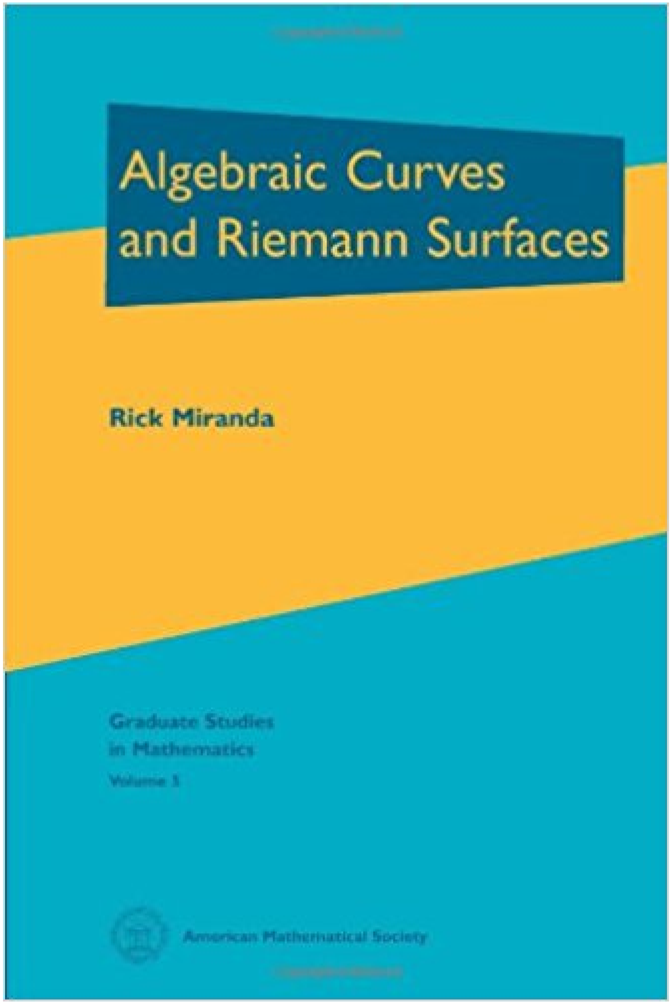
Algebraic Curves And Riemann Surfaces (Graduate Studies In Mathematics, Vol 5)



Synopsis

In this book, Miranda takes the approach that algebraic curves are best encountered for the first time over the complex numbers, where the reader's classical intuition about surfaces, integration, and other concepts can be brought into play. Therefore, many examples of algebraic curves are presented in the first chapters. In this way, the book begins as a primer on Riemann surfaces, with complex charts and meromorphic functions taking center stage. But the main examples come from projective curves, and slowly but surely the text moves toward the algebraic category. Proofs of the Riemann-Roch and Serre Duality Theorems are presented in an algebraic manner, via an adaptation of the adelic proof, expressed completely in terms of solving a Mittag-Leffler problem. Sheaves and cohomology are introduced as a unifying device in the latter chapters, so that their utility and naturalness are immediately obvious. Requiring a background of a one semester of complex variable! theory and a year of abstract algebra, this is an excellent graduate textbook for a second-semester course in complex variables or a year-long course in algebraic geometry.

Book Information

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Customer Reviews

"The text grew out of lecture notes for courses which the author has taught several times during the last ten years. Now, in its evolved and fully ripe form, the text impressively reflects his apparently outstanding teaching skills as well as his admirable ability for combining great expertise in the field with masterly aptitude for representation and didactical sensibility. This book is by far much more than just another text on algebraic curves, among several others, for it offers many new and unique features ... one prominent feature is provided by the fact that the analytic viewpoint (Riemann surfaces) and the algebraic aspect (projective curves) are discussed in a well-balanced fashion ... A wealth of concrete examples ... enhance the rich theoretical material developed in the course of the exposition, very much so to the benefit of the reader. Another advantage of this excellent text is provided by the pleasant and vivid manner of writing ... Altogether, the present book is a masterly written, irresistible invitation to complex algebraic geometry and its generalization to the rich theory of algebraic schemes ... The present book is perfectly suited for graduate students, partly even for senior undergraduate students, for self-teaching non-experts, and also--as an extraordinarily inspiring source and reference book--for teachers and researchers." ---- Zentralblatt MATH"Has a perspective and charm that makes it an excellent addition to the survey literature on the subject ... a leisurely and well-presented introduction to algebraic geometry through the study of algebraic curves over the complex numbers ... contains an abundance of examples and problems and develops the basic notions ... thoroughly and carefully ... excellent for self-study by beginners in the field ... repays examination by anyone interested in the field for some interesting insights and for a number of excellent ideas about the development and presentation of the material ... a charming book ... [recommended] both to those advanced undergraduates who have an interest in this area and to any graduate students who wish to learn more about this important and lively area of mathematics ... both beginners and experts as well will find a number of fascinating topics that do not normally appear in introductory texts." ---- Bulletin of the AMS"The author takes great care in explaining how analytic concepts and algebraic concepts agree, and there is also a fine discussion of monodromy ... on the whole, this is a welcome addition to the texts in this area." ---- Mathematical Reviews

I went to graduate school in mathematics more than 30 years ago and my present job is not related to mathematical research. Recently I have started reading mathematics books at the level similar to some of my old graduate courses just for pure enjoyment of learning. Then I realized that I did not take any course on Riemann surfaces. So I looked at parts of Fulton’s introductory text book on algebraic topology (Chapter on Riemann-Roch Therorem) and then to Miranda’s book on Riemann surfaces. All I wanted to know is what Riemann-Roch Theorem looks like or how the proof looks like. (I was not hoping to master the subject at the level of passing a qualifying exams on the subject.)For now, I have only looked at Miranda’s book up to Chapter VI Theorem 3.11 (Riemann Roch Theorem II). What I did may be called a very crude glancing rather than a careful reading. But even with these limitations on my part, I would like to recommend this book to advanced undergraduate or graduate students who want to have an introduction to Riemann surfaces. From pedagogiacal view point, the author writes very carefully, kindly, and friendly to the reader. The pace is unhurried and I like the style.For example, after giving the definition of the space of memomorphic function with poles bounded by D, L(D) using mathematical expressions, he writes the following sentence: "Hence the conditions imposed on a meromorphic function f to get into a space L(D) are one of two types: either poles are being allowed (to specified order and no worse) or zeros are being requried (to at least some specified oder) at discrete set of points of X." To a non-smart reader (or not so alert person) like me, it was a pleasure and a great help to read such friendly explanation righ after a formal definition. May be many smart readers do not require these extra comments, but in my case, they helped me a lot. So I really thank the author for giving these nice guiding posts here and there. This book seems to be full of these helpful comments. Another such example is in Chapter III Section 4, on the covering spaces and fundamental group. He writes "There is a lot to check here, but the bottom line is that ..." and without necessarily giving all proofs, give a concise summary of topology facts needed.I realize I am not touching upon the later parts of the book which is supposed to have wonderful content for more advanced topics. I hope to be able to reach there someday.If I may say one final slightly critical thing about this wonderful book-this book does not contain figures. I wish they had at least a few to help us visualize, though it can be argued that it may not worth the space and the average reader will not suffer much from the lack of them.

Easily one of the best mathematics textbooks I’ve worked through. Reading this book gives a strong sense of the beauty of Riemann Surfaces and makes fully apparent the geometry of algebraic geometry. The author does an excellent job of motivating theory by examples before building up the technical apparatus needed to go deeper and I often found myself asking questions that lead directly into the next topic he explores. If you want to know what algebraic geometry is really about before slogging through a mountain of category theory and commutative algebra, this is the way to do it.

Excellent book, and couldn’t have received it any faster. Thanks to Yaroslav’s site for that.

I am teaching the course this semester from this book and really enjoying it. The book was obviously written with the insight obtained from teaching the course several times and revising and perfecting the notes. A bonus for the teacher is that Rick has preserved the organization of a course in the book. That is, each section is roughly what you can cover in one lecture, so you can pace your 40 lecture course to try to cover 40 sections. And if you cannot lecture as fast as Rick writes, no worries, his explanations are so clear you can honestly assign the rest as reading.I am also getting a lesson in pedagogy from the book. I am in the habit of proving everything in detail at the greatest possible depth, which helps me maybe, but leaves many students behind. Also I usually never cover a lot of material because everything takes me too long to treat. But Rick has intelligently chosen to cover everything at a uniform depth. if some proof is too complicated to explain fully he assumes it. But nothing is lost since he includes instead a detailed explanation of a simple and very illustrative example, which as everyone knows but me, is more instructive than an abstract general argument.Even so, his explicit arguments and explanations are so clear they illuminate even those topics which he omits. Today for example, we covered his section on covering spaces, and enlarging them to branched covering spaces, such as non constant holomorphic functions give. Rick's discussion was so clear, I was led to expand it slightly to prove the existence of a Riemann surface for a general irreducible plane curve. His own treatment never proves this, choosing instead to give many beautiful and very helpful examples of how to fill in singularities of plane curves by smooth points. But his explanation of the relation between branched and unbranched coverings was so clear I saw it clearly myself and could not resist.Time and again he makes clear how one obtains a better picture of what is going on from several well treated examples than one abstract argument. Of course he also has many very excellent abstract proofs too. This book is written for a well prepared upper level undergraduate audience, and for that reason it is super useful for graduate students and even old professors like me.Let me observe for beginners that thesE ideas were introduced by RIemann in the analytic context and only later translated into algebraic language. There is a reason no one thought of these ideas algebraically before Riemann. The concepts are inherently analytic and topological. Hence it is almost impossible to understand how their algebraic versions were thought of unless you learn the analytic versions first. Hence people starting from Walker or Hartshorne, or even Shafarevich are handicapped by trying to understand the motivation for algebraic concepts which were introduced to mimic analytic ones that are not mentioned. How are you going to appreciate the genus of a curve if you think it is the smallest possible integer g such that for every divisor D of degree d on the curve, we have l(D) is greater than or equal to 1-g + deg(D), where l(D) is the vector dimension of the space of rational functions f with divisor greater than or equal to -D? This is the kind of unilluminating definition given in purely algebraic treatments of the subject. Riemann explains it as the number of handles in a surface which is topologically equivalent to a sphere with a finite number of handles. I.e. for a sphere it is zero, and for a doughnut it is one, etc...One remark of a personal nature. On page 19 of the first edition there was a problem F to show a certain space curve is a non singular complete intersection, whereas in fact it was highly singular. I assigned it since I like problems where the instructions are wrong and the student has to find the right answer himself. (They are easier to grade, since they are wrong unless the student finds the mistake.) I wondered if Rick felt the same and had actually intended this error to be present. Apparently not, since the second edition had a corrected version of the problem. So I was fooled, my students were working a corrected problem and I was expecting them to have to deal with the flawed one.The proof of the Riemann Roch theorem given here is that of Weil, as made clear by Serre, not the original one of Riemann, so in my course we will discuss both and contrast them when the time comes. After giving the analytic treatment of the whole subject, Rick gives a gentle introduction to the algebraic way of treating the same ideas, highly useful to new student I would expect. i only regret i will not have time to cover the entire book. This is the place to start if you really want to understand this subject from the original analytic viewpoint, and also see how it transitions into todays version. This book is written from the perspective I myself recommend and would have used in a book of my own, but it is written by someone with a greater pedagogical gift and greater grasp of the subject than I or most people have. He also took a lot of time and care with it. This is a real find, as this is not otherwise an easy subject to learn. Rick has made a big contribution to the accessibility to this fundamentally important topic.

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