Ihsen Yengui

Constructive Commutative Algebra

Projective Modules Over Polynomial Rings and Dynamical Gröbner Bases

Springer

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Huishi Li

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   Constructive Commutative Algebra Ihsen Yengui,2015-12-11 The main goal of this book is to find the constructive content hidden in abstract proofs of concrete theorems in Commutative Algebra especially in well known theorems concerning projective modules over polynomial rings mainly the Quillen Suslin theorem and syzygies of multivariate polynomials with coefficients in a valuation ring Simple and constructive proofs of some results in the theory of projective modules over polynomial rings are also given and light is cast upon recent progress on the Hermite ring and Gr bner ring conjectures New conjectures on unimodular completion arising from our constructive approach to the unimodular completion problem are presented Constructive algebra can be understood as a first preprocessing step for computer algebra that leads to the discovery of general algorithms even if they are sometimes not efficient From a logical point of view the dynamical evaluation gives a constructive substitute for two highly nonconstructive tools of abstract algebra the Law of Excluded Middle and Zorn s Lemma For instance these tools are required in order to construct the complete prime factorization of an ideal in a Dedekind ring whereas the dynamical method reveals the computational content of this construction These lecture notes follow this dynamical philosophy   **Commutative Algebra: Constructive Methods** Henri Lombardi,Claude Quitté,2015-07-22 Translated from the popular French edition this book offers a detailed introduction to various basic concepts methods principles and results of commutative algebra It takes a constructive viewpoint in commutative algebra and studies algorithmic approaches alongside several abstract classical theories Indeed it revisits these traditional topics with a new and simplifying manner making the subject both accessible and innovative The algorithmic aspects of such naturally abstract topics as Galois theory Dedekind rings Pr fer rings finitely generated projective modules dimension theory of commutative rings and others in the current treatise are all analysed in the spirit of the great developers of constructive algebra in the nineteenth century This updated and revised edition contains over 350 well arranged exercises together with their helpful hints for solution A basic knowledge of linear algebra group theory elementary number theory as well as the fundamentals of ring and module theory is required Commutative Algebra Constructive Methods will be useful for graduate students and also researchers instructors and theoretical computer scientists   **Noncommutative Polynomial Algebras of Solvable Type and Their Modules** Huishi Li,2021-11-08 Noncommutative Polynomial Algebras of Solvable Type and Their Modules is the first book to systematically introduce the basic constructive computational theory and methods developed for investigating solvable polynomial algebras and their modules In doing so this book covers A constructive introduction to solvable polynomial algebras and Gr bner basis theory for left ideals of solvable polynomial algebras and submodules of free modules The new filtered graded techniques combined with the determination of the existence of graded monomial orderings The elimination theory and methods for left ideals and submodules of free modules combining the Gr bner basis techniques with the use of Gelfand Kirillov dimension and the construction of different kinds of elimination

orderings The computational construction of finite free resolutions including computation of syzygies construction of different kinds of finite minimal free resolutions based on computation of different kinds of minimal generating sets etc This book is perfectly suited to researchers and postgraduates researching noncommutative computational algebra and would also be an ideal resource for teaching an advanced lecture course *Mathematical Reviews ,2008* **Encyclopaedia of Mathematics** Michiel Hazewinkel,2013-12-01 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathe matics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977 1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivi sion has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science en gineers and teachers of mathematics These articles treat their material at a fairly general level and aim to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques *Colloquium Mathematicum ,2017* Computational Commutative Algebra 2 Martin Kreuzer,Lorenzo Robbiano,2005-11-04 Hofstadter s Law It always takes longer than you think it will take even if you take into account Hofstadter s Law Douglas R Hofstadter Dear Reader why did we begin the foreword of this second volume with the same quote as the rst There we wrote that it took three years of intense work just to ll three centimeters of your bookshelf The completion of this volume took four years and it is about four centimeters thick Thus we have a con rmed invariant which governs our writing our velocity is one centimeter per year after all e ects due to Hofstadter s Law have been taken into account When westartedthisprojectinthelastmillennium weplannedabookforlearning teaching reading and most of all enjoying the topic at hand Surely there is no law which says that a mathematical book has to be dull boring dry or tedious But how do you make it enjoyable Our approach has been to ll it with amusing quotes varied jokes funny word games owery metaphors and occasional literarye orts There are two possible drawbacks of this method Firstly not everyone has the same sense of humour and not every metaphor works as intended For instance it is easy to joke about certain politicians but what happens if they read this book And when we wrote of a small boat sailing slowly into the Brazilian sunset it was pointed out to us that this entails a geographical problem Secondly it is very di cult to write humorously in a foreign language 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 **Computational Methods in Commutative Algebra and Algebraic Geometry** Wolmer Vasconcelos,2004-06-01 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 *Topics in Computational Algebra* G.M. Piacentini Cattaneo,Elisabetta Strickland,1991-01-31 The main purpose of these lectures is first to briefly survey the fundamental con nection between the representation theory of the symmetric group Sn and the theory of symmetric functions and second to show how combinatorial methods that arise naturally in the theory of symmetric functions lead to efficient algorithms to express various prod ucts of representations of Sn in terms of sums of irreducible representations That is there is a basic isometry which maps the center of the group algebra of Sn Z Sn to the space of homogeneous symmetric functions of degree n An This basic isometry is known as the Frobenius map F The Frobenius map allows us to reduce calculations involving characters of the symmetric group to calculations involving Schur functions Now there is a very rich and beautiful theory of the combinatorics of symmetric functions that has been developed in recent years The combinatorics of symmetric functions then leads to a number of very efficient algorithms for expanding various products of Schur functions into a sum of Schur functions Such expansions of products of Schur functions correspond via the Frobenius map to decomposing various products of irreducible representations of Sn into their irreducible components In addition the Schur functions are also the characters of the irreducible polynomial representations of the general linear group over the complex numbers GLn C **Computational Commutative Algebra 1** ,2008 Eintrag f r die Universit tsbibliographie Computing in algebraic geometry Wolfram Decker,Christoph Lossen,2006 **Geometric Algebra Applications Vol. I** Eduardo Bayro-Corrochano,2018-06-20 The goal of the Volume I Geometric Algebra for Computer Vision Graphics and Neural Computing is to present a unified

mathematical treatment of diverse problems in the general domain of artificial intelligence and associated fields using Clifford or geometric algebra Geometric algebra provides a rich and general mathematical framework for Geometric Cybernetics in order to develop solutions concepts and computer algorithms without losing geometric insight of the problem in question Current mathematical subjects can be treated in an unified manner without abandoning the mathematical system of geometric algebra for instance multilinear algebra projective and affine geometry calculus on manifolds Riemann geometry the representation of Lie algebras and Lie groups using bivector algebras and conformal geometry By treating a wide spectrum of problems in a common language this Volume I offers both new insights and new solutions that should be useful to scientists and engineers working in different areas related with the development and building of intelligent machines Each chapter is written in accessible terms accompanied by numerous examples figures and a complementary appendix on Clifford algebras all to clarify the theory and the crucial aspects of the application of geometric algebra to problems in graphics engineering image processing pattern recognition computer vision machine learning neural computing and cognitive systems **Studies in Constructive Mathematics and Mathematical Logic** A. O. Slisenko,2014-01-15 Computer Algebra and Polynomials Jaime Gutierrez,Josef Schicho,Martin Weimann,2015-01-20 Algebra and number theory have always been counted among the most beautiful mathematical areas with deep proofs and elegant results However for a long time they were not considered that important in view of the lack of real life applications This has dramatically changed nowadays we find applications of algebra and number theory frequently in our daily life This book focuses on the theory and algorithms for polynomials over various coefficient domains such as a finite field or ring The operations on polynomials in the focus are factorization composition and decomposition basis computation for modules etc Algorithms for such operations on polynomials have always been a central interest in computer algebra as it combines formal the variables and algebraic or numeric the coefficients aspects The papers presented were selected from the Workshop on Computer Algebra and Polynomials which was held in Linz at the Johann Radon Institute for Computational and Applied Mathematics RICAM during November 25 29 2013 at the occasion of the Special Semester on Applications of Algebra and Number Theory **Computer Algebra Methods for Equivariant Dynamical Systems** Karin Gatermann,2014-09-01 **Studies in Constructive Mathematics and Mathematical Logic** ,1969 *Algorithms in Algebraic Geometry and Applications* Laureano Gonzalez-Vega,Recio Tomas,1996-06-01 Studies in Constructive Mathematics and Mathematical Logic A. O. Slisenko,1969 **Geometric Algebra Applications** Eduardo Bayro Corrochano,2019 The goal of the Volume I Geometric Algebra for Computer Vision Graphics and Neural Computing is to present a unified mathematical treatment of diverse problems in the general domain of artificial intelligence and associated fields using Clifford or geometric algebra Geometric algebra provides a rich and general mathematical framework for Geometric Cybernetics in order to develop solutions concepts and computer algorithms without losing geometric insight of the problem in question Current

mathematical subjects can be treated in an unified manner without abandoning the mathematical system of geometric algebra for instance multilinear algebra projective and affine geometry calculus on manifolds Riemann geometry the representation of Lie algebras and Lie groups using bivector algebras and conformal geometry By treating a wide spectrum of problems in a common language this Volume I offers both new insights and new solutions that should be useful to scientists and engineers working in different areas related with the development and building of intelligent machines Each chapter is written in accessible terms accompanied by numerous examples figures and a complementary appendix on Clifford algebras all to clarify the theory and the crucial aspects of the application of geometric algebra to problems in graphics engineering image processing pattern recognition computer vision machine learning neural computing and cognitive systems Publisher s description

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