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Soliton Equations and their Algebro-Geometric Solutions: Volume 1, (1+1)-Dimensional Continuous Models *Soliton Equations and Their Algebro-Geometric Solutions: Volume 2, (1+1)-Dimensional Discrete Models* *Soliton Equations and Their Algebro-Geometric Solutions: Volume I: (1 + 1)-Dimensional Continuous Models Soliton Equations and Their Algebro-Geometric Solutions: Volume 2, (1+1)-Dimensional Discrete Models* *Algebro-Geometric Quasi-Periodic Finite-Gap Solutions of the Toda and Kac-van Moerbeke Hierarchies* *Algebraic Geometric Codes: Basic Notions Principles of Algebraic Geometry An Algebraic Approach to Geometry Geometric Algebra Geometric, Algebraic and Topological Methods for Quantum Field Theory An Invitation to Arithmetic Geometry Algebraic Geometry and Arithmetic Curves* *Algebro-geometric Approach to Nonlinear Integrable Equations* *Geometric Algebra for Computer Science Geometry of Algebraic Curves An Algebraic Geometric Approach to Separation of Variables* *Vector Bundles in Algebraic Geometry* *Algebro-geometric Quasi-periodic Finite-gap Solutions of the Toda and Kac-van Moerbeke Hierarchies Algebraic Curves* *Geometry of Algebraic Curves* *Algebraic Geometry and its Applications* *Geometric, Algebraic and Topological Methods for Quantum Field Theory* *Geometric Methods in Physics XXXVI History Algebraic Geometry Integrable Systems and Algebraic Geometry Nonlinear Systems and Their Remarkable Mathematical Structures Glimpses of*

Soliton Theory A Celebration of Algebraic Geometry Algebraic Geometry, Seattle 2005 Geometric Multiplication of Vectors *Positivity in Algebraic Geometry II* *Positivity in algebraic geometry 2 Geometric Algebra for Computer Graphics* *Integrable Systems and Algebraic Geometry:* *Algebraic Geometry* *Foundations of Geometric Algebra Computing Vertex Algebras and Algebraic Curves: Second Edition Algebraic Geometry I A Study in Derived Algebraic Geometry: Volume I: Correspondences and Duality Analysis Meets Geometry*

This two volume work on "Positivity in Algebraic Geometry" contains a contemporary account of a body of work in complex algebraic geometry loosely centered around the theme of positivity. Topics in Volume I include ample line bundles and linear series on a projective variety, the classical theorems of Lefschetz and Bertini and their modern outgrowths, vanishing theorems, and local positivity. Volume II begins with a survey of positivity for vector bundles, and moves on to a systematic development of the theory of multiplier ideals and their applications. A good deal of this material has not previously appeared in book form, and substantial parts are worked out here in detail for the first time. At least a third of the book is devoted to concrete examples, applications, and pointers to further developments. Whereas Volume I is more elementary, the present Volume II is more at the research level and somewhat more specialized. Both volumes are also available as hardcover edition as Vols. 48 and 49 in the series "Ergebnisse der Mathematik und ihrer Grenzgebiete". Based on lectures held at the 7th Villa de Leyva summer school, this book presents an introduction to topics of current interest in the interface of geometry, topology and physics. It is aimed at graduate students in physics or mathematics with interests in geometric, algebraic *as well as topological methods and their applications to quantum field theory. This volume contains the written notes corresponding to lectures given by experts in the field. They cover current topics of research in a way that is suitable for graduate students of mathematics or physics interested in the recent developments and interactions between geometry, topology and physics. The book also contains contributions by younger participants, displaying the ample range of topics treated in the school. A key feature of the present volume is the provision of a pedagogical presentation of rather advanced topics, in a way which is suitable for both mathematicians and physicists. Until recently, almost all of the interactions between objects in virtual 3D worlds have been based on calculations performed using linear algebra. Linear algebra relies heavily on coordinates, however, which can make many geometric programming tasks very specific and complex-often a lot of effort is required to bring about even modest performance enhancements. Although linear algebra is an efficient way to specify low-level computations, it is not a suitable high-level language for geometric programming. Geometric Algebra for Computer Science presents a compelling alternative to the limitations of linear algebra. Geometric algebra, or GA, is a compact, time-effective, and performance-enhancing way to represent the geometry of 3D objects in computer programs. In this book you will find an introduction to GA that will give you a strong grasp of its relationship to linear algebra and its significance for your work. You will learn how to use GA to represent objects and perform geometric operations on them. And you will begin mastering proven techniques for making GA an integral part of your applications in a way that simplifies your code without slowing it down. * The first book on Geometric Algebra for programmers in computer graphics and* *entertainment computing * Written by leaders in the field providing essential information on this new technique for 3D graphics * This full colour book includes a website with GAViewer, a program to experiment with GA Vertex algebras are algebraic objects that encapsulate the concept of operator product expansion from two-dimensional conformal field theory. Vertex algebras are fast becoming ubiquitous in many areas of modern mathematics, with applications to representation theory, algebraic geometry, the theory of finite groups, modular functions, topology, integrable systems, and combinatorics. This book is an introduction to the theory of vertex algebras with a particular emphasis on the relationship with the geometry of algebraic curves. The notion of a vertex algebra is introduced in a coordinate-independent way, so that vertex operators become well defined on arbitrary smooth algebraic curves, possibly equipped with additional data, such as a vector bundle. Vertex algebras then appear as the algebraic objects encoding the geometric structure of various moduli spaces associated with algebraic curves. Therefore they may be used to give a geometric interpretation of various questions of representation theory. The book contains many original results, introduces important new concepts, and brings new insights into the theory of vertex algebras. The authors have made a great effort to make the book self-contained and accessible to readers of all backgrounds. Reviewers of the first edition anticipated that it would have a long-lasting influence on this exciting field of mathematics and would be very useful for graduate students and researchers interested in the subject. This second edition, substantially improved and expanded, includes several new topics, in particular an introduction to the Beilinson-Drinfeld theory of factorization algebras and the geometric Langlands correspondence. Two volume work containing a contemporary* *account on "Positivity in Algebraic Geometry". Both volumes also available as hardcover editions as Vols. 48 and 49 in the series "Ergebnisse der Mathematik und ihrer Grenzgebiete". A good deal of the material has not previously appeared in book form. Volume II is more at the research level and somewhat more specialized than Volume I. Volume II contains a survey of positivity for vector bundles, and moves on to a systematic development of the theory of multiplier ideals and their applications. Contains many concrete examples, applications, and pointers to further developments Konrad Schöbel aims to lay the foundations for a consequent algebraic geometric treatment of variable Separation, which is one of the oldest and most powerful methods to construct exact solutions for the fundamental equations in classical and quantum physics. The present work reveals a surprising algebraic geometric structure behind the famous list of separation coordinates, bringing together a great range of mathematics and mathematical physics, from the late 19th century theory of separation of variables to modern moduli space theory, Stasheff polytopes and operads. "I am particularly impressed by his mastery of a variety of techniques and his ability to show clearly how they interact to produce his results." (Jim Stasheff) This volume contains 18 papers at the Algebraic Geometry Conference, Yaroslavl', August 10-14, 1992. These conferences in algebraic geometry have a great tradition in Russia and are helt since 1979 in Yaroslavl' every second year. The present conference, the eighth one, was the first in which several foreign mathematicians participated. From the Russian side, there was a large group of specialists in algebraic geometry and related fields (invariant theory, topology of manifolds, theory of categories, mathematical physics etc.). Lectures on modern directions in algebraic geometry, such as the theory of exceptional bundles* *and helices on algebraic varieties, moduli of vector bundles on algebraic surfaces with applications to Donaldson's theory, geometry of Hilbert schemes of points, twistor spaces and applications to string theory, and more traditional areas, such as birational geometry of manifolds, adjunction theory, Hodge theory, problems of rationality in the invariant theory, topology of complex algebraic varieties, and others are contained in this volume. The volume consists of invited refereed research papers. The contributions cover a wide spectrum in algebraic geometry, from motives theory to numerical algebraic geometry and are mainly focused on higher dimensional varieties and Minimal Model Program and surfaces of general type. A part of the articles grew out a Conference in memory of Paolo Francia (1951-2000) held in Genova in September 2001 with about 70 participants. Solitons are explicit solutions to nonlinear partial differential equations exhibiting particle-like behavior. This is quite surprising, both mathematically and physically. Waves with these properties were once believed to be impossible by leading mathematical physicists, yet they are now not only accepted as a theoretical possibility but are regularly observed in nature and form the basis of modern fiber-optic communication networks. Glimpses of Soliton Theory addresses some of the hidden mathematical connections in soliton theory which have been revealed over the last half-century. It aims to convince the reader that, like the mirrors and hidden pockets used by magicians, the underlying algebro-geometric structure of soliton equations provides an elegant and surprisingly simple explanation of something seemingly miraculous. Assuming only multivariable calculus and linear algebra as prerequisites, this book introduces the reader to the KdV Equation and its multisoliton solutions, elliptic curves and Weierstrass -functions, the algebra of differential operators, Lax Pairs and their use in* *discovering other soliton equations, wedge products and decomposability, the KP Equation and Sato's theory relating the Bilinear KP Equation to the geometry of Grassmannians. Notable features of the book include: careful selection of topics and detailed explanations to make this advanced subject accessible to any undergraduate math major, numerous worked examples and thought-provoking but not overly-difficult exercises, footnotes and lists of suggested readings to guide the interested reader to more information, and use of the software package Mathematica« to facilitate computation and to animate the solutions under study. This book provides the reader with a unique glimpse of the unity of mathematics and could form the basis for a self-study, one-semester special topics, or "capstone" course. This book is a collection of survey articles by the main speakers at the 1993 Durham symposium on vector bundles in algebraic geometry. This book enables the reader to discover elementary concepts of geometric algebra and its applications with lucid and direct explanations. Why would one want to explore geometric algebra? What if there existed a universal mathematical language that allowed one: to make rotations in any dimension with simple formulas, to see spinors or the Pauli matrices and their products, to solve problems of the special theory of relativity in three-dimensional Euclidean space, to formulate quantum mechanics without the imaginary unit, to easily solve difficult problems of electromagnetism, to treat the Kepler problem with the formulas for a harmonic oscillator, to eliminate unintuitive matrices and tensors, to unite many branches of mathematical physics? What if it were possible to use that same framework to generalize the complex numbers or fractals to any dimension, to play with geometry on a computer, as well as to make calculations in robotics, ray-tracing and brain science? In addition, what if such a language provided a clear,* *geometric interpretation of mathematical objects, even for the imaginary unit in quantum mechanics? Such a mathematical language exists and it is called geometric algebra. High school students have the potential to explore it, and undergraduate students can master it. The universality, the clear geometric interpretation, the power of generalizations to any dimension, the new insights into known theories, and the possibility of computer implementations make geometric algebra a thrilling field to unearth. This concise classic presents advanced undergraduates and graduate students in mathematics with an overview of geometric algebra. The text originated with lecture notes from a New York University course taught by Emil Artin, one of the preeminent mathematicians of the twentieth century. The Bulletin of the American Mathematical Society praised Geometric Algebra upon its initial publication, noting that "mathematicians will find on many pages ample evidence of the author's ability to penetrate a subject and to present material in a particularly elegant manner." Chapter 1 serves as reference, consisting of the proofs of certain isolated algebraic theorems. Subsequent chapters explore affine and projective geometry, symplectic and orthogonal geometry, the general linear group, and the structure of symplectic and orthogonal groups. The author offers suggestions for the use of this book, which concludes with a bibliography and index. Geometric algebra (a Clifford Algebra) has been applied to different branches of physics for a long time but is now being adopted by the computer graphics community and is providing exciting new ways of solving 3D geometric problems. The author tackles this complex subject with inimitable style, and provides an accessible and very readable introduction. The book is filled with lots of clear examples and is very well illustrated. Introductory chapters look at algebraic axioms, vector algebra* *and geometric conventions and the book closes with a chapter on how the algebra is applied to computer graphics. This volume resulted from the conference A Celebration of Algebraic Geometry, which was held at Harvard University from August 25-28, 2011, in honor of Joe Harris' 60th birthday. Harris is famous around the world for his lively textbooks and enthusiastic teaching, as well as for his seminal research contributions. The articles are written in this spirit: clear, original, engaging, enlivened by examples, and accessible to young mathematicians. The articles in this volume focus on the moduli space of curves and more general varieties, commutative algebra, invariant theory, enumerative geometry both classical and modern, rationally connected and Fano varieties, Hodge theory and abelian varieties, and Calabi-Yau and hyperkähler manifolds. Taken together, they present a comprehensive view of the long frontier of current knowledge in algebraic geometry. Titles in this series are co-published with the Clay Mathematics Institute (Cambridge, MA). A brief but self-contained exposition of the basics of Riemann surfaces and theta functions prepares the reader for the main subject of this text, namely, the application of these theories to solving nonlinear integrable equations for various physical systems. Physicists and engineers involved in studying solitons, phase transitions or dynamical (gyroscopic) systems and mathematicians with some background in algebraic geometry and abelian and automorphic functions, are the targeted audience. This book is suitable for use as a supplementary text to a course in mathematical physics. The focus of this book is on algebro-geometric solutions of completely integrable nonlinear partial differential equations in (1+1)-dimensions, also known as soliton equations. Explicitly treated integrable models include the KdV, AKNS, sine-Gordon, and Camassa-Holm hierarchies as well as the classical massive*

Thirring system. An extensive treatment of the class of algebro-geometric solutions in the stationary as well as time-dependent contexts is provided. The formalism presented includes trace formulas, Dubrovin-type initial value problems, Baker-Akhiezer functions, and theta function representations of all relevant quantities involved. The book uses techniques from the theory of differential equations, spectral analysis, and elements of algebraic geometry (most notably, the theory of compact Riemann surfaces). The presentation is rigorous, detailed, and self-contained, with ample background material provided in various appendices. Detailed notes for each chapter together with an exhaustive bibliography enhance the presentation offered in the main text. This book is dedicated to the memory of Mikael Passare, an outstanding Swedish mathematician who devoted his life to developing the theory of analytic functions in several complex variables and exploring geometric ideas first-hand. It includes several papers describing Mikael's life as well as his contributions to mathematics, written by friends of Mikael's who share his attitude and passion for science. A major section of the book presents original research articles that further develop Mikael's ideas and which were written by his former students and co-authors. All these mathematicians work at the interface of analysis and geometry, and Mikael's impact on their research cannot be underestimated. Most of the contributors were invited speakers at the conference organized at Stockholm University in his honor. This book is an attempt to express our gratitude towards this great mathematician, who left us full of energy and new creative mathematical ideas. In recent years there has been enormous activity in the theory of algebraic curves. Many long-standing problems have been solved using the general techniques developed in algebraic geometry during the 1950's and 1960's. Additionally, *unexpected and deep connections between algebraic curves and differential equations have been uncovered, and these in turn shed light on other classical problems in curve theory. It seems fair to say that the theory of algebraic curves looks completely different now from how it appeared 15 years ago; in particular, our current state of knowledge repre sents a significant advance beyond the legacy left by the classical geometers such as Noether, Castelnuovo, Enriques, and Severi. These books give a presentation of one of the central areas of this recent activity; namely, the study of linear series on both a fixed curve (Volume I) and on a variable curve (Volume II). Our goal is to give a comprehensive and self-contained account of the extrinsic geometry of algebraic curves, which in our opinion constitutes the main geometric core of the recent advances in curve theory. Along the way we shall, of course, discuss appli cations of the theory of linear series to a number of classical topics (e.g., the geometry of the Riemann theta divisor) as well as to some of the current research (e.g., the Kodaira dimension of the moduli space of curves). 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 for their cohomology groups. Then follows a chapter on sheaves of differentials, dualizing sheaves, and Grothendieck's 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 funadmental 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. The third volume in this sequence of books consists of a collection of contributions that aims to describe the recent progress in nonlinear differential equations and nonlinear dynamical systems (both continuous and discrete). Nonlinear Systems and Their Remarkable Mathematical Structures: Volume 3, Contributions from China just like the first two volumes, consists of contributions by world-leading experts in the subject of nonlinear systems, but in this instance only featuring contributions by leading Chinese scientists who also work in China (in some cases in collaboration with western scientists). Features Clearly illustrate the mathematical theories of nonlinear systems and its progress to both the non-expert and active researchers in this area Suitable for graduate students in Mathematics, Applied Mathematics and some of the Engineering sciences Written in a careful pedagogical manner by those experts who have been involved in the research themselves, and each contribution is reasonably self-contained This book collects papers based on the XXXVI Białowieża Workshop on Geometric Methods in Physics, 2017. The Workshop, which attracts a community of experts active at the crossroads of mathematics and physics, represents a major annual event in the field. Based on presentations given at the Workshop, the papers gathered here are previously* *unpublished, at the cutting edge of current research, and primarily grounded in geometry and analysis, with applications to classical and quantum physics. In addition, a Special Session was dedicated to S. Twareque Ali, a distinguished mathematical physicist at Concordia University, Montreal, who passed away in January 2016. For the past six years, the Białowieża Workshops have been complemented by a School on Geometry and Physics, comprising a series of advanced lectures for graduate students and early-career researchers. The extended abstracts of this year's lecture series are also included here. The unique character of the Workshop-and-School series is due in part to the venue: a famous historical, cultural and environmental site in the Białowieża forest, a UNESCO World Heritage Centre in eastern Poland. Lectures are given in the Nature and Forest Museum, and local traditions are interwoven with the scientific activities. This book contains several fundamental ideas that are revived time after time in different guises, providing a better understanding of algebraic geometric phenomena. It shows how the field is enriched with loans from analysis and topology and from commutative algebra and homological algebra. The focus of this book is on algebro-geometric solutions of completely integrable nonlinear partial differential equations in (1+1)-dimensions, also known as soliton equations. Explicitly treated integrable models include the KdV, AKNS, sine-Gordon, and Camassa-Holm hierarchies as well as the classical massive Thirring system. An extensive treatment of the class of algebro-geometric solutions in the stationary as well as time-dependent contexts is provided. The formalism presented includes trace formulas, Dubrovin-type initial value problems, Baker-Akhiezer functions, and theta function representations of all relevant quantities involved. The book uses techniques from the theory of differential equations, spectral analysis, and elements of* *algebraic geometry (most notably, the theory of compact Riemann surfaces). The presentation is rigorous, detailed, and self-contained, with ample background material provided in various appendices. Detailed notes for each chapter together with an exhaustive bibliography enhance the presentation offered in the main text. Based on lectures held at the 7th Villa de Leyva summer school, this book presents an introduction to topics of current interest in the interface of geometry, topology and physics. It is aimed at graduate students in physics or mathematics with interests in geometric, algebraic as well as topological methods and their applications to quantum field theory. This volume contains the written notes corresponding to lectures given by experts in the field. They cover current topics of research in a way that is suitable for graduate students of mathematics or physics interested in the recent developments and interactions between geometry, topology and physics. The book also contains contributions by younger participants, displaying the ample range of topics treated in the school. A key feature of the present volume is the provision of a pedagogical presentation of rather advanced topics, in a way which is suitable for both mathematicians and physicists. Contents:Lectures:Spectral Geometry (B Iochum)Index Theory for Non-compact G-manifolds (M Braverman and L Cano)Generalized Euler Characteristics, Graph Hypersurfaces, and Feynman Periods (P Aluffi)Gravitation Theory and Chern-Simons Forms (J Zanelli)Noncommutative Geometry Models for Particle Physics (M Marcolli)Noncommutative Spacetimes and Quantum Physics (A P Balachandran)Integrability and the AdS/CFT Correspondence (M Staudacher)Compactifications of String Theory and Generalized Geometry (M Graña and H Triendl)Short Communications:Groupoids and Poisson Sigma Models with Boundary (A Cattaneo and I Contreras)A Survey on*

Orbifold String Topology (A Angel)Grothendieck Ring Class of Banana and Flower Graphs (P Morales-Almazán)On the Geometry Underlying a Real Lie Algebra Representation (R Vargas Le-Bert) Readership: Researchers in geometry and topology, mathematical physics. Keywords:Geometry;Topology;Geometric Methods;Quantum Field Theory;Renormalization;Index Theory;Noncommutative Geometry;Quantization;String Theory;Key Features:Unique style aimed at a mixed readership of mathematicians and physicistsIdeal for self-study or use in advanced courses or seminars In this work, the authors provide a self-contained discussion of all real-valued quasi-periodic finite-gap solutions of the Toda and Kac-van Moerbeke hierarchies of completely integrable evolution equations. The approach utilizes algebro-geometric methods, factorization techniques for finite difference expressions, as well as Miura-type transformations. Detailed spectral theoretic properties of Lax pairs and theta function representations of the solutions are derived. It features a simple and unified treatment of the topic. It has self-contained development. There are novel results for the Kac-van Moerbeke hierarchy and its algebro-geometric solutions. The author defines "Geometric Algebra Computing" as the geometrically intuitive development of algorithms using geometric algebra with a focus on their efficient implementation, and the goal of this book is to lay the foundations for the widespread use of geometric algebra as a powerful, intuitive mathematical language for engineering applications in academia and industry. The related technology is driven by the invention of conformal geometric algebra as a 5D extension of the 4D projective geometric algebra and by the recent progress in parallel processing, and with the specific conformal geometric algebra there is a growing community in recent years applying *geometric algebra to applications in computer vision, computer graphics, and robotics. This book is organized into three parts: in Part I the author focuses on the mathematical foundations; in Part II he explains the interactive handling of geometric algebra; and in Part III he deals with computing technology for high-performance implementations based on geometric algebra as a domain-specific language in standard programming languages such as C++ and OpenCL. The book is written in a tutorial style and readers should gain experience with the associated freely available software packages and applications. The book is suitable for students, engineers, and researchers in computer science, computational engineering, and mathematics. In this work, the authors provide a self-contained discussion of all real-valued quasi-periodic finite-gap solutions of the Toda and Kac-van Moerbeke hierarchies of completely integrable evolution equations. The approach utilizes algebro-geometric methods, factorization techniques for finite difference expressions, as well as Miura-type transformations. Detialed spectral theoretic properties of Lax pairs and theta function representations of the solutions are derived. This is a unified treatment of the various algebraic approaches to geometric spaces. The study of algebraic curves in the complex projective plane is the natural link between linear geometry at an undergraduate level and algebraic geometry at a graduate level, and it is also an important topic in geometric applications, such as cryptography. 380 years ago, the work of Fermat and Descartes led us to study geometric problems using coordinates and equations. Today, this is the most popular way of handling geometrical problems. Linear algebra provides an efficient tool for studying all the first degree (lines, planes) and second degree (ellipses, hyperboloids) geometric figures, in the affine, the Euclidean, the Hermitian and the projective contexts. But* *recent applications of mathematics, like cryptography, need these notions not only in real or complex cases, but also in more general settings, like in spaces constructed on finite fields. And of course, why not also turn our attention to geometric figures of higher degrees? Besides all the linear aspects of geometry in their most general setting, this book also describes useful algebraic tools for studying curves of arbitrary degree and investigates results as advanced as the Bezout theorem, the Cramer paradox, topological group of a cubic, rational curves etc. Hence the book is of interest for all those who have to teach or study linear geometry: affine, Euclidean, Hermitian, projective; it is also of great interest to those who do not want to restrict themselves to the undergraduate level of geometric figures of degree one or two. From the reviews: "Although several textbooks on modern algebraic geometry have been published in the meantime, Mumford's "Volume I" is, together with its predecessor the red book of varieties and schemes, now as before one of the most excellent and profound primers of modern algebraic geometry. Both books are just true classics!" Zentralblatt A collection of articles discussing integrable systems and algebraic geometry from leading researchers in the field. As a partner to Volume 1: Dimensional Continuous Models, this monograph provides a self-contained introduction to algebro-geometric solutions of completely integrable, nonlinear, partial differential-difference equations, also known as soliton equations. The systems studied in this volume include the Toda lattice hierarchy, the Kac-van Moerbeke hierarchy, and the Ablowitz-Ladik hierarchy. An extensive treatment of the class of algebro-geometric solutions in the stationary as well as time-dependent contexts is provided. The theory presented includes trace formulas, algebro-geometric initial value problems, Baker-Akhiezer functions, and theta function representations of all* *relevant quantities involved. The book uses basic techniques from the theory of difference equations and spectral analysis, some elements of algebraic geometry and especially, the theory of compact Riemann surfaces. The presentation is constructive and rigorous, with ample background material provided in various appendices. Detailed notes for each chapter, together with an exhaustive bibliography, enhance understanding of the main results. This volume contains research and expository papers by some of the speakers at the 2005 AMS Summer Institute on Algebraic Geometry. Numerous papers delve into the geometry of various moduli spaces, including those of stable curves, stable maps, coherent sheaves, and abelian varieties. As a partner to Volume 1: Dimensional Continuous Models, this monograph provides a self-contained introduction to algebro-geometric solutions of completely integrable, nonlinear, partial differential-difference equations, also known as soliton equations. 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Establishes a* *geometric intuition and a working facility with specific geometric practices. Emphasizes applications through the study of interesting examples and the development of computational tools. Coverage ranges from analytic to geometric. Treats basic techniques and results of complex manifold theory, focusing on results applicable to projective varieties, and includes discussion of the theory of Riemann surfaces and algebraic curves, algebraic surfaces and the quadric line complex as well as special topics in complex manifolds. The book is devoted to the theory of algebraic geometric codes, a subject formed on the border of several domains of mathematics. On one side there are such classical areas as algebraic geometry and number theory; on the other, information transmission theory, combinatorics, finite geometries, dense packings, etc. The authors give a unique perspective on the subject. Whereas most books on coding theory build up coding theory from within, starting from elementary concepts and almost always finishing without reaching a certain depth, this book constantly looks for interpretations that connect coding theory to algebraic geometry and number theory. There are no prerequisites other than a standard algebra graduate course. The first two chapters of the book can serve as an introduction to coding theory and algebraic geometry respectively. Special attention is given to the geometry of curves over finite fields in the third chapter. Finally, in the last chapter the authors explain relations between all of these: the theory of algebraic geometric codes. Extremely carefully written, masterfully thought out, and skillfully arranged introduction … to the arithmetic of algebraic curves, on the one hand, and to the algebro-geometric aspects of number theory, on the other hand. … an excellent guide for beginners in arithmetic geometry, just as an interesting reference and methodical inspiration for teachers of the subject*

... a highly welcome addition to the existing literature. —Zentralblatt MATH The interaction between number theory and algebraic geometry has been especially fruitful. In this volume, the author gives a unified presentation of some of the basic tools and concepts in number theory, commutative algebra, and algebraic geometry, and for the first time in a book at this level, brings out the deep analogies between them. The geometric viewpoint is stressed throughout the book. Extensive examples are given to illustrate each new concept, and many interesting exercises are given at the end of each chapter. Most of the important results in the one-dimensional case are proved, including Bombieri's proof of the Riemann Hypothesis for curves over a finite field. While the book is not intended to be an introduction to schemes, the author indicates how many of the geometric notions introduced in the book relate to schemes, which will aid the reader who goes to the next level of this rich subject. Derived algebraic geometry is a far-reaching generalization of algebraic geometry. It has found numerous applications in various parts of mathematics, most prominently in representation theory. This volume develops the theory of ind-coherent sheaves in the context of derived algebraic geometry. Ind-coherent sheaves are a "renormalization" of quasi-coherent sheaves and provide a natural setting for Grothendieck-Serre duality as well as geometric incarnations of numerous categories of interest in representation theory. This volume consists of three parts and an appendix. The first part is a survey of homotopical algebra in the setting of -categories and the basics of derived algebraic geometry. The second part builds the theory of ind-coherent sheaves as a functor out of the category of correspondences and studies the relationship between ind-coherent and quasi-coherent sheaves. The third part sets up the general machinery of the -category of

correspondences needed for the second part. The category of correspondences, via the theory developed in the third part, provides a general framework for Grothendieck's six-functor formalism. The appendix provides the necessary background on -categories needed for the third part. Created as a celebration of mathematical pioneer Emma Previato, this comprehensive book highlights the connections between algebraic geometry and integrable systems, differential equations, mathematical physics, and many other areas. The authors, many of whom have been at the forefront of research into these topics for the last decades, have all been influenced by Previato's research, as her collaborators, students, or colleagues. The diverse articles in the book demonstrate the wide scope of Previato's work and the inclusion of several survey and introductory articles makes the text accessible to graduate students and non-experts, as well as researchers. This first volume covers a wide range of areas related to integrable systems, often emphasizing the deep connections with algebraic geometry. Common themes include theta functions and Abelian varieties, Lax equations, integrable hierarchies, Hamiltonian flows and difference operators. These powerful tools are applied to spinning top, Hitchin, Painleve and many other notable special equations. The second volume of the Geometry of Algebraic Curves is devoted to the foundations of the theory of moduli of algebraic curves. Its authors are research mathematicians who have actively participated in the development of the Geometry of Algebraic Curves. The subject is an extremely fertile and active one, both within the mathematical community and at the interface with the theoretical physics community. The approach is unique in its blending of algebro-geometric, complex analytic and topological/combinatorial methods. It treats important topics such as Teichmuller theory, the cellular decomposition of *moduli and its consequences and the Witten conjecture. The careful and comprehensive presentation of the material will be of value to students who wish to learn the subject and to experts as a reference source. The first volume appeared 1985 as volume 267 of the same series. "*