

Complex Analysis, Riemann Surfaces and Integrable Systems

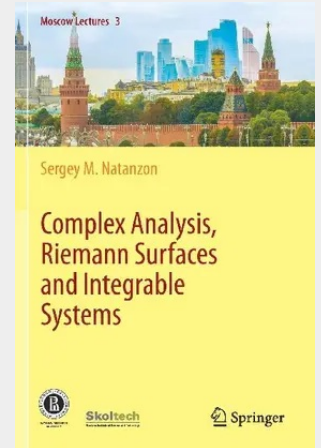
This book is devoted to classical and modern achievements in complex analysis. In order to benefit most from it, a first-year university background is sufficient; all other statements and proofs are provided.

We begin with a brief but fairly complete course on the theory of holomorphic, meromorphic, and harmonic functions. We then present a uniformization theory, and discuss a representation of the moduli space of Riemann surfaces of a fixed topological type as a factor space of a contracted space by a discrete group. Next, we consider compact Riemann surfaces and prove the classical theorems of Riemann-Roch, Abel, Weierstrass, etc. We also construct theta functions that are very important for a range of applications.

After that, we turn to modern applications of this theory. First, we build the (important for mathematics and mathematical physics) Kadomtsev-Petviashvili hierarchy and use validated results to arrive at important solutions to these differential equations. We subsequently use the theory of harmonic functions and the theory of differential hierarchies to explicitly construct a conformal mapping that translates an arbitrary contractible domain into a standard disk – a classical problem that has important applications in hydrodynamics, gas dynamics, etc.

The book is based on numerous lecture courses given by the author at the Independent University of Moscow and at the Mathematics Department of the Higher School of Economics.

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