Algebraic Geometry and Commutative Algebra - Siegfried Bosch 2012-11-15

Algebraic geometry is a fascinating branch of mathematics that combines methods from both, algebra and geometry. It transcends the limited scope of pure algebra by means of geometric construction principles. Moreover, Grothendieck's schemes invented in the late 1950s allowed the application of algebraic-geometric methods in fields that formerly seemed to be far away from geometry, like algebraic number theory. The new techniques paved the way to spectacular progress such as the proof of Fermat's Last Theorem by Wiles and Taylor. The scheme-theoretic approach to algebraic geometry is explained for non-experts. More advanced readers can use the book to broaden their view on the subject. A separate part deals with the necessary prerequisites from commutative algebra. On a whole, the book provides a very accessible and self-contained introduction to algebraic geometry, up to a quite advanced level. Every chapter of the book is preceded by a motivating introduction with an informal discussion of the content, topics and applications. This way the book is an excellent solution for learning by yourself or for complementing knowledge that is already present. It can equally be used as a convenient source for courses and seminars or as supplemental literature.

Commutative Algebra - David Eisenbud 1995-03-30

Commutative Algebra is best understood with knowledge of the geometric ideas that have played a great role in its formation, in short, with a view towards algebraic geometry. The author presents a comprehensive view of commutative algebra, from basics, such as localization and primary decomposition, through dimension theory, differentials, homological methods, free resolutions and duality, emphasizing the origins of the ideas and their connections with other parts of mathematics. Many exercises illustrate and sharpen the theory and extended exercises give the reader an active part in complementing the material presented in the text. One novel feature is a chapter devoted to a quick but thorough treatment of Grobner basis theory and the constructive methods in commutative algebra and algebraic geometry that flow from it. Applications of the theory and even suggestions for computer algebra projects are included. This book will appeal to readers from beginners to advanced students of commutative algebra or algebraic geometry. To help beginners, the essential ideals from algebraic geometry are treated from scratch. Appendices on homological algebra, multilinear algebra and several other useful topics help to make the book relatively self-contained. Novel results and presentations are scattered throughout the text.

Algebraic Geometry and Commutative Algebra - Hiroaki Hijikata 2014-05-10

Algebraic Geometry and Commutative Algebra in Honor of Masayoshi Nagata for his significant contributions to commutative algebra and algebraic geometry. Topics covered range from power series rings and rings of invariants of finite linear groups to the convolution algebra of distributions on totally disconnected locally compact groups. The discussion begins with a description of several formulas for enumerating certain types of objects, which may be tabular arrangements of integers called Young tableaux or some types of monomials. The next chapter explains how to establish these enumerative formulas, with emphasis on the role played by transformations of determinantal polynomials and recurrence relations satisfied by them. The book then turns to several applications of the enumerative formulas and universal identity, including including enumerative proofs of the straightening law of Doubilet-Rota-Stein and computations of Hilbert functions of polynomial ideals of certain determinantal loci. Invariant differentials and quaternion extensions are also examined, along with the moduli of Todorov surfaces and the classification problem of embedded lines in characteristic p. This monograph will be a useful resource for practitioners and researchers in algebra and geometry.

Commutative Algebra and its Interactions to Algebraic Geometry - Nguyen Tu Cuong 2018-08-02

This book presents four lectures on recent research in commutative algebra and its applications to algebraic geometry. Aimed at researchers and graduate students with an advanced background in algebra, these lectures were given during the Commutative Algebra program held at the Vietnam Institute of Advanced Study in Mathematics in the winter semester 2013-2014. The first lecture is on Weyl algebras (certain rings of differential operators) and their D-modules, relating non-commutative and commutative algebra to algebraic geometry and analysis in a very appealing way. The second lecture concerns local systems, their homological origin, and applications to the classification of Artinian Gorenstein rings and the computation of their invariants. The third lecture is on the representation type of projective varieties and the classification of arithmetically Cohen-Macaulay bundles and Ulrich bundles. Related topics such as moduli spaces of sheaves, liaison theory, minimal resolutions, and Hilbert schemes of points are also covered. The last lecture addresses a classical problem: how many equations are needed to define an algebraic variety set-theoretically? It systematically covers (and improves) recent results for the case of toric varieties.

Introduction to Commutative Algebra and Algebraic Geometry - Ernst Kunz 2012-11-06

Originally published in 1965, this classic textbook is an English translation of Einführung in die kommutative Algebra und algebraische Geometrie. As part of the Modern Birkhäuser Classics series, the publisher is proud to make Introduction to Commutative Algebra and Algebraic Geometry available to a wider audience. Aimed at students who have taken a basic course in algebra, the goal of the text is to present important results concerning the representation of algebraic varieties as intersections of the least possible number of hypersurfaces and—a closely related problem—with the most economical generation of ideals in Noetherian rings. Along the way, one encounters many basic concepts of commutative algebra and algebraic geometry and proves many facts which can then serve as a basic stock for a deeper study of these subjects.

Computative Algebra and Algebraic Geometry - Freddy Van Oystaeyen 1999-03-31

Contains contributions by over 25 leading international mathematicians in the areas of commutative algebra and algebraic geometry. The text presents developments and results based on, and inspired by, the work of Mario Fiorentini. It covers topics ranging from almost numerical invariants of algebraic curves to deformation of projective schemes.

Computational Methods in Commutative Algebra and Algebraic Geometry - Wolmer Vasconcelos 2004-05-18

This ACM volume deals with tackling problems that can be represented by data structures which are essentially matrices with polynomial entries, mediated by the disciplines of commutative algebra and algebraic geometry. The discoveries stem from an interdisciplinary branch of research which has been growing steadily over the past decade. The author covers a wide range, from showing how to obtain deep heuristics in a computation of a ring, a module or a morphism, to developing means of solving nonlinear systems of equations - highlighting the use of advanced techniques to bring down the cost of computation. Although intended for advanced students and researchers with interests both in algebra and computation, many parts may be read by anyone with a basic abstract algebra course.
Algebraic Geometry and Commutative Algebra - Hiroaki Hijikata 2014-05-10 Algebraic Geometry and Commutative Algebra in Honor of Masayoshi Nagata presents a collection of papers on algebraic geometry and commutative algebra in honor of Masayoshi Nagata for his significant contributions to commutative algebra. Topics covered range from Weierstrass models and endomorphism algebras of abelian varieties to the generic Torelli theorem for hypersurfaces in compact irreducible hermitian symmetric spaces. Coarse moduli spaces for curves are also discussed, along with discriminants of curves of genus 2 and arithmetic surfaces. Comprised of 14 chapters, this volume begins by describing a basic fibrational structure, with emphasis on elliptic fibrations with a section. The reader is then introduced to canonical bundles of analytic surfaces of class V0 with curves; Lifting Problem on ideal-adically complete noetherian rings; and the canonical ring of a curve. Subsequent chapters deal with algebraic surfaces for regular systems of weights; elementary transformations of algebraic vector bundles; the irreducibility of the first differential equation of Painlevé; and F-pure normal rings of dimension two. The book concludes with an assessment of the existence of some curves. This monograph will be a useful resource for practitioners and researchers in algebra and geometry.

Introduction to Algebraic Geometry and Commutative Algebra - Dilip P Patil 2010-03-31 This introductory textbook for a graduate course in pure mathematics provides a gateway into the two difficult fields of algebraic geometry and commutative algebra. Algebraic geometry, supported fundamentally by commutative algebra, is a cornerstone of pure mathematics. Along the lines developed by Grothendieck, this book delves into the rich interplay between algebraic geometry and commutative algebra. A selection is made from the wealth of material in the discipline, along with concise yet clear definitions and synopses.

Commutative Algebra and Noncommutative Algebraic Geometry: Undergraduate Commutative Algebra - Miles Reid 1995-11-30 For those looking for an introduction to the area of commutative algebra, this book opens all the right doors and provides a clarity of understanding that all will welcome.

Ideals, Varieties, and Algorithms - David Cox 2013-04-17 Written at a level appropriate to undergraduates, this book covers such topics as the Hilbert Basis Theorem, the Nullstellensatz, invariant theory, projective geometry, and dimension theory. Contains a new section on Axiom and an update about MAPLE, Mathematica and REDUCE.

Algebraic Geometry - Robin Hartshorne 2013-06-29 An introduction to abstract algebraic geometry, with the only prerequisites being results from commutative algebra, which are stated as needed, and some elementary topology. More than 400 exercises distributed throughout the book offer specific examples as well as more specialised topics not treated in the main text, while three appendices present brief accounts of some areas of current research. This book can thus be used as textbook for an introductory course in algebraic geometry following a basic graduate course in algebra. Robin Hartshorne studied algebraic geometry with Oscar Zariski and David Mumford at Harvard, and with J. P. Serre and A. Grothendieck in Paris. He is the author of "Residues and Duality", "Foundations of Projective Geometry", "Ample Subvarieties of Algebraic Varieties", and numerous research titles.

Ideals, Varieties, and Algorithms - David Cox 2013-03-09 Written at a level appropriate to undergraduates, this book covers such topics as the Hilbert Basis Theorem, the Nullstellensatz, invariant theory, projective geometry, and dimension theory. The book bakes its discussion of algorithms on a generalisation of the division algorithm for polynomials in one variable that was only discovered in the 1960's. Although the algorithmic roots of algebraic geometry are old, the computational aspects were neglected earlier in this century. This has changed in recent years, and new algorithms, coupled with the power of fast computers, have let to some interesting applications, for example in robotics and in geometric theorem proving. In preparing this new edition, the authors present an improved proof of the Buchberger Criterion as well as a proof of Bezout's Theorem.

Ideals, Varieties, and Algorithms - David A. Cox 2008-07-31 This book details the heart and soul of modern commutative and algebraic geometry. It covers such topics as the Hilbert Basis Theorem, the Nullstellensatz, invariant theory, projective geometry, and dimension theory. In addition to enhancing the text of the second edition, with over 200 pages reflecting changes to enhance clarity and correctness, this third edition of Ideals, Varieties and Algorithms includes: a significantly updated section on Maple; updated information on AXIOM, CoCoA, Macaulay 2, Magma, Mathematica and SINGULAR; and presents a shorter proof of the Extension Theorem.

Introduction to Algebraic Geometry and Commutative Algebra - Dilip P. Patil 2010 Along the lines developed by Grothendieck, this book delves into the rich interplay between algebraic geometry and commutative algebra. With concise yet clear definitions and synopses a selection is made from the wealth of material in the disciplines including the Riemann-Roch theorem for arbitrary projective curves. "...pub. desc.

The Geometry of Syzygies - David Eisenbud 2006-10-28 First textbook-level account of basic examples and techniques in this area. Suitable for self-study by a reader who knows a little commutative algebra and algebraic geometry already. David Eisenbud is a well-known mathematician and current president of the American Mathematical Society, as well as a successful Springer author.

Algebraic Geometry and Arithmetic Curves - Qing Liu 2006-06-29 This book is a general introduction to the theory of schemes, followed by applications to arithmetic surfaces and to the theory of reduction of algebraic curves. The first part introduces basic objects such as schemes, morphisms, base change, local properties (normality, regularity, Zariski's Main Theorem). This is followed by the more global aspect: coherent sheaves and a finiteness theorem. Then follow the two fundamental theorems of Grothendieck: the existence of aPicard group and the duality theory. The first part ends with the theorem of Riemann-Roch and its application to the study of smooth projective curves over a field. Singular curves are treated through a detailed study of the Picard group. The second part starts with blowing-ups and desingularisation (embedded or not) of fibered surfaces over a Dedekind ring that leads on to intersection theory on arithmetic surfaces. Castelnuovo's criterion is proved and also the existence of the minimal regular model. This leads to the study of reduction of algebraic curves. The case of elliptic curves is studied in detail. The book concludes with the fundamental theorem of stable reduction of Deligne-Mumford. The book is essentially self-contained, including the necessary material on commutative algebra. The prerequisites are therefore few, and the book should suit a graduate student. It contains many examples and nearly 600 exercises.

Ideals, Varieties, and Algorithms - David A. Cox 2015-04-30 This text covers topics in algebraic geometry and commutative algebra with a strong perspective toward practical and computational aspects. The first four chapters form the core of the book. A comprehensive chart in the Preface illustrates a variety of ways to proceed with the material once these chapters are covered. In addition to the fundamentals of algebraic geometry—the elimination theory, projective geometry, and dimension theory—the new edition incorporates several substantial changes, all of which are listed in the Preface. The largest revision incorporates a new Chapter (ten), which presents some of the essentials of progress made over the last decades in computing Gröbner bases. The book also includes current computer algebra material in Appendix C and updated independent projects (Appendix D). The book may serve as a first or second course in undergraduate abstract algebra and with some supplementation perhaps, for beginning graduate level courses in algebraic geometry or commutative algebra. Prerequisites for the reader include linear algebra and a proof-oriented course. It is assumed that the reader has access to a computer algebra system. Appendix C describes features of MapleTM, Mathematica® and Sage, as well as other systems that are most relevant to the text. Pseudocode is used in the text; Appendix B carefully describes the pseudocode used. From the reviews of previous editions: "...The book
A Course in Commutative Algebra-Gregor Kemper 2010-12-02 This textbook offers a thorough, modern introduction into commutative algebra. It is intended mainly to serve as a guide for a course of one or two semesters, or for self-study. The carefully selected subject matter concentrates on the concepts and results at the center of the field. The book maintains a constant view on the natural geometric context, enabling the reader to gain a deeper understanding of the material. Although it emphasizes theory, three chapters are devoted to computational aspects. Many illustrative examples and exercises enrich the text.

Commutative Algebra-David Eisenbud 2013-12-01 This is a comprehensive review of commutative algebra, from localization and primary decomposition through dimension theory, homological methods, free resolutions and duality, emphasizing the origins of the ideas and their connections with other parts of mathematics. The book gives a concise treatment of Gröbner basis theory and the constructive methods in commutative algebra and algebraic geometry that flow from it. Many exercises included.

Using Algebraic Geometry-David A. Cox 2013-04-17 An illustration of the many uses of algebraic geometry, highlighting the more recent applications of Groebner bases and resultants. Along the way, the authors provide an introduction to some algebraic objects and techniques more advanced than typically encountered in a first course. The book is accessible to non-specialists and to readers with a diverse range of backgrounds, assuming readers know the material covered in standard undergraduate courses, including abstract algebra. But because the text is intended for beginning graduate students, it does not require graduate algebra, and in particular, does not assume that the reader is familiar with modules.

Free Resolutions in Commutative Algebra and Algebraic Geometry-Taylor & Francis Group 2020-09-30 The selected contributions in this volume originated at the Sundance conference, which was devoted to discussions of current work in the area of free resolutions. The papers include new research, not otherwise published, and expositions that develop current problems likely to influence future developments in the field.

Computational Commutative Algebra 1-Martin Kreuzer 2008-07-15 This introduction to polynomial rings, Gröbner bases and applications bridges the gap in the literature between theory and actual computation. It details numerous applications, covering fields as disparate as algebraic geometry and financial markets. To aid in a full understanding of these applications, more than 40 tutorials illustrate how the theory can be used. The book also includes many exercises, both theoretical and practical.

Combinatorial Commutative Algebra-Ezra Miller 2006-03-30 Recent developments are covered Contains over 100 figures and 250 exercises Includes complete proofs

Non-commutative Algebraic Geometry-F.M.J. van Oystaeyen 2006-11-14

Algebraic Geometry and Commutative Algebra-Siegfried Bosch 2012-11-16 Algebraic geometry is a fascinating branch of mathematics that connects methods from both, algebra and geometry. It transcends the limited scope of pure algebra by means of geometric construction principles. Moreover, Grothendieck’s schemes invented in the late 1950s allowed the application of algebraic-geometric methods in fields that formerly seemed to be far away from geometry, like algebraic number theory. The new techniques paved the way to spectacular progress such as the proof of Fermat’s Last Theorem by Wiles and Taylor. The scheme-theoretic approach to algebraic geometry is explained for non-experts. More advanced readers can use the book to broaden their view on the subject. A separate part deals with the necessary prerequisites from commutative algebra. On a whole, the book provides a very accessible and self-contained introduction to algebraic geometry, up to a quite advanced level. Every chapter of the book is preceded by a motivating introduction with an informal discussion of the contents. Typical examples and an abundance of exercises illustrate each section. This way the book is an excellent solution for learning by yourself or for complementing knowledge that is already present. It can equally be used as a convenient source for courses and seminars or as supplemental literature.

Commutative Algebra-Aron Simis 2020-03-09 This unique book on commutative algebra is divided into two parts in order to facilitate its use in several types of courses. The first introductory part covers the basic theory, connections with algebraic geometry, computational aspects, and extensions to module theory. The more advanced second part covers material such as associated primes and primary decomposition, local rings, M-sequences and Cohen-Macaulay modules, and homological methods.

A Singular Introduction to Commutative Algebra-Gert-Martin Greuel 2012-12-06 This book can be understood as a model for teaching commutative algebra, and takes into account modern developments such as algorithmic and computational aspects. As soon as a new concept is introduced, the authors show how the concept can be used on a computer. The computations are exemplified with the computer algebra system Singular, developed by the authors. Singular is a special system for polynomial computation with many features for global as well as for local commutative algebra and algebraic geometry. The book includes a CD containing Singular as well as the examples and procedures explained in the book.

Combinatorial Aspects of Commutative Algebra and Algebraic Geometry-Gunnar Fløystad 2011-05-16 The Abel Symposium 2009 "Combinatorial aspects of Commutative Algebra and Algebraic Geometry", held at Voss, Norway, featured talks by leading researchers in the field. This is the proceedings of the Symposium, presenting contributions on syzygies, tropical geometry, Boij-Söderberg theory, Schubert calculus, and quiver varieties. The volume also includes an introductory survey on binomial ideals with applications to hypergeometric series, combinatorial games and chemical reactions. The contributions pose interesting problems, and offer up-to-date research on some of the most active fields of commutative algebra and algebraic geometry with a combinatorial flavour.

Elementary Algebraic Geometry-Klaus Hulek 2003 This book is a true introduction to the basic concepts and techniques of algebraic geometry. The language is purposely kept on an elementary level, avoiding sheaf theory and cohomology theory. The introduction of new algebraic concepts is always motivated by a discussion of the corresponding geometric ideas. The main point of the book is to illustrate the interplay between abstract theory and specific examples. The book contains numerous problems that illustrate the general theory. The text is suitable for advanced undergraduates and beginning graduate students. It contains sufficient material for a one-semester course. The reader should be familiar with the basic concepts of modern algebra. A course in one complex variable would be helpful, but is not necessary.

Number Theory, Algebraic Geometry and Commutative Algebra-Yasuo Akizuki 1973

Modular Invariant Theory-H.E.A. Eddy Campbell 2011-01-12 This book covers the modular invariant theory of finite groups, the case when the characteristic of the field divides the order of the group, a theory that is more complicated than the study of the classical non-modular case. Largely self-contained, the book develops the theory from its origins up to modern results. It explores many examples, illustrating the theory and its contrast with the
better understood non-modular setting. It details techniques for the computation of invariants for many modular representations of finite groups, especially the case of the cyclic group of prime order. It includes detailed examples of many topics as well as a quick survey of the elements of algebraic geometry and commutative algebra as they apply to invariant theory. The book is aimed at both graduate students and researchers—an introduction to many important topics in modern algebra within a concrete setting for the former, an exploration of a fascinating subfield of algebraic geometry for the latter.

Commutative Algebra, Algebraic Geometry, and Computational Methods - David Eisenbud 1999-07-01 This volume contains papers presented at the International Conference on Commutative Algebra, Algebraic geometry, and Computational methods held in Hanoi in 1996, as well as papers written subsequently. It features both expository articles as well as research papers on a range of currently active areas in commutative algebra, algebraic geometry (particularly surveys on intersection theory) and combinatorics. In addition, a special feature is a section on the life and work of Wolfgang Vogel, who was an organiser of the conference.

Commutative Algebra - J. William Hoffman 2016-04-15 The purpose of this book is twofold: to present some basic ideas in commutative algebra and algebraic geometry and to introduce topics of current research, centered around the themes of Gröbner bases, resultants and syzygies. The presentation of the material combines definitions and proofs with an emphasis on concrete examples. The authors illustrate the use of software such as Mathematica and Singular. The design of the text in each chapter consists of two parts: the fundamentals and the applications, which make it suitable for courses of various lengths, levels, and topics based on the mathematical background of the students. The fundamentals portion of the chapter is intended to be read with minimal outside assistance, and to learn some of the most useful tools in commutative algebra. The applications of the chapter are to provide a glimpse of the advanced mathematical research where the topics and results are related to the material presented earlier. In the applications portion, the authors present a number of results from a wide range of sources without detailed proofs. The applications portion of the chapter is suitable for a reader who knows a little commutative algebra and algebraic geometry already, and serves as a guide to some interesting research topics. This book should be thought of as an introduction to more advanced texts and research topics. Its novelty is that the material presented is a unique combination of the essential methods and the current research results. The goal is to equip readers with the fundamental classical algebra and geometry tools, ignite their research interests, and initiate some potential research projects in the related areas.

Computations in Algebraic Geometry with Macaulay 2 - David Eisenbud 2013-03-14 This book presents algorithmic tools for algebraic geometry, with experimental applications. It also introduces Macaulay 2, a computer algebra system supporting research in algebraic geometry, commutative algebra, and their applications. The algorithmic tools presented here are designed to serve readers wishing to bring such tools to bear on their own problems. The first part of the book covers Macaulay 2 using concrete applications; the second emphasizes details of the mathematics.

Computational Algebraic Geometry - HENRY SCHENCK 2003-10-06 Table of contents

Cohen-Macaulay Rings - Winfried Bruns 1998-06-18 Now in paperback, this advanced text on Cohen-Macaulay rings has been updated and expanded.

Algebraic Geometry and Commutative Algebra - 1988