Preface

Our goal in writing this book was to present a rigorous and self-contained introduction to complex variables and their applications. The book is based on notes from an undergraduate course in complex variables that we taught at the University of Missouri and on the book Applied Complex Analysis with Partial Differential Equations by N. Asmar (with the assistance of Gregory C. Jones), published by Prentice Hall in 2002.

A course in complex variables must serve students with different mathematical backgrounds from engineering, physics, and mathematics. The challenge in teaching such a course is to find a balance between rigorous mathematical proofs and applications. While recognizing the importance of developing proof-writing skills, we have tried not to let this process hinder a student's ability to understand and appreciate the applications of the theory. This book has been written so that the instructor has the flexibility to choose the level of proofs to present to the class. We have included complete proofs of most results. Some proofs are very basic (for example, those found in the early sections of each chapter); others require a deeper understanding of calculus (for example, use of differentiability in Sections 2.4, 2.5); and yet others propel the students to the graduate level of mathematics. The latter are found in optional sections, such as Sections 3.5 and 3.6.

The core material for a one-semester course is contained in the first five chapters of the book. Aiming for a flexible exposition, we have given at least two versions of Cauchy's Theorem, which is the most fundamental result contained in this book. In Section 3.4 we provide a quick proof of Cauchy's Theorem as a consequence of Green's Theorem which covers practically most applications. Then in Section 3.5 we discuss a more theoretical version of Cauchy's Theorem for arbitrary homotopic curves; this approach may be skipped without altering the flow of the presentation. The book contains classical applications of complex variables to the computation of definite integrals and infinite series. Further applications are given related to conformal mappings and to Dirichlet and Neumann problems; these boundary value problems motivate the introduction to Fourier series, which are briefly discussed in Section 6.4.

The importance that we attribute to the exercises and examples is clear from the space they occupy in the book. We have included far more examples and exercises than can be covered in one course. The examples are presented in full detail. As with the proofs, the objective is to give the instructor the option to choose the examples that are suitable to the class, while providing the students many more illustrations to assist them with the homework problems.