

Manifolds and Modular Forms. By Friedrich Hirzebruch, Thomas Berger, and Rainer Jung, translated by Peter S. Landweber, Verlag Vieweg, D-6200 Wiesbaden 1, Germany, 1992, xi+211 pp., DM 68.00

This publication of the Max-Planck-Institut für Mathematik, Bonn, is volume E20 in the series Aspects of Mathematics. It provides a comprehensive introduction to the theory of elliptic genera due to Ochanine, Landweber, Strong and others. The theory describes a new cobordism invariant for manifolds in terms of modular forms. The text is in most parts self-contained. The results are illustrated by explicit examples and by comparisons with well-known theorems.

Information Bounds and Nonparametric Maximum Likelihood Estimation. By Piet Groeneboom and Jon A. Wellner, Birkhäuser Verlag, 1992, viii+126 pp., \$29.50

This is volume 19 in the series DMV Seminar. It contains the lecture notes for a course which sketched the theory of information bounds for nonparametric and semiparametric models, and developed the theory of nonparametric maximum likelihood estimation in several particular inverse problems: interval censoring and deconvolution models.

Quantization of Gauge Systems. By Marc Henneaux and Claudio Teitelboim, Princeton University Press, 1992, xxii+520 pp., \$59.50

In gauge theories, the physical system being dealt with is described by more variables than there are physically independent degrees of freedom, which is the case with many physical theories of fundamental significance. The physically meaningful degrees of freedom then reemerge as being those invariant under a transformation connecting the variables (gauge transformation). Thus, one introduces extra variables to make the description more transparent and brings in at the same time a gauge symmetry to extract the physically relevant content. This book gives a fully general and unified treatment of the classical and quantum theories of gauge systems. It starts from the classical analysis of Dirac, showing that gauge theories are constrained Hamiltonian systems, and works its way up to ghosts and the Becchi-Rouet-Tyutin symmetry and its cohomology, including the formulation in terms of antifields. The quantum mechanical analysis deals with both the operator and path integral methods. Chapter headings: 1. Constrained Hamiltonian systems; 2. Geometry of the constraint surface; 3. Gauge invariance of the action. 4. Generally covariant systems; 5. First-class constraints: further developments; 6. Fermi degrees of freedom: classical mechanics over a Grassmann algebra; 7. Constrained systems with Fermi variables; 8. Graded differential algebras—algebraic structures of the BRST symmetry; 9. BRST construction in the irreducible case; 10. BRST construction in the reducible case; 11. Dynamics of the ghosts—gauge-fixed action; 12. The BRST transformation in field theory; 13. Quantum mechanics of constrained systems: standard operator methods; 14. BRST operator method—quantum BRST cohomology; 15. Path integral for unconstrained systems; 16. Path integral for constrained systems; 17. Antifield formalism: classical theory; 18. Antifield formalism and path theory; 19. Free Maxwell theory. Abelian two-form gauge field; 20. Complementary material.

The Power of Interaction. By Carsten Lund, The MIT Press, 1992, xii+125 pp., \$25.00

This is a volume in the series ACM Distinguished Dissertations. It is a revision of a doctoral dissertation submitted in 1991 to the University of Chicago. It describes a new technique for constructing randomized proofs and shows that interactive proof systems are far more powerful than traditional *NP* proof systems.