The contents of the book are as follows: On the Gauss-Broyden Method for Nonlinear Least-Squares *by A. Griewank and L. Sheng*; Parallel Adaptive Algorithms for Multiple Integrals *by A. Genz*; A Comparison of Hypercube Implementations of Parallel Shooting *by H. B. Keller and P. Nelson*; An Asymptotic Induced Numerical Method for the Convection-Diffusion-Reaction Equation *by J. S. Scroggs and D. C. Sorensen*; The Rate of Convergence of the Modified Method of Characteristics for Linear Advection Equations in One Dimension *by C. N. Dawson, T. F. Dupont, and M. F. Wheeler*; A Time-Discretization Procedure for a Mixed Finite Element Approximation of Contamination by Incompressible Nuclear Waste in Porous Media by *R. E. Ewing, Y. Yuan, and G. Li*; Implementation of Finite Element Alternating-Direction Methods for Vector Computers *by S. V. Krishnamachari and L. J. Hayes*; Performance of Advanced Scientific Computers for the Efficient Solution of an Elastic Wave Code for Seismic Modeling *by K. E. Jordan*; Generalized Gray Codes and Their Properties *by L. S. Barasch, S. Lakshmivarahan, and S. K. Dhall*; Nested Block Factorization Preconditioners for Convective-Diffusion Problems in Three Dimensions *by G. K. Leaf, M. Minkoff, and J. C. Díaz*; Performance of the Chebyshev Iterative Method, GMRES and ORTHOMIN on a Set of Oil-Reservoir Simulation Problems *by S. Gómes and J. L. Morales*; A Survey of Spline Collocation Methods for the Numerical Solution of Differential Equations *by G. Fairweather and D. Meade.*

R. SCOTT

35[93–06, 93B40, 65–06].—K. BOWERS & J. LUND (Editors), *Computation and Control*, Progress in Systems and Control Theory, Vol. 1, Birkhäuser, Boston, 1989, xi + 410 pp., 23 $\frac{1}{2}$ cm. Price $49.00.

The proceedings of the 1988 Bozeman, Montana conference organized by Bowers and Lund reveal the symbiotic relationship of approximation and computation theory with control theory. These thirty published papers cover a broad spectrum of pure and applied mathematics. An indication of the contents is given by listing the titles of the works presented by the organizers and their four plenary speakers C. I. Byrnes, W. Gautschi, C. F. Martin, and F. Stenger:

"Efficient Numerical Solution of Fourth-Order Problems in the Modeling of Flexible Structures" by R. C. Smith, Bowers, and Lund;

"Accuracy and Conditioning in the Inversion of the Heat Equation" by Lund;

"Feedback Design from the Zero Dynamics Point of View" by Byrnes and A. Isidori.

"Orthogonality—Conventional and Unconventional—in Numerical Analysis" by Gautschi;

"Observability, Interpolation and Related Topics" by Martin.

"Explicit Approximate Methods for Computational Control Theory" by Stenger.

The book is printed directly from manuscripts presented in camera-ready form and is remarkably easy to read. It should be a valuable reference work and it augurs well for the success of the series.

E. I.

36[68–02, 65–02, 70–04, 68Q40, 65C99].—ROBERT GROSSMAN (Editor), *Symbolic Computation: Applications to Scientific Computing*, Frontiers in Applied Mathematics, Vol. 5, SIAM, Philadelphia, PA, 1989, x + 185 pp., 23 cm. Price $24.50 paperback.

These collected papers provide a timely summary of the state of symbolic/numerical algorithms and software for dynamical systems, Lie brackets and vector fields, finite difference operators and domains, and perturbation theory. Their particular interest lies in the diversity of approaches represented. The paper "Dynamicist's Workbench" by Abelson and Sussman describes an "automatic programming" technique that symbolically generates a "complete set" of numerical simulation programs to enumerate all "qualitatively different" behaviors of a physical system. At a different point on the spectrum, the papers "Multibody Simulation" by Sreenath and Krishnaprasad and "Symbolic Computations in Differential Geometry" by Akhrif and Blankenship present high-level user interfaces for the instantiation simulation, and visualization of physical systems under human control. The paper "FIDIL: A Language for Scientific Programming" by Hilfinger and Colella presents a *C*-like programming language that supports manipulation of domains and maps for finite difference schemes as first-class objects. The paper "Perturbation Methods and Computer Algebra" by Rand describes the use of computer algebra to automate the solution of nonlinear differential equations by perturbation methods. In the paper "Vector Fields and Nilpotent Lie Algebras" by Grayson and Grossman, the efficient symbolic computation of flows of ordinary differential equations is described. An introductory chapter by Fateman and Grossman sets the stage with a discussion of algebraic manipulation for operator algebras and operator actions.

The material in this volume offers the reader a broad yet detailed view of current progress towards a compelling goal: the combination of symbolic, numerical, and graphical computation for "user-friendly" modeling, visualization and analysis of physical systems. It is warmly recommended to all who share an interest in this goal.

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