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Sinopsis

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This textbook presents a unified approach to compact and noncompact Riemann surfaces from the point of view of the L^2 -method, a powerful technique used in the theory of several complex variables. The work features a simple construction of a strictly subharmonic exhaustion function and a related construction of a positive-curvature Hermitian metric in a holomorphic line bundle, topics which serve as starting points for proofs of standard results such as the Mittag-Leffler, Weierstrass, and Runge theorems; the Riemann-Roch theorem; the Serre duality and Hodge decomposition theorems; and the uniformization theorem. The book also contains treatments of other facts concerning the holomorphic, smooth, and topological structure of a Riemann surface, such as the biholomorphic classification of Riemann surfaces, the embedding theorems, the integrability of almost complex structures, the Schönflies theorem (and the Jordan curve theorem), and the existence of smooth structures on second countable surfaces.

Although some previous experience with complex analysis, Hilbert space theory, and analysis on manifolds would be helpful, the only prerequisite for this book is a working knowledge of point-set topology and elementary measure theory. The work includes numerous exercises_many of which lead to further development of the theory_and presents (with proofs) streamlined treatments of background topics from analysis and topology on manifolds in easily-accessible reference chapters, making it ideal for a one- or two-semester graduate course.