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This text on complex variables is geared toward graduate students and undergraduates who have taken an introductory course in real analysis. It is a substantially revised and updated edition of the popular text by Robert B. Ash, offering a concise treatment that provides careful and complete explanations as well as numerous problems and solutions. An introduction presents basic definitions, covering topology of the plane, analytic functions, real-differentiability and the Cauchy-Riemann equations, and exponential and harmonic functions. Succeeding chapters examine the elementary theory and the general Cauchy theorem and its applications, including singularities, residue theory, the open mapping theorem for analytic functions, linear fractional transformations, conformal mapping, and analytic mappings of one disk to another. The Riemann mapping theorem receives a thorough treatment, along with factorization of analytic functions. As an application of many of the ideas and results appearing in earlier chapters, the text ends with a proof of the prime number theorem.

You're outnumbered, in fear for your life, surrounded by flesh-eating zombies. What can save you now? Mathematics, of course. *Mathematical Modelling of Zombies* engages the imagination to illustrate the power of mathematical modelling. Using zombies as a "hook," you'll learn how mathematics can predict the unpredictable. In order to be prepared for the apocalypse, you'll need mathematical models, differential equations, statistical estimations, discretetime models, and adaptive strategies for zombie attacks—as well as baseball bats and Dire Straits records (latter two items not included). In *Mathematical Modelling of Zombies*, Robert Smith? brings together a highly skilled team of contribu-

tors to fend off a zombie uprising. You'll also learn how modelling can advise government policy, how theoretical results can be communicated to a nonmathematical audience and how models can be formulated with only limited information. A forward by Andrew Cartmel—former script editor of *Doctor Who*, author, zombie fan and all-round famous person in science-fiction circles—even provides a genealogy of the undead. By understanding how to combat zombies, readers will be introduced to a wide variety of modelling techniques that are applicable to other real-world issues (biology, epidemiology, medicine, public health, etc.). So if the zombies turn up, reach for this book. The future of the human race may depend on it.

The past several years have witnessed a striking number of important developments in Complex Analysis. One of the characteristics of these developments has been to bridge the gap existing between the theory of functions of one and of several complex variables. The Special Year in Complex Analysis at the University of Maryland, and these proceedings, were conceived as a forum where these new developments could be presented and where specialists in different areas of complex analysis could exchange ideas. These proceedings contain both surveys of different subjects covered during the year as well as many new results and insights. The manuscripts are accessible not only to specialists but to a broader audience. Among the subjects touched upon are Nevanlinna theory in one and several variables, interpolation problems in C_n , estimations and integral representations of the solutions of the Cauchy-Riemann equations, the complex Monge-Ampère equation, geometric problems in complex analysis in C_n , applications of complex analysis to harmonic analysis, partial differential equations.

"This textbook is intended for a year-long graduate course on com-

plex analysis, a branch of mathematical analysis that has broad applications, particularly in physics, engineering, and applied mathematics. Based on nearly twenty years of classroom lectures, the book is accessible enough for independent study, while the rigorous approach will appeal to more experienced readers and scholars, propelling further research in this field. While other graduate-level complex analysis textbooks do exist, Zakeri takes a distinctive approach by highlighting the geometric properties and topological underpinnings of this area. Zakeri includes more than three hundred and fifty problems, with problem sets at the end of each chapter, along with additional solved examples. Background knowledge of undergraduate analysis and topology is needed, but the thoughtful examples are accessible to beginning graduate students and advanced undergraduates. At the same time, the book has sufficient depth for advanced readers to enhance their own research. The textbook is well-written, clearly illustrated, and peppered with historical information, making it approachable without sacrificing rigor. It is poised to be a valuable textbook for graduate students, filling a needed gap by way of its level and unique approach"--

Probabilistic approaches have played a prominent role in the study of complex physical systems for more than thirty years. This volume collects twenty articles on various topics in this field, including self-interacting random walks and polymer models in random and non-random environments, branching processes, Parisi formulas and metastability in spin glasses, and hydrodynamic limits for gradient Gibbs models. The majority of these articles contain original results at the forefront of contemporary research; some of them include review aspects and summarize the state-of-the-art on topical issues - one focal point is the parabolic Anderson model, which is considered with various novel aspects includ-

ing moving catalysts, acceleration and deceleration and from propagation, for both time-dependent and time-independent potentials. The authors are among the world's leading experts. This Festschrift honours two eminent researchers, Erwin Bolthausen and Jürgen Gärtner, whose scientific work has profoundly influenced the field and all of the present contributions.

Environmental modelling has enjoyed a long tradition, but there is a defined need to continually address both the power and the limitations of such models, as well as their quantitative assessment. This book showcases modern environmental modelling methods, the basic theory behind them and their incorporation into complex environmental investigations. It highlights advanced computing technologies and how they have led to unprecedented and adaptive modelling, simulation and decision-support tools to study complex environmental systems, and how they can be applied to current environmental concerns. This volume is essential reading for researchers in academia, industry and government-related bodies who have a vested interest in all aspects of environmental modelling. Features include: A range of modern environmental modelling techniques are described by experts from around the world, including the USA, Canada, Australia, Europe and Thailand; many examples from air, water, soil/sediment and biological matrices are covered in detail throughout the book; key chapters are included on modelling uncertainty and sensitivity analysis; and, a selection of figures are provided in full colour to enable greater comprehension of the topics discussed

The contributions to this volume are devoted to a discussion of state-of-the-art research and treatment of problems of a wide spectrum of areas in complex analysis ranging from pure to applied and interdisciplinary mathematical research. Topics covered include: holomorphic approximation, hypercomplex analysis, special functions of complex variables, automorphic groups, zeros of the Riemann zeta function, Gaussian multiplicative chaos, non-constant frequency decompositions, minimal kernels, one-component inner functions, power moment problems, complex dynamics, biholomorphic cryptosystems, fermionic and bosonic operators. The book will appeal to graduate students and research mathematicians as well as to physicists, engineers, and scientists, whose work is related to the topics covered.

This book is a polished version of my course notes for Math 6283, Several Complex Variables, given in Spring 2014 and Spring 2016

semester at Oklahoma State University. The course covers basics of holomorphic function theory, CR geometry, the $\bar{\partial}$ problem, integral kernels and basic theory of complex analytic subvarieties. See <http://www.jirka.org/scv/> for more information.

Complex Function Theory is a concise and rigorous introduction to the theory of functions of a complex variable. Written in a classical style, it is in the spirit of the books by Ahlfors and by Saks and Zygmund. Being designed for a one-semester course, it is much shorter than many of the standard texts. Sarason covers the basic material through Cauchy's theorem and applications, plus the Riemann mapping theorem. It is suitable for either an introductory graduate course or an undergraduate course for students with adequate preparation. The first edition was published with the title Notes on Complex Function Theory.

The basics of what every scientist and engineer should know, from complex numbers, limits in the complex plane, and complex functions to Cauchy's theory, power series, and applications of residues. 1974 edition.

This book uses a mathematical approach to deriving the laws of science and technology, based upon the concept of Fisher information. The approach that follows from these ideas is called the principle of Extreme Physical Information (EPI). The authors show how to use EPI to determine the theoretical input/output laws of unknown systems. Will benefit readers whose math skill is at the level of an undergraduate science or engineering degree.

Outstanding undergraduate text provides a thorough understanding of fundamentals and creates the basis for higher-level courses. Numerous examples and extensive exercise sections of varying difficulty, plus answers to selected exercises. 1990 edition.

This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics. It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by 'Soviet Encyclopaedia Publishing House' in five volumes in 1977 - 1985. The annotated translation consists of ten volumes including a special index volume. There are three kinds of articles in this ENCYCLOPAEDIA. First of all there are survey-type articles dealing with the various main directions in mathematics (where a rather fine subdivision has been used). The main requirement for these articles has been that they should give a reasonably complete up-to-date account of the current state of

affairs in these areas and that they should be maximally accessible. On the whole, these articles should be understandable to mathematics students in their first specialization years, to graduates from other mathematical areas and, depending on the specific subject, to specialists in other domains of science, engineers and teachers of mathematics. These articles treat their material at a fairly general level and aim to give an idea of the kind of problems, techniques and concepts involved in the area in question. They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions.

Provides the reader with a deep appreciation of complex analysis and how this subject fits into mathematics. The first four chapters provide an introduction to complex analysis with many elementary and unusual applications. Chapters 5 to 7 develop the Cauchy theory and include some striking applications to calculus. Chapter 8 glimpses several appealing topics, simultaneously unifying the book and opening the door to further study.

Physics and Ecology in Fluids: Modeling and Numerical Experiments develops mathematical and numerical modeling methodologies for coupled biological-hydrodynamic problems with a focus on process studies. The modeling is presented in a way that discusses mathematical background but does not depend on a large body of mathematical pre-requisites or experience. Models are built up from simple, to complex. This includes discussion of approximations and shortcuts commonly made by large computational models for natural bodies of water. Computational approaches are presented using conceptual explanations and pseudo-code along with well-documented, open-source code. Over a dozen codes that run locally on the reader's laptop provide hands on experience with various aspects of the modeling process and its scientific results. One large-scale code for basin scale modeling based on the Discontinuous Galerkin methodology is presented, along with a self-contained discussion of theoretical background and implementation details. Physics and Ecology in Fluids is written for graduate students, academic researchers and government scientists. Professors can use the book as a stand-alone resource for a one term graduate course, or to supplement teaching of their own graduate courses. All readers may also use the book as background/user's guide for the software included with the book.

Presents accessible codes along with clear explanations of the mathematical modeling process that leads up to the code. Provides a consistent development of the mathematical models for hydrodynamic and biological modeling, which are rarely covered together. Includes an informal, discussion-style tone throughout, but with serious applied mathematics content, allowing a level of detail relevant for multiple reader types.

This book collects recent developments in nonlinear and complex systems. It provides up-to-date theoretic developments and new techniques based on a nonlinear dynamical systems approach that can be used to model and understand complex behavior in nonlinear dynamical systems. It covers symmetry groups, conservation laws, risk reduction management, barriers in Hamiltonian systems, and synchronization and chaotic transient. Illustrating mathematical modeling applications to nonlinear physics and nonlinear engineering, the book is ideal for academic and industrial researchers concerned with machinery and controls, manufacturing, and controls.

- Introduces new concepts for understanding and modeling complex systems;
- Explains risk reduction management in complex systems;
- Examines the symmetry group approach to understanding complex systems;
- Illustrates the relation between transient chaos and crises.

Complex multivariate testing problems are frequently encountered in many scientific disciplines, such as engineering, medicine and the social sciences. As a result, modern statistics needs permutation testing for complex data with low sample size and many variables, especially in observational studies. The Authors give a general overview on permutation tests with a focus on recent theoretical advances within univariate and multivariate complex permutation testing problems, this book brings the reader completely up to date with today's current thinking. Key Features: Examines the most up-to-date methodologies of univariate and multivariate permutation testing. Includes extensive software codes in MATLAB, R and SAS, featuring worked examples, and uses real case studies from both experimental and observational studies. Includes a standalone free software NPC Test Release 10 with a graphical interface which allows practitioners from every scientific field to easily implement almost all complex testing procedures included in the book. Presents and discusses solutions to the most important and frequently encountered real problems in multivariate analyses. A supplementary website containing all of the data

sets examined in the book along with ready to use software codes. Together with a wide set of application cases, the Authors present a thorough theory of permutation testing both with formal description and proofs, and analysing real case studies. Practitioners and researchers, working in different scientific fields such as engineering, biostatistics, psychology or medicine will benefit from this book.

This textbook covers the fundamental mechanisms of the Six Sigma philosophy, while showing how this approach is used in solving problems that affect the variability and quality of processes and outcomes in business settings. Further, it teaches readers how to integrate a statistical perspective into problem solving and decision-making processes. Part I provides foundational background and introduces the Six Sigma methodology while Part II focuses on the details of DMAIC process and tools used in each phase of DMAIC. The student-centered approach based on learning objectives, solved examples, practice and discussion questions is ideal for those studying Six Sigma.

Partial differential equations are a central concept in mathematics. They are used in mathematical models of a huge range of real-world phenomena, from electromagnetism to financial markets. This new edition of the well-known text by Ockendon et al., providing an enthusiastic and clear guide to the theory and applications of PDEs, provides timely updates on: transform methods (especially multidimensional Fourier transforms and the Radon transform); explicit representations of general solutions of the wave equation; bifurcations; the Wiener-Hopf method; free surface flows; American options; the Monge-Ampere equation; linear elasticity and complex characteristics; as well as numerous topical exercises. This book is ideal for students of mathematics, engineering and physics seeking a comprehensive text in the modern applications of PDEs.

Systems studied in environmental science, due to their structure and the heterogeneity of the entities composing them, often exhibit complex dynamics that can only be captured by hybrid modeling approaches. While several concurrent definitions of "hybrid modeling" can be found in the literature, it is defined here broadly as the approach consisting in coupling existing modelling paradigms to achieve a more accurate or efficient representation of systems. The need for hybrid models generally arises from the necessity to overcome the limitation of a single modeling tech-

nique in terms of structural flexibility, capabilities, or computational efficiency. This book brings together experts in the field of hybrid modelling to demonstrate how this approach can address the challenge of representing the complexity of natural systems. Chapters cover applied examples as well as modeling methodology.

A unique collection of competition problems from over twenty major national and international mathematical competitions for high school students. Written for trainers and participants of contests of all levels up to the highest level, this will appeal to high school teachers conducting a mathematics club who need a range of simple to complex problems and to those instructors wishing to pose a "problem of the week", thus bringing a creative atmosphere into the classrooms. Equally, this is a must-have for individuals interested in solving difficult and challenging problems. Each chapter starts with typical examples illustrating the central concepts and is followed by a number of carefully selected problems and their solutions. Most of the solutions are complete, but some merely point to the road leading to the final solution. In addition to being a valuable resource of mathematical problems and solution strategies, this is the most complete training book on the market.

Topics include the complex plane, basic properties of analytic functions, analytic functions as mappings, analytic and harmonic functions in applications, transform methods. Hundreds of solved examples, exercises, applications. 1990 edition. Appendices.

Explores the interrelations between real and complex numbers by adopting both generalization and specialization methods to move between them, while simultaneously examining their analytic and geometric characteristics. Engaging exposition with discussions, remarks, questions, and exercises to motivate understanding and critical thinking skills. Includes numerous examples and applications relevant to science and engineering students.

Complex Variables is an extended course in complex analysis and its applications for engineering students and for those who use complex analysis in their work. In addition to classical results, it includes results recently obtained by the authors. Antimirov, Kolyshkin, and Vaillancourt have combined a rigorous presentation with clarity and many solved examples. The text introduces the theory of functions of one complex variable, and presents an evaluation of many new integration formulae and the summation of new infinite series by the calculus of residue. The book also in-

cludes the Fatou-Julia theory for meromorphic functions for finding selective roots of some transcendental equations as found in the applications. The exercises provided in the text are elementary and aim at the understanding of the theory of analytic functions. Answers to odd-numbered exercises are in the back of the book; answers to even-numbered exercises are provided in an accompanying instructor's manual. Key Features: * Uses direct mathematical language, avoiding unnecessary abstract style * Contains planes of domain and image of mappings which are always clearly specified and well-illustrated with figures * Provides several new integration and summation formulas, which may eventually find their way into symbolic softwares * Includes a large collection of exercises * Expands entire functions in infinite products into simpler forms than those found in many textbooks * Presents fresh information on the dynamics of meromorphic functions to solve transcendental equation found in the applications

"A handy book like this," noted The Mathematical Gazette, "will fill a great want." Devoted to fully worked out examples, this unique text constitutes a self-contained introductory course in vector analysis for undergraduate and graduate students of applied mathematics. Opening chapters define vector addition and subtraction, show how to resolve and determine the direction of two or more vectors, and explain systems of coordinates, vector equations of a plane and straight line, relative velocity and acceleration, and infinitely small vectors. The following chapters deal with scalar and vector multiplication, axial and polar vectors, areas, differentiation of vector functions, gradient, curl, divergence, and analytical properties of the position vector. Applications of vector analysis to dynamics and physics are the focus of the final chapter, including such topics as moving rigid bodies, energy of a moving rigid system, central forces, equipotential surfaces, Gauss's theorem, and vector flow. Dover (2014) republication of

Introduction to Vector Analysis, originally published by Macmillan and Company, Ltd., London, 1931. See every Dover book in print at www.doverpublications.com

This text provides a balance between pure (theoretical) and applied aspects of complex analysis. The many applications of complex analysis to science and engineering are described, and this third edition contains a historical introduction depicting the origins of complex numbers.

Basic treatment includes existence theorem for solutions of differential systems where data is analytic, holomorphic functions, Cauchy's integral, Taylor and Laurent expansions, more. Exercises. 1973 edition.

Focusing on routines as basic as going to school and cooking and cleaning, *Voices of Civil War America: Contemporary Accounts of Daily Life* explores the lives of ordinary Americans during one of the nation's most tumultuous eras. The book emphasizes the ordinary rather than the momentous to help students achieve a true understanding of mid-19th-century American culture and society. Recognizing that there is no better way to learn history than to allow those who lived it to speak for themselves, the authors utilize primary documents to depict various aspects of daily life, including politics, the military, economics, domestic life, material culture, religion, intellectual life, and leisure. Each of the documents is augmented by an introduction and aftermath, as well as lists of topics to consider and questions to ask.

The book focuses on how to implement discrete wavelet transform methods in order to solve problems of reaction-diffusion equations and fractional-order differential equations that arise when modelling real physical phenomena. It explores the analytical and numerical approximate solutions obtained by wavelet methods for both classical and fractional-order differential equations; provides comprehensive information on the conceptual basis of wavelet

theory and its applications; and strikes a sensible balance between mathematical rigour and the practical applications of wavelet theory. The book is divided into 11 chapters, the first three of which are devoted to the mathematical foundations and basics of wavelet theory. The remaining chapters provide wavelet-based numerical methods for linear, nonlinear, and fractional reaction-diffusion problems. Given its scope and format, the book is ideally suited as a text for undergraduate and graduate students of mathematics and engineering.

This book proposes and explores the idea that the forced union of the aleatory and epistemic aspects of probability is a sterile hybrid, inspired and nourished for 300 years by a false hope of formalizing inductive reasoning, making uncertainty the object of precise calculation. Because this is not really a possible goal, statistical inference is not, cannot be, doing for us today what we imagine it is doing for us. It is for these reasons that statistical inference can be characterized as a myth. The book is aimed primarily at social scientists, for whom statistics and statistical inference are a common concern and frustration. Because the historical development given here is not merely anecdotal, but makes clear the guiding ideas and ambitions that motivated the formulation of particular methods, this book offers an understanding of statistical inference which has not hitherto been available. It will also serve as a supplement to the standard statistics texts. Finally, general readers will find here an interesting study with implications far beyond statistics. The development of statistical inference, to its present position of prominence in the social sciences, epitomizes a number of trends in Western intellectual history of the last three centuries, and the 11th chapter, considering the function of statistical inference in light of our needs for structure, rules, authority, and consensus in general, develops some provocative parallels, especially between epistemology and politics.