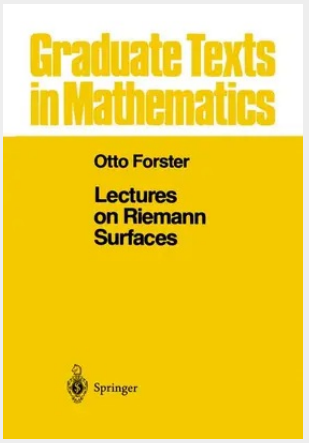
Forster

Lectures on Riemann Surfaces



This book grew out of lectures on Riemann surfaces which the author gave at the universities of Munich, Regensburg and Munster. Its aim is to give an introduction to this rich and beautiful subject, while presenting methods from the theory of complex manifolds which, in the special case of one complex variable, turn out to be particularly elementary and transparent. The book is divided into three chapters. In the first chapter we consider Riemann surfaces as covering spaces and develop a few basics from topology which are needed for this. Then we construct the Riemann surfaces which arise via analytic continuation of function germs. In particular this includes the Riemann surfaces of algebraic functions. As well we look more closely at analytic functions which display a special multi-valued behavior. Examples of this are the primitives of holomorphic i-forms and the solutions of linear differential equations. The second chapter is devoted to compact Riemann surfaces. The main classical results, like the Riemann-Roch Theorem, Abel's Theorem and the Jacobi inversion problem, are presented. Sheaf cohomology is an important technical tool. But only the first cohomology groups are used and these are comparatively easy to handle. The main theorems are all derived, following Serre, from the finite dimensionality of the first cohomology group with coefficients in the sheaf of holomorphic functions. And the proof of this is based on the fact that one can locally solve inhomogeneous Cauchy Riemann equations and on Schwarz' Lemma.

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71,64 €
66,95 € (zzgl. MwSt.)

Lieferfrist: bis zu 10 Tage

Artikelnummer: 9781461259633
Medium: Buch
ISBN: 978-1-4612-5963-3
Verlag: Humana
Erscheinungstermin: 12.10.2011
Sprache(n): Englisch
Auflage: Erscheinungsjahr 2011
Serie: Graduate Texts in Mathematics
Produktform: Kartoniert
Gewicht: 411 g
Seiten: 256
Format (B x H): 155 x 235 mm

Kundenservice Verlag Dr. Otto Schmidt KG
Neumannstraße 10, 40235 Düsseldorf | kundenservice@otto-schmidt.de | 0221-93738-997 (Inland)