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Systems of Conservation Laws, Volume 2—Geometric Structures, Oscillations and Mixed Problems. By Denis Serre, translated by Ian N. Sneddon, Cambridge University Press, 2000, viii + 269 pp., $74.95

Following on from the previous volume (see review in this journal's issue of March 2003, p. 110), the author considers the maximum principle from the viewpoints of both viscous approximation and numerical schemes. Convergence is studied through compensated compactness. This tool is applied to the description of large amplitude wave propagation. Small waves are studied through geometrical optics. Special structures are presented in chapters on rich and Temple systems. The author explains why the initial-boundary value problem is far from trivial, with descriptions of the Kreiss-Lopatinski condition for wellposedness, with applications to shock wave stability, and certain problems in boundary layer theory.

An Introduction to Radiative Transfer—Methods and Applications in Astrophysics. By Annamaneni Peraiah, Cambridge University Press, 2002, xii + 480 pp., $110.00 (hardcover), $40.00 (softcover)

This book presents techniques developed by astrophysicists for solving the radiative transfer equations as applied to stellar atmospheres, planetary nebulae, supernovae, and other objects with similar geometrical and physical conditions. It includes the different accurate, fast, probabilistic, and approximate methods used for computing line profiles, polarization due to resonance line scattering, polarization in magnetic media, and similar phenomena. Chapter headings: 1. Definitions of fundamental quantities of the radiative field; 2. The equations of radiative transfer; 3. Methods of solution of the transfer equation; 4. Two-point boundary problems; 5. Principle of invariance; 6. Discrete space theory; 7. Transfer equation in moving media: the observer frame; 8. Radiative transfer equation in comoving frame; 9. Escape probability methods; 10. Operator perturbation methods; 11. Polarization; 12. Polarization in magnetic media; 13. Multidimensional radiative transfer.

Introduction to Stochastic Search and Optimization—Estimation, Simulation, and Control. By James C. Spall, Wiley-Interscience, 2003, xx + 595 pp.

This is a volume in the Wiley-Interscience Series in Discrete Mathematics and Optimization. It provides a broad survey of many of the most important methods in the field. These include random search, recursive least squares, stochastic approximation, simulated annealing, evolutionary computation (including genetic algorithms), and reinforced learning. It also includes a discussion of closely-related subjects such as multiple statistical comparisons, model selection, simulation-based optimization, Markov chain Monte Carlo, and experimental design. Chapters 1–12 are devoted to a description of core algorithms and chapters 13–17 discuss some closely related subjects inmodeling, simulation, and estimation, including some important applications of the algorithms in chapters 1–12. Readers should have a working knowledge of basic probability and statistics as well as command of multivariate calculus and basic matrix algebra. Chapter headings: 1. Stochastic search and optimization: motivation and supporting results; 2. Direct methods for stochastic search; 3. Recursive estimation for linear models; 4. Stochastic approximation for nonlinear root-finding; 5. Stochastic gradient form of stochastic approximation; 6. Stochastic approximation and the finite difference method; 7. Simultaneous perturbation stochastic approximation; 8. Annealing-type algorithms; 9. Evolutionary computation I: genetic algorithms; 10. Evolutionary computation II: general methods and theory; 11. Reinforced learning via temporal differences; 12. Statistical methods for optimization in discrete problems; 13. Model selection and statistical information; 14. Simulation-based optimization I: regeneration, common random numbers, and selection methods; 15. Simulation-based optimization II: stochastic gradient and sample path methods; 16. Markov chain Monte-Carlo; 17. Optimal design for experimental inputs. There are five appendices, reviewing essential background in multivariate analysis, matrix theory, statistical testing, probability theory, pseudorandom number generation, and Markov chains. There is a bibliography of about 400 items and a section with answers to selected exercises.

Analysis of Panel Data. By Cheng Hsiao, Cambridge University Press, 2003, xv + 366 pp., $85.00 (hardcover), $30.00 (softcover)

First published in 1986, this is the second edition and a substantial revision of volume 34 in the Econometric Society Monographs series. Some of the major additions are on nonlinear panel data models of discrete choice (chapter 7) and sample selection (chapter 8), new sections on estimation of dynamic models, Bayesian treatment of models with fixed and random coefficients, and repeated cross-sectional data, as well as miscellaneous topics (chapter 10) such as simulation techniques, multiple level structure, cross-sectional dependence, etc. Many discussions of old chapters have been updated. For instance, the notion of strict exogeneity is introduced. The emphasis remains on formulating appropriate statistical inference for issues shaped by important policy concerns. Chapter headings: 1. Introduction; 2. Analysis of covariance; 3. Simple regression with variable intercepts; 4. Dynamic models with variable intercepts; 5. Simultaneous-equation models; 6. Variable coefficient models; 7. Discrete data; 8. Truncated and censored data; 9. Incomplete panel data; 10. Miscellaneous topics; 11. A summary view. There is a bibliography of over 400 items.

Geometry, Topology and Physics. By Mikio Nakahara, Institute of Physics Publishing, 2003, xxii + 573 pp., $55.00

First published in 1990, this is the second edition of a volume in the Graduate Student Series in Physics. It is an expansion of lectures at the University of Essex to postgraduate students and faculty members working in particle physics, condensed matter physics, and general relativity. It is meant to fill the gap between highly advanced and introductory books and is divided into four parts. Chapters 1 and 2 deal with the preliminary concepts in physics and mathematics, respectively. Chapters 3 to 8 are devoted to the basics of algebraic topology and differential geometry (homology and homotopy groups, manifolds, Riemannian geometry), chapters 9 to 12 to the unification of topology and geometry (fibre bundles, characteristic classes, index theorems), and chapters 13 and 14 to the most fascinating applications of topology and geometry in contemporary physics.In chapter 13, the author applies the theory of fibre bundles, characteristic classes, and index theorems to the study of anomalies in gauge theory, and in chapter 14, Polyako's bosonic string theory is analysed from the geometrical point of view.

Waves and Compressible Flow. By Hilary Ockendon and John R. Ockendon, Springer, 2004, ix + 188 pp., $59.95

This is volume 47 in the Texts in Applied Mathematics series. It has its origin in lecture notes for a course given at Oxford over many years, which formed the basis for *On Inviscid Fluid Flows* by John Ockendon and Alan Tayler, published in 1983. This monograph has now been retitled and rewritten to reflect scientific development in the 1990s. In particular, it reflects what the authors call the three recent revolutions which have changed the mathematical aspects of compressible flow and, more generally, of wave motion: the computer revolution, which has changed the emphasis from exact solutions and *ad hoc* approximate solutions to well-posedness and systematic perturbation theories that can provide quality control for scientific computation; the communications revolution, which increased the demand for understanding electromagnetic waves in situations such as optical fibers, radio waves in cluttered environments, and the waves generated by electronic components; and thirdly, the host of new problems provided by the environmental revolution, such as those associated with wave propagation in the atmosphere, in the oceans, and in the interior of the earth. The book, and the lecture course on which it is based, have consequently undergone a transformation to provide students with an understanding of the wide range of wave phenomena with which an applied mathematician may nowadays be confronted. It begins in chapter 2 with a self-contained derivation of the equations of compressible flow. Chapter 3 presents the simplest wave motion model, viz., the model for acoustics. Some of the more important exact solutions are recalled in chapter 4, including the phenomenon of dispersion. Chapter 5 returns to the generic theme of compressible flow by reviewing what is known about nonlinear solutions, including the theory of nonlinear surface waves. Chapter 6 presents theory allowing consideration of shock waves and the sound barrier, as well as laminar and turbulent nozzle flows, detonations, and transonic and hypersonic flows. The book assumes that the reader already has some familiarity with basic fluid dynamics modeling; a knowledge of elementary asymptotic analysis would also be helpful. The chapter headings are: 1. Introduction; 2. The equations of inviscid compressible flow; 3. Models for linear wave propagation; 4. Theories for nonlinear waves; 5. Nonlinear waves in fluids; 6. Shock waves; 7. Epilogue.