

QUARTERLY
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The *Quarterly of Applied Mathematics* prints original papers in applied mathematics which have an intimate connection with applications. It is expected that each paper will be of a high scientific standard; that the presentation will be of such character that the paper can be easily read by those to whom it would be of interest; and that the mathematical argument, judged by the standard of the field of application, will be of an advanced character.

In accordance with their general policy, the Editors welcome particularly contributions which will be of interest both to mathematicians and to scientists or engineers. Authors will receive galley proof only. The author's institution will be requested to pay a publication charge of \$30 per page to support production costs which, if honored, entitles the author to 100 free offprints. Detailed instructions will be sent with galley proofs.

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The editors will appreciate the authors' cooperation in taking note of the following directions for the preparation of manuscripts. These directions have been drawn up with a view toward eliminating unnecessary correspondence, avoiding the return of papers for changes, and reducing the charges made for "author's corrections."

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Mathematical Population Genetics, Volume I. Theoretical Introduction. By Warren J. Ewens, Springer, 2004, xix + 417 pp., \$69.95

First published in 1979, this is the second edition of a volume in the Interdisciplinary Applied Mathematics series. It is the first of a planned two-volume sequence discussing mathematical aspects of population genetics, with an emphasis on the evolutionary theory. This first volume, discussing the more introductory aspects of the theory, draws heavily from the first edition, since the material in that edition may now be taken as introductory to the contemporary theory, to which the second volume will be devoted. However, introductory aspects of the theory of molecular population genetics—the most important of the developments introduced or significantly developed during the past 25 years, where the basic genetic unit is no longer the gene, but the nucleotide—are already taken up in the later chapters of this volume, although a far more extensive description will be given in Volume II, which will also form connections between evolutionary genetics, human genetics, and bioinformatics. Despite the emphasis on evolutionary population genetics in this volume, some material concerning human genetics has been included. The focus on the purely mathematical aspects of population genetics theory is retained in this book. The molecular nature of current data implies that statistical methods are used far more frequently than was the case in the first edition, with the molecular data being used to test various hypotheses about the evolutionary process. Current theory in mathematical population genetics emphasises retrospective analyses rather than the prospective analyses making up much of the classical theory. An introduction to the theory surrounding the Kingman coalescent process—a significant part of current research—is given in chapter 10, with a more extensive discussion postponed to Volume II. Chapter headings: 1. Historical background; 2. Technicalities and generalizations; 3. Discrete stochastic models; 4. Diffusion theory; 5. Applications of diffusion theory; 6. Two loci; 7. Many loci; 8. Further considerations; 9. Molecular population genetics; 10. Looking backward in time: the coalescent; 11. Looking backward: testing the neutral theory; 12. Looking backward in time: population and species comparisons. There is a bibliography of about 500 references.

Methods of Operations Research. By Philip M. Morse and George E. Kimball, Dover Publications, 2003, viii + 158 pp., \$19.95

This is a reprint, with a new Introduction by Saul I. Gass of the “bible” of operations research, first published by the MIT Press and John Wiley in 1951. It was earlier circulated, in 1946, as a security-classified document by the Department of the Navy. It describes mathematical, probabilistic, and statistical procedures that were found to be of value in resolving a range of military problems: search by aircraft for submarines, exchange rate (ratio between friendly and enemy loss), evaluation of equipment performance, Lanchester’s equations of combat, tactical analysis, gunnery, and bombardment, and planning operational experiments. The first and last chapters deal with the philosophy, practice, and organization of Operations Research. Although obviously not a modern or complete textbook on OR, it makes essential reading for anyone wishing to understand the principles of Operations Research, how it evolved, how it helped to win World War II, and why it has become such an important field of study and application. The chapter headings are: 1. Introduction; 2. Probability; 3. The use of measures of effectiveness; 4. Strategic kinematics; 5. Tactical analysis; 6. Gunnery and bombardment problems; 7. Operational experiments with equipment and tactics; 8. Organizational and procedural problems.

Heterogeneous Materials I—Linear Transport and Optical Properties. By Muhammad Sahimi, Springer, 2003, xix + 691 pp., \$99.00

This is volume 22 in the Interdisciplinary Applied Mathematics series. It is the first of two volumes (see next review) describing and discussing various theoretical and computational approaches for understanding and predicting the effective macroscopic properties of heterogeneous materials. Most of the work is devoted to comparing and contrasting the two main classes, and approaches to disordered materials, namely, the continuum models and the discrete models. A main goal of the work is to describe the recent advances in discrete modeling and in predicting their macroscopic properties, and compare their predictions with those of the continuum models. This first volume considers characterization and modeling of the morphology of disordered materials, and describes theoretical and computational approaches for predicting their *linear* transport and optical properties. Among the properties of heterogeneous materials studied in this volume are the effective (electrical, thermal, hopping, and Hall) conductivity, the effective dielectric constant and optical properties, and the effective elastic moduli. Volume II focuses on nonlinear properties, and fracture and breakdown of disordered materials, in addition to describing their atomistic modeling. Chapter headings: 1. Introduction; Part I. Characterization and Modeling of the Morphology: 2. Characterization of connectivity and clustering; 3. Characterization and modeling of the morphology. Part II. Linear Transport and Optical Properties: 4. Effective conductivity, dielectric constant, and optical properties: the continuum approach; 5. Effective conductivity and dielectric constant: the discrete approach; 6. Frequency-dependent properties: the discrete approach; 7. Rigidity and elastic properties: the continuum approach; 8. Rigidity and elastic properties: the discrete approach; 9. Rigidity and elastic properties of network glasses, polymers, and composite solids: the discrete approach. There is a bibliography of approximately 1,000 items.

Heterogeneous Materials II—Nonlinear and Breakdown Properties and Atomistic Modeling. By Muhammad Sahimi, Springer, 2003, xix + 637 pp., \$99.00

This is volume 23 in the Interdisciplinary Applied Mathematics series. It is the second volume of a two-volume work (see preceding review), continuing the study of transport processes in heterogeneous materials and focusing on their effective *nonlinear* properties. After an introductory chapter studying characterization of surface structure of materials when the surface is rough, the remaining chapters are divided into three parts. Part I. Effective Properties of Heterogeneous Materials with Constitutive Nonlinearities: 2. Nonlinear conductivity and dielectric constant: the continuum approach; 3. Nonlinear conductivity, dielectric constant, and optical properties: the discrete approach; 4. Nonlinear rigidity and elastic moduli: the continuum approach. Part II. Fracture and Breakdown of Heterogeneous Materials: 5. Electrical and dielectric breakdown: the discrete approach; 6. Fracture: basic concepts and experimental techniques; 7. Brittle fracture: the continuum approach; 8. Brittle fracture: the discrete approach. Part III. Atomistic and Multiscale Modeling of Materials: 9. Atomistic modeling of materials; 10. Multiscale modeling of materials: joining atomistic models with continuum mechanics. There is a bibliography of approximately 1,000 items (additional to those in Volume I).

Design and Analysis of DNA Microarray Investigations. By Richard M. Simon, Edward L. Korn, Lisa M. McShane, Michael D. Radmacher, George W. Wright, and Yingdong Zhao, Springer, 2003, x+199 pp., \$59.95

This is a volume in the series Statistics for Biology and Health. The objectives of this book are to provide scientists with information about the design and analysis of studies using DNA microarrays that will enable them to plan and analyse their own studies or to work with statistical collaborators effectively, and to aid statistical and computational scientists wishing to develop expertise in this area. There are nine chapters: 1. Introduction, 2. DNA microarray technology, 3. Design of DNA microarray experiments, 4. Image analysis; 5. Quality control, 6. Array normalization, 7. Class comparison, 8. Class prediction, 9. Class discovery. There are three appendices, on the basic biology of gene expression, a description of the gene expression datasets used as examples, and BRB-Array Tools, respectively. The latter (developed by R. Simon and Amy Peng Lam) is an integrated menu-driven software package for the analysis of DNA microarray data containing sophisticated and powerful analytic and visualization tools. It is implemented as an add-in for Microsoft Excel 2000 and later version for Windows.

Planning, Construction, and Statistical Analysis of Comparative Experiments. By Francis G. Giebrecht and Marcia L. Gumpertz, Wiley, 2004, xiv+693 pp., \$115.00

This is a volume in the Wiley Series in Probability and Statistics. It is designed to be used as a textbook for students who have already had a solid course in statistical methods, and as a handbook and reference for active researchers and statisticians who serve as consultants in the design of experiments. The mathematical knowledge required is only algebra and matrix manipulation. The scope of the text is apparent from the chapter headings: 1. Introduction; 2. Completely randomized design; 3. Linear models for designed experiments; 4. Testing hypotheses and determining sample size; 5. Methods of reducing unexplained variation; 6. Latin squares; 7. Split-plot and related designs; 8. Incomplete block designs; 9. Repeated treatment designs; 10. Factorial experiments: the 2^N system; 11. Factorial experiments: the 3^N system; 12. Analysis of experiments without designed error terms; 13. Confounding effects with blocks; 14. Fractional factorial experiments; 15. Response surface designs; 16. Plackett-Burman Hadamard plans; 17. General p^N and nonstandard factorials; 18. Plans for which run order is important; 19. Sequences of fractions of factorials; 20. Factorial experiments with quantitative factors: blocking and fractions; 21. Supersaturated plans; 22. Multistage experiments; 23. Orthogonal arrays and related structures; 24. Factorial plans derived via orthogonal arrays; 25. Experiments on the computer.

Applied Longitudinal Analysis. By Garrett M. Fitzmaurice, Nan M. Laird, and James H. Ware, Wiley, 2004, xvii+506 pp., \$89.95

This is a volume in the Wiley Series in Probability and Statistics. The authors' goal in writing this book was to provide a rigorous and systematic description of modern methods for analyzing data from longitudinal studies. The text arose from teaching a graduate level course at the Harvard School of Public Health, but it is also designed as a reference source. The methods are presented in the setting of numerous applications to real data sets and the emphasis is on the practical rather than the theoretical aspects of the subject. The data sets discussed can be downloaded from the book's web site. Because longitudinal data are a special case of clustered data, a description of modern methods for analyzing the latter is also given. *SAS* is used to perform the analyses presented throughout the book and illustrative *SAS* commands are included with basic description of their usage. Table of Contents: Part I - Introduction to Longitudinal and Clustered Data. 1. Longitudinal and clustered data; 2. Longitudinal data: basic concepts. Part II - Linear Models for Longitudinal Continuous Data. 3. Overview of linear models for longitudinal data; 4. Estimation and statistical inference; 5. Modelling the mean: analyzing response profiles; 6. Modelling the mean: parametric curves; 7. Modelling the covariance; 8. Linear mixed effects models; 9. Residual analyses and diagnostics. Part III - Generalized Linear Models for Longitudinal Data. 10. Review of generalized linear models; 11. Marginal models: generalized estimating equations (GEE); 12. Generalized linear mixed effects models; 13. Contrasting marginal and mixed effects models. Part IV - Advanced topics for longitudinal and clustered data. 14. Missing data and dropout; 15. Some aspects of the design of longitudinal studies; 16. Repeated measures and related designs; 17. Multilevel models.