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KEY=GEOMETRY - REILLY KAIYA

A COURSE IN MODERN MATHEMATICAL PHYSICS

GROUPS, HILBERT SPACE AND DIFFERENTIAL GEOMETRY

Cambridge University Press *Publisher Description*

THE MOMENT-WEIGHT INEQUALITY AND THE HILBERT–MUMFORD CRITERION

GIT FROM THE DIFFERENTIAL GEOMETRIC VIEWPOINT

Springer Nature *This book provides an introduction to geometric invariant theory from a differential geometric viewpoint. It is inspired by certain infinite-dimensional analogues of geometric invariant theory that arise naturally in several different areas of geometry. The central ingredients are the moment-weight inequality relating the Mumford numerical invariants to the norm of the moment map, the negative gradient flow of the moment map squared, and the Kempf--Ness function. The exposition is essentially self-contained, except for an appeal to the Lojasiewicz gradient inequality. A broad variety of examples illustrate the theory, and five appendices cover essential topics that go beyond the basic concepts of differential geometry. The comprehensive bibliography will be a valuable resource for researchers. The book is addressed to graduate students and researchers interested in geometric invariant theory and related subjects. It will be easily accessible to readers with a basic understanding of differential geometry and does not require any knowledge of algebraic geometry.*

INTRODUCTION TO DIFFERENTIAL GEOMETRY

Springer Nature *This textbook is suitable for a one semester lecture course on differential geometry for students of mathematics or STEM disciplines with a working knowledge of analysis, linear algebra, complex analysis, and point set topology. The book treats the subject both from an extrinsic and an intrinsic view point. The first chapters give a historical overview of the field and contain an introduction to basic concepts such as manifolds and smooth maps, vector fields and flows, and Lie groups, leading up to the theorem of Frobenius. Subsequent chapters deal with the Levi-Civita connection, geodesics, the Riemann curvature tensor, a proof of the Cartan-Ambrose-Hicks theorem, as well as applications to flat spaces, symmetric spaces, and constant curvature manifolds. Also included are sections about manifolds with nonpositive sectional curvature, the Ricci tensor, the scalar curvature, and the Weyl tensor. An additional chapter goes beyond the scope of a one semester lecture course and deals with subjects such as conjugate points and the Morse index, the injectivity radius, the group of isometries and the Myers-Steenrod theorem, and Donaldson's differential geometric approach to Lie algebra theory.*

ADVANCES IN NONCOMMUTATIVE GEOMETRY

ON THE OCCASION OF ALAIN CONNES' 70TH BIRTHDAY

Springer Nature *This authoritative volume in honor of Alain Connes, the foremost architect of Noncommutative Geometry, presents the state-of-the art in the subject. The book features an amalgam of invited survey and research papers that will no doubt be accessed, read, and referred to, for several decades to come. The pertinence and potency of new concepts and methods are concretely illustrated in each contribution. Much of the content is a direct outgrowth of the Noncommutative Geometry conference, held March 23–April 7, 2017, in Shanghai, China. The conference covered the latest research and future areas of potential exploration surrounding topology and physics, number theory, as well as index theory and its ramifications in geometry.*

GEOMETRY, TOPOLOGY AND PHYSICS

Taylor & Francis *Differential geometry and topology have become essential tools for many theoretical physicists. In particular, they are indispensable in theoretical studies of condensed matter physics, gravity, and particle physics. Geometry, Topology and Physics, Second Edition introduces the ideas and techniques of differential geometry and topology at a level suitable for postgraduate students and researchers in these fields. The second edition of this popular and established text incorporates a number of changes designed to meet the needs of the reader and reflect the development of the subject. The book features a considerably expanded first chapter, reviewing aspects of path integral quantization and gauge theories. Chapter 2 introduces the mathematical concepts of maps, vector spaces, and topology. The following chapters focus on more elaborate concepts in geometry and topology and discuss the application*

of these concepts to liquid crystals, superfluid helium, general relativity, and bosonic string theory. Later chapters unify geometry and topology, exploring fiber bundles, characteristic classes, and index theorems. New to this second edition is the proof of the index theorem in terms of supersymmetric quantum mechanics. The final two chapters are devoted to the most fascinating applications of geometry and topology in contemporary physics, namely the study of anomalies in gauge field theories and the analysis of Polakov's bosonic string theory from the geometrical point of view. Geometry, Topology and Physics, Second Edition is an ideal introduction to differential geometry and topology for postgraduate students and researchers in theoretical and mathematical physics.

COMPLEXITY SCIENCE

THE WARWICK MASTER'S COURSE

Cambridge University Press *This book presents introductions to the essential mathematical aspects of complexity science, suitable for advanced undergraduate/masters-level students and researchers.*

INTRODUCTION TO DIFFERENTIAL GEOMETRY

Springer Spektrum *This textbook is suitable for a one semester lecture course on differential geometry for students of mathematics or STEM disciplines with a working knowledge of analysis, linear algebra, complex analysis, and point set topology. The book treats the subject both from an extrinsic and an intrinsic view point. The first chapters give a historical overview of the field and contain an introduction to basic concepts such as manifolds and smooth maps, vector fields and flows, and Lie groups, leading up to the theorem of Frobenius. Subsequent chapters deal with the Levi-Civita connection, geodesics, the Riemann curvature tensor, a proof of the Cartan-Ambrose-Hicks theorem, as well as applications to flat spaces, symmetric spaces, and constant curvature manifolds. Also included are sections about manifolds with nonpositive sectional curvature, the Ricci tensor, the scalar curvature, and the Weyl tensor. An additional chapter goes beyond the scope of a one semester lecture course and deals with subjects such as conjugate points and the Morse index, the injectivity radius, the group of isometries and the Myers-Steenrod theorem, and Donaldson's differential geometric approach to Lie algebra theory.*

GEOMETRIC GROUP THEORY

American Mathematical Soc. *The key idea in geometric group theory is to study infinite groups by endowing them with a metric and treating them as geometric spaces. This applies to many groups naturally appearing in topology, geometry, and algebra, such as fundamental groups of manifolds, groups of matrices with integer coefficients, etc. The primary focus of this book is to cover the foundations of geometric group theory, including coarse topology, ultralimits and asymptotic cones, hyperbolic groups, isoperimetric inequalities, growth of groups, amenability, Kazhdan's Property (T) and the Haagerup property, as well as their characterizations in terms of group actions on median spaces and spaces with walls. The book contains proofs of several fundamental results of geometric group theory, such as Gromov's theorem on groups of polynomial growth, Tits's alternative, Stallings's theorem on ends of groups, Dunwoody's accessibility theorem, the Mostow Rigidity Theorem, and quasiisometric rigidity theorems of Tukia and Schwartz. This is the first book in which geometric group theory is presented in a form accessible to advanced graduate students and young research mathematicians. It fills a big gap in the literature and will be used by researchers in geometric group theory and its applications.*

LIE GROUPS AND GEOMETRIC ASPECTS OF ISOMETRIC ACTIONS

Springer *This book provides quick access to the theory of Lie groups and isometric actions on smooth manifolds, using a concise geometric approach. After a gentle introduction to the subject, some of its recent applications to active research areas are explored, keeping a constant connection with the basic material. The topics discussed include polar actions, singular Riemannian foliations, cohomogeneity one actions, and positively curved manifolds with many symmetries. This book stems from the experience gathered by the authors in several lectures along the years and was designed to be as self-contained as possible. It is intended for advanced undergraduates, graduate students and young researchers in geometry and can be used for a one-semester course or independent study.*

GEOMETRY AND DYNAMICS IN GROMOV HYPERBOLIC METRIC SPACES

American Mathematical Soc. *This book presents the foundations of the theory of groups and semigroups acting isometrically on Gromov hyperbolic metric spaces. Particular emphasis is paid to the geometry of their limit sets and on behavior not found in the proper setting. The authors provide a number of examples of groups which exhibit a wide range of phenomena not to be found in the finite-dimensional theory. The book contains both introductory material to help beginners as well as new research results, and closes with a list of attractive unsolved problems.*

DIFFERENTIAL EQUATIONS - GEOMETRY, SYMMETRIES AND INTEGRABILITY

THE ABEL SYMPOSIUM 2008

Springer Science & Business Media *The Abel Symposium 2008 focused on the modern theory of differential equations and their applications in geometry, mechanics, and mathematical physics. Following the tradition of Monge, Abel and Lie, the scientific program emphasized the role of algebro-geometric methods, which nowadays permeate all mathematical models in natural and engineering sciences. The ideas of invariance and symmetry are of fundamental importance in the geometric approach to differential equations, with a serious impact coming from the area of integrable systems and field theories. This volume consists of original contributions and broad overview lectures of the participants of the Symposium. The papers in this volume present the modern approach to this classical subject.*

ARITHMETIC GROUPS AND THEIR GENERALIZATIONS

WHAT, WHY, AND HOW

American Mathematical Soc. *In one guise or another, many mathematicians are familiar with certain arithmetic groups, such as $\mathbf{Z}$ or $\textrm{SL}(n,\mathbf{Z})$. Yet, many applications of arithmetic groups and many connections to other subjects within mathematics are less well known. Indeed, arithmetic groups admit many natural and important generalizations. The purpose of this expository book is to explain, through some brief and informal comments and extensive references, what arithmetic groups and their generalizations are, why they are important to study, and how they can be understood and applied to many fields, such as analysis, geometry, topology, number theory, representation theory, and algebraic geometry. It is hoped that such an overview will shed a light on the important role played by arithmetic groups in modern mathematics. Titles in this series are co-published with International Press, Cambridge, MA. Table of Contents: Introduction; General comments on references; Examples of basic arithmetic groups; General arithmetic subgroups and locally symmetric spaces; Discrete subgroups of Lie groups and arithmeticity of lattices in Lie groups; Different completions of $\mathbb{Q}$ and S-arithmetic groups over number fields; Global fields and S-arithmetic groups over function fields; Finiteness properties of arithmetic and S-arithmetic groups; Symmetric spaces, Bruhat-Tits buildings and their arithmetic quotients; Compactifications of locally symmetric spaces; Rigidity of locally symmetric spaces; Automorphic forms and automorphic representations for general arithmetic groups; Cohomology of arithmetic groups; K-groups of rings of integers and K-groups of group rings; Locally homogeneous manifolds and period domains; Non-cofinite discrete groups, geometrically finite groups; Large scale geometry of discrete groups; Tree lattices; Hyperbolic groups; Mapping class groups and outer automorphism groups of free groups; Outer automorphism group of free groups and the outer spaces; References; Index. Review from Mathematical Reviews: ...the author deserves credit for having done the tremendous job of encompassing every aspect of arithmetic groups visible in today's mathematics in a systematic manner; the book should be an important guide for some time to come. (AMSIP/43.)*

GROUPS ST ANDREWS 2017 IN BIRMINGHAM

Cambridge University Press *These proceedings of 'Groups St Andrews 2017' provide a snapshot of the state-of-the-art in contemporary group theory.*

FUNDAMENTALS OF DIFFERENTIAL GEOMETRY

Springer Science & Business Media *This book provides an introduction to the basic concepts in differential topology, differential geometry, and differential equations, and some of the main basic theorems in all three areas. This new edition includes new chapters, sections, examples, and exercises. From the reviews: "There are many books on the fundamentals of differential geometry, but this one is quite exceptional; this is not surprising for those who know Serge Lang's books." --EMS NEWSLETTER*

AN INTRODUCTION TO LIE GROUPS AND LIE ALGEBRAS

Cambridge University Press *This book is an introduction to semisimple Lie algebras; concise and informal, with numerous exercises and examples.*

THE GEOMETRY OF PHYSICS

AN INTRODUCTION

Cambridge University Press *This book provides a working knowledge of those parts of exterior differential forms, differential geometry, algebraic and differential topology, Lie groups, vector bundles and Chern forms that are essential for a deeper understanding of both classical and modern physics and engineering. Included are discussions of analytical and fluid dynamics, electromagnetism (in flat and curved space), thermodynamics, the Dirac operator and spinors, and gauge fields, including Yang–Mills, the Aharonov–Bohm effect, Berry phase and instanton winding numbers, quarks and quark model for mesons. Before discussing abstract notions of differential geometry, geometric intuition is developed through a rather extensive introduction to the study of surfaces in ordinary space. The book is ideal for graduate and advanced undergraduate students of physics, engineering or mathematics as a course text or for self study. This third edition includes an overview of Cartan's exterior differential forms, which previews many of the geometric concepts developed in the text.*

LINEAR DIFFERENTIAL EQUATIONS AND GROUP THEORY FROM RIEMANN TO POINCARE

Springer Science & Business Media *This book is a study of how a particular vision of the unity of mathematics, often called geometric function theory, was created in the 19th century. The central focus is on the convergence of three mathematical topics: the hypergeometric and related linear differential equations, group theory, and on-Euclidean geometry. The text for this second edition has been greatly expanded and revised, and the existing appendices enriched. The exercises have been retained, making it possible to use the book as a companion to mathematics courses at the graduate level.*

HIGHER INDEX THEORY

Cambridge University Press *Index theory studies the solutions to differential equations on geometric spaces, their relation to the underlying geometry and topology, and applications to physics. If the space of solutions is infinite dimensional, it becomes necessary to generalise the classical Fredholm index using tools from the K-theory of operator algebras. This leads to higher index theory, a rapidly developing subject with connections to noncommutative geometry, large-scale geometry, manifold topology and geometry, and operator algebras. Aimed at geometers, topologists and operator algebraists, this book takes a friendly and concrete approach to this exciting theory, focusing on the main conjectures in the area and their applications outside of it. A well-balanced combination of*

detailed introductory material (with exercises), cutting-edge developments and references to the wider literature make this a valuable guide to this active area for graduate students and experts alike.

PROJECTIVE DIFFERENTIAL GEOMETRY OLD AND NEW

FROM THE SCHWARZIAN DERIVATIVE TO THE COHOMOLOGY OF DIFFEOMORPHISM GROUPS

Cambridge University Press *Ideas of projective geometry keep reappearing in seemingly unrelated fields of mathematics. The authors' main goal in this 2005 book is to emphasize connections between classical projective differential geometry and contemporary mathematics and mathematical physics. They also give results and proofs of classic theorems. Exercises play a prominent role: historical and cultural comments set the basic notions in a broader context. The book opens by discussing the Schwarzian derivative and its connection to the Virasoro algebra. One-dimensional projective differential geometry features strongly. Related topics include differential operators, the cohomology of the group of diffeomorphisms of the circle, and the classical four-vertex theorem. The classical theory of projective hypersurfaces is surveyed and related to some very recent results and conjectures. A final chapter considers various versions of multi-dimensional Schwarzian derivative. In sum, here is a rapid route for graduate students and researchers to the frontiers of current research in this evergreen subject.*

DIFFERENTIAL GEOMETRY AND LIE GROUPS

A COMPUTATIONAL PERSPECTIVE

Springer Nature *This textbook offers an introduction to differential geometry designed for readers interested in modern geometry processing. Working from basic undergraduate prerequisites, the authors develop manifold theory and Lie groups from scratch; fundamental topics in Riemannian geometry follow, culminating in the theory that underpins manifold optimization techniques. Students and professionals working in computer vision, robotics, and machine learning will appreciate this pathway into the mathematical concepts behind many modern applications. Starting with the matrix exponential, the text begins with an introduction to Lie groups and group actions. Manifolds, tangent spaces, and cotangent spaces follow; a chapter on the construction of manifolds from gluing data is particularly relevant to the reconstruction of surfaces from 3D meshes. Vector fields and basic point-set topology bridge into the second part of the book, which focuses on Riemannian geometry. Chapters on Riemannian manifolds encompass Riemannian metrics, geodesics, and curvature. Topics that follow include submersions, curvature on Lie groups, and the Log-Euclidean framework. The final chapter highlights naturally reductive homogeneous manifolds and symmetric spaces, revealing the machinery needed to generalize important optimization techniques to Riemannian manifolds. Exercises are included throughout, along with optional sections that delve into more theoretical topics. Differential Geometry and Lie Groups: A Computational Perspective offers a uniquely accessible perspective on differential geometry for those interested in the theory behind modern computing applications. Equally suited to classroom use or independent study, the text will appeal to students and professionals alike; only a background in calculus and linear algebra is assumed. Readers looking to continue on to more advanced topics will appreciate the authors' companion volume Differential Geometry and Lie Groups: A Second Course.*

A HILBERT SPACE PROBLEM BOOK

Springer Science & Business Media *From the Preface: "This book was written for the active reader. The first part consists of problems, frequently preceded by definitions and motivation, and sometimes followed by corollaries and historical remarks... The second part, a very short one, consists of hints... The third part, the longest, consists of solutions: proofs, answers, or contructions, depending on the nature of the problem.... This is not an introduction to Hilbert space theory. Some knowledge of that subject is a prerequisite: at the very least, a study of the elements of Hilbert space theory should proceed concurrently with the reading of this book."*

AN INTRODUCTION TO DIFFERENTIAL GEOMETRY

Courier Corporation *This text employs vector methods to explore the classical theory of curves and surfaces. Topics include basic theory of tensor algebra, tensor calculus, calculus of differential forms, and elements of Riemannian geometry. 1959 edition.*

DIFFERENTIAL GEOMETRY AND MATHEMATICAL PHYSICS

PART I. MANIFOLDS, LIE GROUPS AND HAMILTONIAN SYSTEMS

Springer Science & Business Media *Starting from an undergraduate level, this book systematically develops the basics of • Calculus on manifolds, vector bundles, vector fields and differential forms, • Lie groups and Lie group actions, • Linear symplectic algebra and symplectic geometry, • Hamiltonian systems, symmetries and reduction, integrable systems and Hamilton-Jacobi theory. The topics listed under the first item are relevant for virtually all areas of mathematical physics. The second and third items constitute the link between abstract calculus and the theory of Hamiltonian systems. The last item provides an introduction to various aspects of this theory, including Morse families, the Maslov class and caustics. The book guides the reader from elementary differential geometry to advanced topics in the theory of Hamiltonian systems with the aim of making current research literature accessible. The style is that of a mathematical textbook,with full proofs given in the text or as exercises. The material is illustrated by numerous detailed examples, some of which are taken up several times for demonstrating how the methods evolve and interact.*

HILBERT'S FIFTH PROBLEM AND RELATED TOPICS

American Mathematical Soc. *In the fifth of his famous list of 23 problems, Hilbert asked if every topological group which was locally Euclidean was in fact a Lie group. Through the work of Gleason, Montgomery-Zippin, Yamabe, and others, this question was solved affirmatively; more generally, a satisfactory description of the (mesoscopic) structure of locally compact groups was established.*

Subsequently, this structure theory was used to prove Gromov's theorem on groups of polynomial growth, and more recently in the work of Hrushovski, Breuillard, Green, and the author on the structure of approximate groups. In this graduate text, all of this material is presented in a unified manner, starting with the analytic structural theory of real Lie groups and Lie algebras (emphasising the role of one-parameter groups and the Baker-Campbell-Hausdorff formula), then presenting a proof of the Gleason-Yamabe structure theorem for locally compact groups (emphasising the role of Gleason metrics), from which the solution to Hilbert's fifth problem follows as a corollary. After reviewing some model-theoretic preliminaries (most notably the theory of ultraproducts), the combinatorial applications of the Gleason-Yamabe theorem to approximate groups and groups of polynomial growth are then given. A large number of relevant exercises and other supplementary material are also provided.

NEW SPACES IN PHYSICS

FORMAL AND CONCEPTUAL REFLECTIONS

Cambridge University Press *After the development of manifolds and algebraic varieties in the previous century, mathematicians and physicists have continued to advance concepts of space. This book and its companion explore various new notions of space, including both formal and conceptual points of view, as presented by leading experts at the New Spaces in Mathematics and Physics workshop held at the Institut Henri Poincaré in 2015. This volume covers a broad range of topics in mathematical physics, including noncommutative geometry, supergeometry, derived symplectic geometry, higher geometric quantization, intuitionistic quantum logic, problems with the continuum description of spacetime, twistor theory, loop quantum gravity, and geometry in string theory. It is addressed primarily to mathematical physicists and mathematicians, but also to historians and philosophers of these disciplines.*

GEOMETRY IN A FRÉCHET CONTEXT

A PROJECTIVE LIMIT APPROACH

ENCYCLOPAEDIA OF MATHEMATICS, SUPPLEMENT III

Springer Science & Business Media *This is the third supplementary volume to Kluwer's highly acclaimed twelve-volume Encyclopaedia of Mathematics. This additional volume contains nearly 500 new entries written by experts and covers developments and topics not included in the previous volumes. These entries are arranged alphabetically throughout and a detailed index is included. This supplementary volume enhances the existing twelve volumes, and together, these thirteen volumes represent the most authoritative, comprehensive and up-to-date Encyclopaedia of Mathematics available.*

RIEMANNIAN MANIFOLDS AND HOMOGENEOUS GEODESICS

Springer Nature *This book is devoted to Killing vector fields and the one-parameter isometry groups of Riemannian manifolds generated by them. It also provides a detailed introduction to homogeneous geodesics, that is, geodesics that are integral curves of Killing vector fields, presenting both classical and modern results, some very recent, many of which are due to the authors. The main focus is on the class of Riemannian manifolds with homogeneous geodesics and on some of its important subclasses. To keep the exposition self-contained the book also includes useful general results not only on geodesic orbit manifolds, but also on smooth and Riemannian manifolds, Lie groups and Lie algebras, homogeneous Riemannian manifolds, and compact homogeneous Riemannian spaces. The intended audience is graduate students and researchers whose work involves differential geometry and transformation groups.*

LECTURES ON CLASSICAL DIFFERENTIAL GEOMETRY

Courier Corporation *Elementary, yet authoritative and scholarly, this book offers an excellent brief introduction to the classical theory of differential geometry. It is aimed at advanced undergraduate and graduate students who will find it not only highly readable but replete with illustrations carefully selected to help stimulate the student's visual understanding of geometry. The text features an abundance of problems, most of which are simple enough for class use, and often convey an interesting geometrical fact. A selection of more difficult problems has been included to challenge the ambitious student. Written by a noted mathematician and historian of mathematics, this volume presents the fundamental conceptions of the theory of curves and surfaces and applies them to a number of examples. Dr. Struik has enhanced the treatment with copious historical, biographical, and bibliographical references that place the theory in context and encourage the student to consult original sources and discover additional important ideas there. For this second edition, Professor Struik made some corrections and added an appendix with a sketch of the application of Cartan's method of Pfaffians to curve and surface theory. The result was to further increase the merit of this stimulating, thought-provoking text — ideal for classroom use, but also perfectly suited for self-study. In this attractive, inexpensive paperback edition, it belongs in the library of any mathematician or student of mathematics interested in differential geometry.*

LECTURES ON LIE GROUPS

University of Chicago Press "*[Lectures in Lie Groups] fulfills its aim admirably and should be a useful reference for any mathematician who would like to learn the basic results for compact Lie groups. . . . The book is a well written basic text [and Adams] has done a service to the mathematical community."—Irving Kaplansky*

STRUCTURE AND GEOMETRY OF LIE GROUPS

Springer Science & Business Media *This self-contained text is an excellent introduction to Lie groups and their actions on manifolds. The authors start with an elementary discussion of matrix groups, followed by chapters devoted to the basic structure and representation theory of finite dimensinal Lie algebras. They then turn to global issues, demonstrating the key issue of the interplay*

between differential geometry and Lie theory. Special emphasis is placed on homogeneous spaces and invariant geometric structures. The last section of the book is dedicated to the structure theory of Lie groups. Particularly, they focus on maximal compact subgroups, dense subgroups, complex structures, and linearity. This text is accessible to a broad range of mathematicians and graduate students; it will be useful both as a graduate textbook and as a research reference.

AN INTRODUCTION TO HILBERT SPACE

Cambridge University Press *This textbook is an introduction to the theory of Hilbert space and its applications. The notion of Hilbert space is central in functional analysis and is used in numerous branches of pure and applied mathematics. Dr Young has stressed applications of the theory, particularly to the solution of partial differential equations in mathematical physics and to the approximation of functions in complex analysis. Some basic familiarity with real analysis, linear algebra and metric spaces is assumed, but otherwise the book is self-contained. It is based on courses given at the University of Glasgow and contains numerous examples and exercises (many with solutions). Thus it will make an excellent first course in Hilbert space theory at either undergraduate or graduate level and will also be of interest to electrical engineers and physicists, particularly those involved in control theory and filter design.*

HANDBOOK OF HILBERT GEOMETRY

Erich Schmidt Verlag GmbH & Co. KG *This volume presents surveys, written by experts in the field, on various classical and modern aspects of Hilbert geometry. They assume several points of view: Finsler geometry, calculus of variations, projective geometry, dynamical systems, and others. Some fruitful relations between Hilbert geometry and other subjects in mathematics are emphasized, including Teichmuller spaces, convexity theory, Perron-Frobenius theory, representation theory, partial differential equations, coarse geometry, ergodic theory, algebraic groups, Coxeter groups, geometric group theory, Lie groups and discrete group actions. This book is addressed to both students who want to learn the theory and researchers in this area.*

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

INDEX

FUNCTIONAL ANALYSIS, SOBOLEV SPACES AND PARTIAL DIFFERENTIAL EQUATIONS

Springer Science & Business Media *This textbook is a completely revised, updated, and expanded English edition of the important Analyse fonctionnelle (1983). In addition, it contains a wealth of problems and exercises (with solutions) to guide the reader. Uniquely, this book presents in a coherent, concise and unified way the main results from functional analysis together with the main results from the theory of partial differential equations (PDEs). Although there are many books on functional analysis and many on PDEs, this is the first to cover both of these closely connected topics. Since the French book was first published, it has been translated into Spanish, Italian, Japanese, Korean, Romanian, Greek and Chinese. The English edition makes a welcome addition to this list.*

CALABI-YAU VARIETIES: ARITHMETIC, GEOMETRY AND PHYSICS

LECTURE NOTES ON CONCENTRATED GRADUATE COURSES

Springer *This volume presents a lively introduction to the rapidly developing and vast research areas surrounding Calabi–Yau varieties and string theory. With its coverage of the various perspectives of a wide area of topics such as Hodge theory, Gross–Siebert program, moduli problems, toric approach, and arithmetic aspects, the book gives a comprehensive overview of the current streams of mathematical research in the area. The contributions in this book are based on lectures that took place during workshops with the following thematic titles: “Modular Forms Around String Theory,” “Enumerative Geometry and Calabi–Yau Varieties,” “Physics Around Mirror Symmetry,” “Hodge Theory in String Theory.” The book is ideal for graduate students and researchers learning about Calabi–Yau varieties as well as physics students and string theorists who wish to learn the mathematics behind these varieties.*

THE GEOMETRY AND TOPOLOGY OF COXETER GROUPS. (LMS-32)

Princeton University Press *The Geometry and Topology of Coxeter Groups is a comprehensive and authoritative treatment of Coxeter groups from the viewpoint of geometric group theory. Groups generated by reflections are ubiquitous in mathematics, and there are classical examples of reflection groups in spherical, Euclidean, and hyperbolic geometry. Any Coxeter group can be realized as a group generated by reflection on a certain contractible cell complex, and this complex is the principal subject of this book. The book explains a theorem of Moussong that demonstrates that a polyhedral metric on this cell complex is nonpositively curved, meaning that Coxeter groups are "CAT(0) groups." The book describes the reflection group trick, one of the most potent sources of examples of aspherical manifolds. And the book discusses many important topics in geometric group theory and topology, including Hopf's theory of ends; contractible manifolds and homology spheres; the Poincaré Conjecture; and Gromov's theory of CAT(0) spaces and groups. Finally, the book examines connections between Coxeter groups and some of topology's most famous open problems concerning aspherical manifolds, such as the Euler Characteristic Conjecture and the Borel and Singer conjectures.*

PROCESSING, ANALYZING AND LEARNING OF IMAGES, SHAPES, AND FORMS: PART 2

Elsevier *Processing, Analyzing and Learning of Images, Shapes, and Forms: Part 2, Volume 20, surveys the contemporary developments relating to the analysis and learning of images, shapes and forms, covering mathematical models and quick computational techniques. Chapter cover Alternating Diffusion: A Geometric Approach for Sensor Fusion, Generating Structured TV-based Priors and Associated Primal-dual Methods, Graph-based Optimization Approaches for Machine Learning, Uncertainty Quantification and Networks, Extrinsic Shape Analysis from Boundary Representations, Efficient Numerical Methods for Gradient Flows*

and Phase-field Models, Recent Advances in Denoising of Manifold-Valued Images, Optimal Registration of Images, Surfaces and Shapes, and much more. Covers contemporary developments relating to the analysis and learning of images, shapes and forms Presents mathematical models and quick computational techniques relating to the topic Provides broad coverage, with sample chapters presenting content on Alternating Diffusion and Generating Structured TV-based Priors and Associated Primal-dual Methods

THE GEOMETRY OF SCHEMES

Springer Science & Business Media *Grothendieck's beautiful theory of schemes permeates modern algebraic geometry and underlies its applications to number theory, physics, and applied mathematics. This simple account of that theory emphasizes and explains the universal geometric concepts behind the definitions. In the book, concepts are illustrated with fundamental examples, and explicit calculations show how the constructions of scheme theory are carried out in practice.*

DIFFERENTIAL GEOMETRY AND LIE GROUPS FOR PHYSICISTS

Cambridge University Press *Differential geometry plays an increasingly important role in modern theoretical physics and applied mathematics. This textbook gives an introduction to geometrical topics useful in theoretical physics and applied mathematics, covering: manifolds, tensor fields, differential forms, connections, symplectic geometry, actions of Lie groups, bundles, spinors, and so on. Written in an informal style, the author places a strong emphasis on developing the understanding of the general theory through more than 1000 simple exercises, with complete solutions or detailed hints. The book will prepare readers for studying modern treatments of Lagrangian and Hamiltonian mechanics, electromagnetism, gauge fields, relativity and gravitation. Differential Geometry and Lie Groups for Physicists is well suited for courses in physics, mathematics and engineering for advanced undergraduate or graduate students, and can also be used for active self-study. The required mathematical background knowledge does not go beyond the level of standard introductory undergraduate mathematics courses.*