METADATA

Title: Complex Analysis

Other Titles: An introduction

Language: Greek

Authors: Giannoulis, I., Associate Professor, UOI

ISBN: 978-618-228-175-8

Subject: MATHEMATICS AND COMPUTER SCIENCE

Keywords: Complex numbers / Complex plane / Complex sequences and functions / Holomorphic functions / Curves in the plane

Bibliographic Reference: Giannoulis, I. (2024). Complex Analysis [Undergraduate textbook]. Kallipos, Open Academic Editions. http://dx.doi.org/10.57713/kallipos-408

Abstract

The present textbook contains, at least to a big extent, the standard topics of an introduction to Complex Analysis that are usually taught in a one-semester undergraduate course for Mathematics students. In the first chapter the field of complex numbers as well as its representation by the complex plane is introduced as an extension of the field of the real numbers, and the related algebraic and geometric properties are presented. Also, the functions of integer power and the exponential function as well as their inverse functions are studied. In the second chapter the topology of the complex plane is introduced and the limits of sequences and functions are discussed as well as the continuity of the latter. The third chapter addresses the notion of complex differentiability (holomorphy) of a complex function and its relation to the differentiability of the corresponding vector field in the two-dimensional Euclidean space. Some basic facts about conformal mappings are also presented as well as the needed notions about curves in the plane. The subject of the fourth chapter are power series. Their holomorphy is proven and the notion of an analytic function as a function that can be expanded locally into a power series is introduced, implying thus its holomorphy. Also, the expansions into power series for the most fundamental functions are given. In the fifth chapter the contour (aka line or path) integrals of complex functions are studied and Cauchy's integration theory is presented, culminating in the Representation Theorem of Cauchy-Taylor (in short: holomorphic functions are analytic) and its consequences. Finally, the sixth chapter is concerned with isolated singularities, Laurent series and residues and their applications.

The Project is funded by the National Development Programme 2021-2025 of the Ministry of Education and Religious Affairs and implemented by the Special Account for Research Funds of the National Technical University of Athens and the Hellenic Academic Libraries Link.