Book Reviews

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BOOK REVIEWS

F. Colonius, W. Kliemann: THE DYNAMICS OF CONTROL. Birkhäuser-Verlag, Boston, 2000. ISBN 0-8176-3683-8, 648 pages, price USD 99.–.

The scope of the present book is comprehensive and includes a variety of topics related to the theory of systems and control. The main frame is the notion of control flow with its global dynamics and linearization. Time-varying perturbations, global and local dynamics of control systems as well as relevant numerical methods are treated. The book consists of 13 Chapters and four Appendices (that include basics on Geometric Control Theory, Dynamical Systems, and Numerical Computation of Orbits). Some specific topics that are covered: linear control theory (e.g. Ch. 11), nonlinear controllability (Ch. 3, 4, 8, 9 and 13), bilinear control systems (Ch. 3, 4, 6 and 7), linear flows on vector bundles (Ch. 5), time-varying perturbations of dynamical systems (3–6, 11, 13) and nonlinear stability and stabilization (3, 5, 6, for examples cf. 8, 9, and 12).

The book is an excellent resource for the foundations and applications of control theory and nonlinear dynamics for mathematicians, physisists and engineers. The point of view of the authors, who incorporated into this treatise a variety of topics from fields that were often considered rather separately, makes the book especially interesting.

Bohdan Maslowski

H. Dehling, T. Mikosch, M. Sørensen, eds.: EMPIRICAL PROCESS TECHNIQUES FOR DEPENDENT DATA. Birkhäuser-Verlag, Boston-Basel-Berlin, 2002. ISBN 3-7643-4201-3, vi + 382 pages, price EUR 100.–.

The book is an outgrowth of the workshop held in November 2000 at the University of Copenhagen. It opens by an extensive tutorial covering the topic from the early roots up to recent developments and is accompanied by a vast bibliography of nearly 150 items.

The following five parts contain the contributions of 19 leading specialists. Under the title Techniques for the empirical process of stationary sequences, the concept of weak dependence is introduced; in particular a weak limit theory and empirical central limit theorem are derived. After the generalization of Hoeffding's inequality to the case of dependent variables, strong laws of large numbers and central limit theorems are obtained for various classes of dependent processes by means of coupling the initial sequence with an independent one.

The part entitled The empirical processes of long-range dependent data considers a class of time-series and their asymptotic behaviour. Asymptotic distributions of long-memory moving averages in i.i.d. variables are treated in the first of the three included papers, whereas the remaining two contributions cover the uniform reduction principle and limit theorems for sums of nonlinear functions of a stationary sequence of Gaussian random variables.

Empirical spectral process techniques are the topic of the fourth part. The links between empirical process theory and spectral analysis are elucidated and possibilities of goodness-of-fit tests, Whittle likelihood estimation and spectral analysis are discussed. Then then analogies between the periodogram at the Fourier frequencies and a sequence of i.i.d. random variables are shown.

The next part reviews the tail empirical processes which are a useful tool for parameter estimation for extremes of dependent data, tails and high quantiles.

Finally, the sixth part deals with the bootstrap for dependent data and its recent developments for stationary sequences including also Markov chains. A discussion on the frequency domain bootstrap for time series closes the whole book.

Data of the considered type are encountered in diverse fields like geology, environmental science, finance, insurance, meteorology, physiology etc. The book is the first comprehensive treatment of this topic, perhaps because only the present-day computers are able to meet the enormous requirements for high speed and large memory necessary for the application of statistical techniques to dependent data. It will be suitable for classroom use as well as for specialists in probability and statistics and for practitioners in the above mentioned branches of dependent data applications.

Ivan Saxl

S. G. Krantz, H. R. Parks: THE IMPLICIT FUNCTION THEOREM. HISTORY, THEORY, AND APPLICATIONS. Birkhäuser-Verlag, Basel-Boston-Berlin, 2002. ISBN 0-8176-4285-4, 176 pages, price EUR 82.24.

The authors collect in this book many variants of the Implicit Function Theorem (IFT) and various methods of the proof. They emphasize the IFT as a powerful tool in many branches of mathematics. After a historical introduction in Sections 1 and 2 including the problem of finding the roots of polynomial functions by Newton (the Newton polygon), the Inverse Function Theorem (InvFT) by Lagrange and the Cauchy version of IFT for holomorphic functions, they focus in Section 3 on the basic methods of the proof of several variants of IFT (inductive proof of Dini, "classical" one involving the Jacobi determinant, the equivalence of IFT and InvFT, the Contraction Mapping Fixed Point Principle, the Rank and Decomposition Theorems).

Section 4 is devoted to the applications to Ordinary Differential Equations (with a proof of IFT via Picard iteration technique), to numerical homotopy methods and to the study of a smooth surface in Euclidean space and of the smoothness of the distance function.

In Section 5 there are some generalizations of the previously discussed results: the Weierstrass preparation theorem, IFT without differentiability (via the Schauder Fixed Point Theorem and Measurable Selection Theorem) and InvFT for continuous mappings as well as the singular version of IFT under degenerate Jacobi matrix.

In the last section the authors draw the reader's attention to the complex analytic version of IFT, to Hadamard's Global InvFT (with an application to the proof of the fundamental theorem of algebra), to the Newton-Rapson method (implying the IFT in Sobolev, Lipschitz, Besov and even more general spaces) and to the Nash-Moser IFT (connected to the problem of isometric imbedding of a Riemannian manifold into the Euclidean space and having consequences in geometric analysis and nonlinear PDEs).

Jan Eisner