



# Riemann Surfaces by Way of Complex Analytic Geometry (Graduate Studies in Mathematics)

*Dror Varolin*

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**Riemann Surfaces by Way of Complex Analytic Geometry (Graduate Studies in Mathematics)** Dror Varolin

This book establishes the basic function theory and complex geometry of Riemann surfaces, both open and compact. Many of the methods used in the book are adaptations and simplifications of methods from the theories of several complex variables and complex analytic geometry and would serve as excellent training for mathematicians wanting to work in complex analytic geometry. After three introductory chapters, the book embarks on its central, and certainly most novel, goal of studying Hermitian holomorphic line bundles and their sections. Among other things, finite-dimensionality of spaces of sections of holomorphic line bundles of compact Riemann surfaces and the triviality of holomorphic line bundles over Riemann surfaces are proved, with various applications. Perhaps the main result of the book is Hörmander's Theorem on the square-integrable solution of the Cauchy-Riemann equations. The crowning application is the proof of the Kodaira and Narasimhan Embedding Theorems for compact and open Riemann surfaces. The intended reader has had first courses in real and complex analysis, as well as advanced calculus and basic differential topology (though the latter subject is not crucial). As such, the book should appeal to a broad portion of the mathematical and scientific community. This book is the first to give a textbook exposition of Riemann surface theory from the viewpoint of positive Hermitian line bundles and Hörmander  $\bar{\partial}$ -estimates. It is more analytical and PDE oriented than prior texts in the field, and is an excellent introduction to the methods used currently in complex geometry, as exemplified in J. P. Demailly's online but otherwise unpublished book "Complex analytic and differential geometry." I used it for a one quarter course on Riemann surfaces and found it to be clearly written and self-contained. It not only fills a significant gap in the large textbook literature on Riemann surfaces but is also rather indispensable for those who would like to teach the subject from a differential geometric and PDE viewpoint.

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