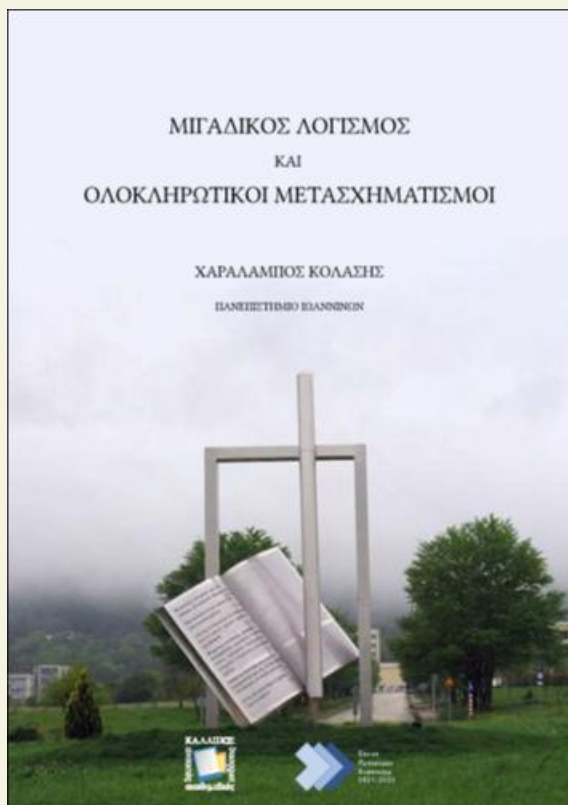




METADATA

Title: Complex calculus and integral transforms

Other Titles: -

Language: Greek

Authors: Kolasis, C., Assistant Professor, UOI

ISBN: 978-618-228-323-3

Subject: MATHEMATICS AND COMPUTER SCIENCE

Keywords: Complex analysis / Analytic functions / Branch points and branch cuts / Cauchy-Riemann equations / Contour integral

Bibliographic Reference: Kolasis, C. (2025). Complex calculus and integral transforms [Undergraduate textbook]. Kallipos, Open Academic Editions. <http://doi.org/10.57713/kallipos-1073>

Abstract

This book is intended for students in physics and engineering departments at universities and polytechnic schools. The first part begins with a concise exposition of the algebra and geometry of complex numbers, and continues with the presentation of the established and now solidified introductory undergraduate material in complex analysis. Specifically, it covers the study of functions of a complex variable with an emphasis on analytic functions. The concepts of complex differentiability, contour integration, Taylor and Laurent series, analytic continuation, singular points, residues, and all the fundamental theorems related to these concepts are presented and studied. The residue theorem and its applications in calculating real definite integrals are developed in detail with numerous examples and a large number of exercises to solve, often accompanied by hints and remarks. Conformal mappings and their applications in physics are presented with many thoroughly developed examples. The originalities that distinguish

the first part of this book from other complex analysis books are, on one hand, the method of studying multivalued functions with algebraic branch points and, on the other hand, the handling of contour integrals along simply closed contours whose interior and exterior contain non-isolated singular points of the function being integrated. The second part of the book begins with the presentation of some specific functions and function spaces. Introductory concepts necessary for the subsequent sections are covered, where distributions, Fourier series, Fourier and Laplace transform along with their main applications are studied. The last chapter deals with the mathematical foundation of quantum mechanics, namely Hilbert spaces along with the related Dirac formalism and the linear operators acting on these spaces. This material is presented in more detail than what can be found in most quantum mechanics books, addressing some subtle issues that are often not covered there mainly for practical reasons.

