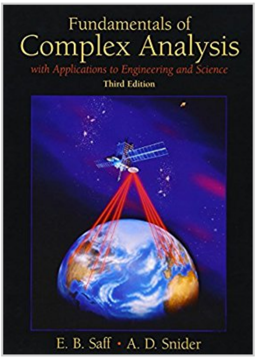

Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics (3rd Edition)

By Edward B. Saff, Arthur David Snider

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This is the best seller in this market. It provides a comprehensive introduction to complex variable theory and its applications to current engineering problems. It is designed to make the fundamentals of the subject more easily accessible to students who have little inclination to wade through the rigors of the axiomatic approach. Modeled after standard calculus books–both in level of exposition and layout–it incorporates physical applications *throughout* the presentation, so that the mathematical methodology appears less sterile to engineering students.

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Editorial Review

From the Back Cover
This book provides a comprehensive introduction to complex variable theory and its applications to current engineering problems and is designed to make the fundamentals of the subject more easily accessible to readers who have little inclination to wade through the rigors of the axiomatic approach. Modeled after standard calculus books--both in level of exposition and layout--it incorporates physical applications throughout, so that the mathematical methodology appears less sterile to engineers. It makes frequent use of analogies from elementary calculus or algebra to introduce complex concepts, includes fully worked examples, and provides a dual heuristic/analytic discussion of all topics. A downloadable MATLAB toolbox--a state-of-the-art computer aid--is available. Complex Numbers. Analytic Functions. Elementary Functions. Complex Integration. Series Representations for Analytic Functions. Residue Theory. Conformal Mapping. The Transforms of Applied Mathematics. MATLAB ToolBox for Visualization of Conformal Maps. Numerical Construction of Conformal Maps. Table of Conformal Mappings. Features coverage of Julia Sets; modern exposition of the use of complex numbers in linear analysis (e.g., AC circuits, kinematics, signal processing); applications of complex algebra in celestial mechanics and gear kinematics; and an introduction to Cauchy integrals and the Sokhotskyi-Plemeij formulas. For mathematicians and engineers interested in Complex Analysis and Mathematical Physics.

The raison d'existence for Fundamentals of Complex Analysis with Applications to Engineering and Science, 3/e is our conviction that engineering, science, and mathematics undergraduates who have completed the calculus sequence are capable of understanding the basics of complex analysis and applying its methods to solve engineering problems. Accordingly, we address ourselves to this audience in our attempt to make the fundamentals of the subject more easily accessible to readers who have little inclination to wade through the rigors of the axiomatic approach. To accomplish this goal we have modeled the text after standard calculus books, both in level of exposition and layout, and have incorporated engineering applications throughout the text so that the mathematical methodology will appear less sterile to the reader.

To be more specific about our mode of exposition, we begin by addressing the question most instructors ask first: To what extent is the book self contained, i.e., which results are proved and which are merely stated? Let us say that we have elected to include all the proofs that reflect the spirit of analytic function theory and to omit most of those that involve deeper results from real analysis (such as the convergence of Riemann sums for complex integrals, the Cauchy criterion for convergence, Goursat's generalization of Cauchy's theorem, or the Riemann mapping theorem). Moreover, in keeping with our philosophy of avoiding pedantics, we have shunned the ordered pairs interpretation of complex numbers and retained the more intuitive approach (grounded in algebraic field extensions).

Cauchy's theorem is given two alternative presentations in Chapter 4. The first is based on the deformation of contours, or what is known to topologists as homotopy. We have taken some pains to make this approach understandable and transparent to the novice because it is easy to visualize and to apply in specific situations. The second treatment interprets contour integrals in terms of line integrals and invokes Green's theorem to complete the argument. These parallel developments constitute the two parts of Section 4 in Chapter 4; either one may be read, and the other omitted, without disrupting the exposition (although it should not be difficult to discern our preference, from this paragraph).

Steady state temperature patterns in two dimensions are, in our opinion, the most familiar instances of harmonic functions, so we have principally chosen this interpretation for visualization of the theorems of analytic function theory. This application receives attention throughout the book, with special emphasis in Chapter 7 in the context of conformal mapping. There we draw the distinction between direct methods, wherein a mapping must be constructed to solve a specific problem, and indirect methods that postulate a mapping and then investigate which problems it solves. In doing so we hope to dispel the impression, given in many older books, that all applications of the technique fall in the latter category.

In this third edition L. N. Trefethen and T. Driscoll have updated an appendix that reflects the progress made in recent years on the numerical construction of conformal mappings. A second appendix compiles a listing of some useful mappings having closed form expressions.

Linear systems analysis is another application that recurs in the text. The basic ideas of frequency analysis are introduced in Chapter 3 following the study of the transcendental functions; Smith charts, circuit synthesis, and stability criteria are addressed at appropriate times; and the development culminates in Chapter 8 with the exposition of the analytic-function aspects of Fourier, Mellin, Laplace, Hilbert, and z transforms, including new applications in signal processing and communications. We hope thereby that our book will continue to serve the reader as a reference resource for subsequent coursework in these areas.
Features of the Third Edition

Novel features of the third edition are a discussion of the Riemann sphere, adding substance to the pragmatic concept of the "point at infinity" in complex analysis; an introduction to functional iteration and the picturesque Julia sets that thereby manifest themselves in the complex plane; an early exploration of the enrichment that the complex viewpoint provides in the analysis of polynomials and rational functions; and an introductory survey of harmonic function methods for calculating equilibrium temperatures for simple geometries. Optional sections are indicated with an asterisk so that readers can select topics of special interest. Summaries and suggested readings appear at the end of each chapter. As in previous editions, the text is distinguished by its wealth of worked-out examples that illustrate the theorems, techniques, and applications of complex analysis.

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(click on complextools.zip). Instructions for its use are detailed in the file compman.doc. The toolbox provides graphic onscreen visualizations and animations of the algebraic manipulations of complex numbers and the common conformal maps, as well as a introductory guide for designing Joukowski airfoils.

A downloadable .pdf file of the inevitable errata that our helpful readers report to us is also available at this site.

The authors wish to acknowledge our mentors, Joseph L. Walsh and Paul Garabedian, who have inspired our careers, and to express their gratitude to Samuel Garrett, our longtime colleague at the University of South Florida; to acquisitions editor George Lobell for encouraging this project; to Adam Lewenberg for providing the art work and technical support; to our production editor Bob Waiters for his guidance in converting this work from manuscript to book; and to the following mathematicians, whose critical commentary contributed enormously to the development of the text:

Carlos Berenstein, University of Maryland
Keith Kearnes, University of Colorado

Dmitry Khavinson, University of Arkansas
Donald Marshall, University of Washington (Chapters 1-4, only)
Mihai Putinar, University of California at Santa Barbara
Sergei Suslov, Arizona State University
Rebecca Wahl, Butler University
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