometric results, the book proceeds with an exposition of the geometry and the formal group of elliptic curves, elliptic curves over finite fields, the complex numbers, local fields, and global fields. Final chapters deal with integral and rational points, including Siegels theorem and explicit computations for the curve $Y = X + DX$, while three appendices conclude the whole: Elliptic Curves in Characteristics 2 and 3, Group Cohomology, and an overview of more advanced topics.
Advances in Non-Archimedean Analysis Helge Glöckner 2016-05-20 This

volume contains the Proceedings of the 13th International Conference on p-adic Functional Analysis, held from August 12–16, 2014, at the University of Paderborn, Paderborn, Germany. The articles included in this book feature recent developments in various areas of non-Archimedean analysis, non-Archimedean functional analysis, representation theory, number theory, non-Archimedean dynamical systems and applications. Through a combination of new research articles and survey papers, this book provides the reader with an overview of current developments and techniques in non-Archimedean analysis as well as a broad knowledge of some of the sub-areas of this exciting and fast-developing research area.

Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics: Fractals in pure mathematics David Carfi 2013-10-22 This volume contains the proceedings from three conferences: the PISRS 2011 International Conference on Analysis, Fractal Geometry, Dynamical Systems and Economics, held November 8-12, 2011 in Messina, Italy; the AMS Special Session on Fractal Geometry in Pure and Applied Mathematics, in memory of Benoit Mandelbrot, held January 4-7, 2012, in Boston, MA; and the AMS Special Session on Geometry and Analysis on Fractal Spaces, held March 3-4, 2012, in Honolulu, HI. Articles in this volume cover fractal geometry (and some aspects of dynamical systems) in pure mathematics. Also included are articles discussing a variety of connections of fractal geometry with other fields of mathematics, including probability theory, number theory, geometric measure theory, partial differential equations, global analysis on non-smooth spaces, harmonic analysis and spectral geometry. The companion volume (Contemporary Mathematics, Volume 601) focuses on applications of fractal geometry and dynamical systems to other sciences, including physics, engineering, computer science, economics, and finance.

Ergodic Theory, Dynamical Systems, and the Continuing Influence of John C. Oxtoby Joseph Auslander 2016-11-29 This volume contains the proceedings of three conferences in Ergodic Theory and Symbolic Dynamics: the Oxtoby Centennial Conference, held from October 30–31, 2010, at Bryn Mawr College; the Williams Ergodic Theory Conference, held from July 27–29, 2012, at Williams College; and the AMS Special Session on Ergodic Theory and Symbolic Dynamics, held from January 17–18, 2014, in Baltimore, MD. This volume contains articles covering a variety of topics in measurable, symbolic and complex dynamics. It also includes a survey article on the life and work of John Oxtoby, providing a source of information about the many ways Oxtoby's work influenced mathematical thought in this and other fields.

Dynamics in One Non-Archimedean Variable Robert L. Benedetto 2019-03-05 The theory of complex dynamics in one variable, initiated by Fatou and Julia in the early twentieth century, concerns the iteration of a rational function acting on the Riemann sphere. Building on foundational investigations of p-adic dynamics in the late twentieth century, dynamics in one non-archimedean variable is the

analogous theory over non-archimedean fields rather than over the complex numbers. It is also an essential component of the number-theoretic study of arithmetic dynamics. This textbook presents the fundamentals of non-archimedean dynamics, including a unified exposition of Rivera-Letelier's classification theorem, as well as results on wandering domains, repelling periodic points, and equilibrium measures. The Berkovich projective line, which is the appropriate setting for the associated Fatou and Julia sets, is developed from the ground up, as are relevant results in non-archimedean analysis. The presentation is accessible to graduate students with only first-year courses in algebra and analysis under their belts, although some previous exposure to non-archimedean fields, such as the p-adic numbers, is recommended. The book should also be a useful reference for more advanced students and researchers in arithmetic and non-archimedean dynamics.

Number Theory Revealed: A Masterclass Andrew Granville 2020-09-23 Number Theory Revealed: A Masterclass acquaints enthusiastic students with the “Queen of Mathematics”. The text offers a fresh take on congruences, power residues, quadratic residues, primes, and Diophantine equations and presents hot topics like cryptography, factoring, and primality testing. Students are also introduced to beautiful enlightening questions like the structure of Pascal's triangle mod p and modern twists on traditional questions like the values represented by binary quadratic forms, the anatomy of integers, and elliptic curves. This Masterclass edition contains many additional chapters and appendices not found in Number Theory Revealed: An Introduction, highlighting beautiful developments and inspiring other subjects in mathematics (like algebra). This allows instructors to tailor a course suited to their own (and their students') interests. There are new yet accessible topics like the curvature of circles in a tiling of a circle by circles, the latest discoveries on gaps between primes, a new proof of Mordell's Theorem for congruent elliptic curves, and a discussion of the abc-conjecture including its proof for polynomials. About the Author: Andrew Granville is the Canada Research Chair in Number Theory at the University of Montreal and professor of mathematics at University College London. He has won several international writing prizes for exposition in mathematics, including the 2008 Chauvenet Prize and the 2019 Halmos-Ford Prize, and is the author of Prime Suspects (Princeton University Press, 2019), a beautifully illustrated graphic novel murder mystery that explores surprising connections between the anatomies of integers and of permutations.

Dynamical Systems and Ergodic Theory Mark Pollicott 1998-01-29 This book is an introduction to topological dynamics and ergodic theory. It is divided into a number of relatively short chapters with the intention that each may be used as a component of a lecture course tailored to the particular audience. The authors provide a number of applications, principally to number theory and arithmetic progressions (through Van der Waerden's theorem and Szemerdi's theorem). This text is suitable for advanced undergraduate and beginning graduate

students.

An Experimental Introduction to Number Theory Benjamin Hutz 2018-04-17 This book presents material suitable for an undergraduate course in elementary number theory from a computational perspective. It seeks to not only introduce students to the standard topics in elementary number theory, such as prime factorization and modular arithmetic, but also to develop their ability to formulate and test precise conjectures from experimental data. Each topic is motivated by a question to be answered, followed by some experimental data, and, finally, the statement and proof of a theorem. There are numerous opportunities throughout the chapters and exercises for the students to engage in (guided) open-ended exploration. At the end of a course using this book, the students will understand how mathematics is developed from asking questions to gathering data to formulating and proving theorems. The mathematical prerequisites for this book are few. Early chapters contain topics such as integer divisibility, modular arithmetic, and applications to cryptography, while later chapters contain more specialized topics, such as Diophantine approximation, number theory of dynamical systems, and number theory with polynomials. Students of all levels will be drawn in by the patterns and relationships of number theory uncovered through data driven exploration.

Potential Theory and Dynamics on the Berkovich Projective Line Matthew Baker 2010-03-10 The purpose of this book is to develop the foundations of potential theory and rational dynamics on the Berkovich projective line over an arbitrary complete, algebraically closed non-Archimedean field. In addition to providing a concrete and ``elementary'' introduction to Berkovich analytic spaces and to potential theory and rational iteration on the Berkovich line, the book contains applications to arithmetic geometry and arithmetic dynamics. A number of results in the book are new, and most have not previously appeared in book form. Three appendices--on analysis, $\mathbb{R}$-trees, and Berkovich's general theory of analytic spaces--are included to make the book as self-contained as possible. The authors first give a detailed description of the topological structure of the Berkovich projective line and then introduce the Hsia kernel, the fundamental kernel for potential theory. Using the theory of metrized graphs, they define a Laplacian operator on the Berkovich line and construct theories of capacities, harmonic and subharmonic functions, and Green's functions, all of which are strikingly similar to their classical complex counterparts. After developing a theory of multiplicities for rational functions, they give applications to non-Archimedean dynamics, including local and global equidistribution theorems, fixed point theorems, and Berkovich space analogues of many fundamental results from the classical Fatou-Julia theory of rational iteration. They illustrate the theory with concrete examples and exposit Rivera-Letelier's results concerning rational dynamics over the field of p-adic complex numbers. They also establish Berkovich space versions of arithmetic results such as the Fekete-

Szego theorem and Bilu's equidistribution theorem.
Dynamical Systems and Ergodic Theory Mark Pollicott 1998-01-29 This book is an essentially self contained introduction to topological dynamics and ergodic theory. It is divided into a number of relatively short chapters with the intention that each may be used as a component of a lecture course tailored to the particular audience. Parts of the book are suitable for a final year undergraduate course or for a masters level course. A number of applications are given, principally to number theory and arithmetic progressions (through van der waerden's theorem and szemerdi's theorem).
Chaos and Dynamical Systems David P. Feldman 2019-08-06 Chaos and Dynamical Systems presents an accessible, clear introduction to dynamical systems and chaos theory, important and exciting areas that have shaped many scientific fields. While the rules governing dynamical systems are well-specified and simple, the behavior of many dynamical systems is remarkably complex. Of particular note, simple deterministic dynamical systems produce output that appears random and for which long-term prediction is impossible. Using little math beyond basic algebra, David Feldman gives readers a grounded, concrete, and concise overview. In initial chapters, Feldman introduces iterated functions and differential equations. He then surveys the key concepts and results to emerge from dynamical systems: chaos and the butterfly effect, deterministic randomness, bifurcations, universality, phase space, and strange attractors. Throughout, Feldman examines possible scientific implications of these phenomena for the study of complex systems, highlighting the relationships between simplicity and complexity, order and disorder. Filling the gap between popular accounts of dynamical systems and chaos and textbooks aimed at physicists and mathematicians, Chaos and Dynamical Systems will be highly useful not only to students at the undergraduate and advanced levels, but also to researchers in the natural, social, and biological sciences.
Dynamical Numbers: Interplay between Dynamical Systems and Number Theory S. F. Koli?a?da 2010 This volume contains papers from the special program and international conference on Dynamical Numbers which were held at the Max-Planck Institute in Bonn, Germany in 2009. These papers reflect the extraordinary range and depth of the interactions between ergodic theory and dynamical systems and number theory. Topics covered in the book include stationary measures, systems of enumeration, geometrical methods, spectral methods, and algebraic dynamical systems.
The Arithmetic of Elliptic Curves Joseph H. Silverman 2013-03-09 The theory of elliptic curves is distinguished by its long history and by the diversity of the methods that have been used in its study. This book treats the arithmetic approach in its modern formulation, through the use of basic algebraic number theory and algebraic geometry. Following a brief discussion of the necessary algebro-geometric results, the book proceeds with an exposition of the geometry and the formal group of elliptic curves, elliptic curves over finite fields, the

complex numbers, local fields, and global fields. Final chapters deal with integral and rational points, including Siegels theorem and explicit computations for the curve Y = X + DX, while three appendices conclude the whole: Elliptic Curves in Characteristics 2 and 3, Group Cohomology, and an overview of more advanced topics.

Moduli Spaces and Arithmetic Dynamics Joseph H. Silverman

Applied Algebraic Dynamics Vladimir Anashin 2009-06-02 This monograph presents recent developments of the theory of algebraic dynamical systems and their applications to computer sciences, cryptography, cognitive sciences, psychology, image analysis, and numerical simulations. The most important mathematical results presented in this book are in the fields of ergodicity, p-adic numbers, and noncommutative groups. For students and researchers working on the theory of dynamical systems, algebra, number theory, measure theory, computer sciences, cryptography, and image analysis.

Trilogy Of Numbers And Arithmetic - Book 1: History Of Numbers And Arithmetic: An Information Perspective Mark Burgin 2022-04-22 The book is the first in the trilogy which will bring you to the fascinating world of numbers and operations with them. Numbers provide information about myriads of things. Together with operations, numbers constitute arithmetic forming in basic intellectual instruments of theoretical and practical activity of people and offering powerful tools for representation, acquisition, transmission, processing, storage, and management of information about the world.The history of numbers and arithmetic is the topic of a variety of books and at the same time, it is extensively presented in many books on the history of mathematics. However, all of them, at best, bring the reader to the end of the 19th century without including the developments in these areas in the 20th century and later. Besides, such books consider and describe only the most popular classes of numbers, such as whole numbers or real numbers. At the same time, a diversity of new classes of numbers and arithmetic were introduced in the 20th century.This book looks into the chronicle of numbers and arithmetic from ancient times all the way to 21st century. It also includes the developments in these areas in the 20th century and later. A unique aspect of this book is its information orientation of the exposition of the history of numbers and arithmetic.

The Arithmetic of Dynamical Systems J. H. Silverman 2010-11-19 This book provides an introduction to the relatively new discipline of arithmetic dynamics. Whereas classical discrete dynamics is the study of iteration of self-maps of the complex plane or real line, arithmetic dynamics is the study of the number-theoretic properties of rational and algebraic points under repeated application of a polynomial or rational function. A principal theme of arithmetic dynamics is that many of the fundamental problems in the theory of Diophantine equations have dynamical analogs.This graduate-level text provides an entry for students into an

active field of research and serves as a standard reference for researchers.