

## Book reviews

J.L. CHABERT et al.

*A History of Algorithms. From the Pebble to the Microchip*  
Springer, Berlin, 1999

This is a source book, with discussions and historical and scientific commentaries, on numerical algorithms. Some of the sources are translated into English for the first time (they can be found in French in the original edition of this book: J.L. Chabert et al., *Histoire d'Algorithms*, Belin, Paris, 1994). Each chapter presents a central theme and is arranged, more or less, in chronological order. The chapters deal with algorithms for arithmetic operations, magic squares, methods of false position, Euclid's algorithm, measuring the circle, Newton's methods, successive approximations, algorithms for arithmetic, systems of linear equations, interpolation, quadrature, differential equations, approximation of functions, acceleration of convergence, and the concept of algorithm. The book ends with short biographies. It is an interesting introduction to the historical development of algorithms and numerical analysis.

S. SASTRY

*Nonlinear Systems. Analysis, Stability, and Control*  
Springer, New York, 1999

In many commonly observed phenomena, the dynamics of linear systems are not rich enough to describe the reality, and nonlinear systems cannot accurately be represented by linear models. A simple example of this situation is given by bifurcations and chaos. These last ten years saw the emergence of new mathematical techniques for the analysis and control of nonlinear systems. There exist many books on linear control, but only few on nonlinear control. This is why this book is certainly most welcome. It covers analysis, stability theory, and geometric nonlinear control. The chapters are: Linear vs. nonlinear, Planar dynamical systems, Mathematical background, Input–output analysis, Lyapunov stability theory, Applications of Lyapunov theory, Dynamical systems and bifurcations, Basics of differential geometry, Linearization by state feedback, Design examples using linearization, Geometric nonlinear control, Exterior differential systems in control, New vista: multi-agent hybrid systems.

The book has been written with great care. It is well structured. Each chapter ends with a summary and exercises. The proofs of the most important theorems are given. Examples illustrate the theory. A good bibliography is provided. Finally, the overall presentation of the book is quite attractive.

This is a certainly a reference book.

J. NOCEDAL and S.J. WRIGHT  
*Numerical Optimization*  
Springer, New York, 1999

As written in the preface, [the] goal in this book is to give a comprehensive description of the most powerful, state-of-the-art, techniques for solving continuous optimization problems. The motivating ideas behind each algorithm are given in order to stimulate the reader's intuition and make the technical details easier to follow. The procedures are presented in the form of easy to implement pseudo-codes. Many examples illustrate the theoretical results. The chapters end with notes and references, and exercises. The necessary background material is gathered in two appendices.

This book is clearly written and presented and it is accessible to a wide audience: graduate students, researchers, engineers and practitioners of optimization techniques. It is a very valuable addition to the already abundant literature in this domain.

I have a small comment on the choice of the bibliographical items. I find it strange that some authors are mentioned in the text but not quoted in the bibliography (which does not make the book less valuable). This is, for example, the case of C.G. Broyden: the title of section 8.3 is *The Broyden class*, but Broyden does not appear in the bibliography. Maybe this is real fame!

G. PICCI and D.S. GILLIAM, eds.  
*Dynamical Systems, Control, Coding, Computer Vision*  
Birkhäuser, Basel, 1999

This book contains expanded versions of the invited lectures given at the *Mathematical Theory of Networks and Systems Symposium* (MTNS '98) in Padova, Italy, in July 1998. These papers cover systems, networks and control theory, and some of the interactions of these disciplines with coding, computer vision, discrete-events and hybrid systems. Control theory involves tools from many different areas of pure and applied mathematics, numerical analysis, statistics, etc., which is reflected in these papers. Since the volume presents the main current research topics in the domains of its title, it will be of interest to graduate students, researchers, and control engineers.

W. GAUTSCHI, G.H. GOLUB and G. OPFER, eds.  
*Applications and Computation of Orthogonal Polynomials*  
Birkhäuser, Basel, 1999

This book contains the papers presented during a conference held in Oberwolfach in March 1998. Orthogonal polynomials are present in many branches of science. In particular, in numerical analysis, they are involved in least-squares, interpolation, quadrature, iterative methods of linear algebra, the detection of singularities, integral equations, approximation theory (Padé approximants), etc. Applications include wavelets, control theory, dynamical systems, gas dynamics.

This book is mostly intended for researchers in numerical analysis, but it can also be interesting for engineers and scientists.

B.N. DATTA, ed.

*Applied and Computational Control, Signals, and Circuits, Vol. 1*  
Birkhäuser, Boston, 1999

This volume is the first of a new series of books, all with the same title and under the editorship of B.N. Datta. As said in the series preface, the purpose is to keep abreast of the fast-paced developments in computational mathematics and scientific computing and their increasing use in control, signals, and circuits. So, they will be, by nature, interdisciplinary.

This volume contains ten chapters, each of them written by a leading expert. They deal with discrete-event systems, algorithms for  $\mathcal{H}_2$  and  $\mathcal{H}_\infty$  estimation, nonuniqueness, uncertainty, and complexity in modeling, iterative learning control, FIR filter design, system identification, ill-posed systems of equations, wavelet-based image coding, reduced-order modelling, and a subroutine library.

This is the kind of book which is very useful to graduate students needing an up-to-date introduction to the field, and to researchers and engineers wanting to learn the most recent developments and techniques.

C. GOMEZ, ed.

*Engineering and Scientific Computing with Scilab*  
Birkhäuser, Boston, 1999

Scilab is a scientific public-domain software package for numerical computations and engineering applications. The book is a complete description of this software. It comes with a CD-ROM containing the package and it can also be freely obtained from Internet at <http://www-rocq.inria.fr/scilab>. Scilab, which is quite close to Matlab, has toolboxes on control and signal processing, simulation, optimization, graphs and network flow, and a symbolic/numeric environment with a Maple-to-Scilab interface. The book contains two applications. The codes used in the examples and other features can be found on the CD.

E.W. WEISSTEIN

*CRC Concise Encyclopedia of Mathematics*  
CRC Press, Boca Raton, 1999

It is an enormous task to produce an encyclopedia of 1969 large, two-column pages, and almost an impossible one for a single author. Of course any encyclopedia is useful for finding a definition, or the premises of a subject, or the corresponding bibliography and, in this respect, this one can be more interesting than others for some topics. Of course, I mainly looked at the entries related to numerical analysis, but I

was disappointed by the explanations, or by the references, and I even found some mistakes (for example, the definition of Padé approximants). My preference goes to the Encyclopedic Dictionary of Mathematics edited some years ago by the Mathematical Society of Japan, which has almost the same number of pages.

G.E. KOLOSOV

*Optimal Design of Control Systems*

Marcel Dekker, New York, 1999

This book deals with optimal control algorithms for deterministic and stochastic dynamical systems, with applications to biological, radio engineering, mechanical, and servomechanical technologies. The chapters are: Synthesis problems and the dynamic programming approach, Exact methods for synthesis problems, Approximate synthesis of stochastic control systems, Synthesis of quasioptimal systems, Control of oscillatory systems, Applications of asymptotic synthesis methods, and Numerical synthesis methods. It is a book for upper-level undergraduate and graduate students.

H.R. LERNER, ed.

*Plant Responses to Environmental Stresses from Phytohormones to Genome Reorganization*

Marcel Dekker, New York, 1999

From the foreword: This book, which addresses the responses of plants to environmental stresses at the genomal, hormonal, and whole organism levels of organization, contains the writings of a group of international experts . . . . As a subject of this nature expands and publications proliferate, sometimes knowledge is obtained at the expense of understanding.

So, this book is a survey/review volume and it could certainly help those interested in these subjects.

Claude Brezinski