cal ways of identifying non-linear system response properties using measured ocean engineering data. Copious illustrative graphs are provided.

Chapter 7, 'Nonlinear system response properties of a naval barge from measured ocean engineering data', contains the results of a second experimental test programme carried out at the USNA in July 1995. A scale model of a rectangular barge was subjected to small and large amplitude waves in the directions of head, beam and quartering (oblique) seas. Heave responses in head, beam and quartering seas turned out to be predominantly linear, but non-linearity was significant in roll and pitch responses in beam and quartering seas. In contrast with the results of the first test, reverse MISO techniques turned out to give better non-linear results than did direct MISO techniques. Again, there are numerous illustrative graphs in the text. The author concludes that the test results of Chapters 6 and 7 'demonstrate the capability of these new practical MI/SO Techniques to solve nonlinear system problems in many engineering and scientific fields'.

In Chapter 8, 'Bilinear and trilinear systems', the theoretical properties of bilinear (second-order) and trilinear (third-order) systems, which represent functional Volterra extensions of properties for linear (first-order) systems, are outlined. Several examples are given; these are designed to indicate when and how the complicated Volterra techniques should be applied.

Chapter 9, 'Input/output relations for bilinear and trilinear systems', the final chapter, discusses multidimensional input–output correlation and spectral relationships for Gaussian stationary random data passing through bilinear and trilinear systems; the results obtained do not hold for non-Gaussian data. Formulae are given on how to identify the optimum nature of parallel linear, bilinear and trilinear systems minimizing the output noise spectrum, based on measurements of the input and output data. The complexity of the required density functions indicates the need for the practical MISO techniques of Chapters 3–7.

The book ends with three and a half pages of references, a seven-page index and a two-page glossary of symbols.

This is a research-oriented book which will appeal particularly to specialists in engineering and stochastic analysis. With its clear style, and its wealth of examples and illustrations, it provides an excellent account of the analysis of non-linear systems.

Joe Gani
Australian National University
Canberra

Efficient and Adaptive Estimation for Semiparametric Models

P. J. Bickel, C. A. J. Klaassen, Y. Ritov and J. A. Wellner, 1998
New York, Springer
xx + 560 pp., £40.00
ISBN 0 387 98473 9

This is a paperback edition of the book which first appeared in 1993 under the imprint of the Johns Hopkins University Press. The authors characterize their work as being 'about estimation in situations when we believe we have enough knowledge to model some features of the data parametrically, but are unwilling to assume anything for other features'. Typically, in such circumstances, one relies on non-linear estimation procedures; these can often only be implemented algorithmically. The procedures are based on asymptotic approximations, and the performance for finite samples is gauged mostly by simulations.

The authors cite four of their goals, which can be briefly summarized as follows:

(a) to show that estimation methods for their models are extensions of those for classical parametric models;
(b) to apply their techniques to as broad a range of models as possible;
(c) to develop the theory of information bounds for estimation of infinite dimensional parameters;
(d) to present a coherent heuristic view of estimation methods used in semiparametric models.

They regret that they have succeeded only partially in a fifth goal. This is to provide simple necessary and sufficient conditions for particular methods to work as expected asymptotically.

The book consists of seven chapters, followed by 10 appendixes, a list of symbols, a bibliography with 22 pages of references, an author index and a subject index. Special features are the lists of examples and figures which appear after the contents table at the beginning of the book.

The summary of contents which follows may be helpful to potential readers.

Chapter 1, 'Introduction', is a brief discussion of the concepts involved in nonparametric and semiparametric models. The authors outline the problems to be resolved and their scope, illustrating them with seven examples.

Chapter 2, 'Asymptotic inference for (finite-dimensional) parametric models', reviews some basic results in asymptotic inference and estimation for regular parametric models. Models for the independent and identically distributed data case are considered and regular estimates of Euclidean parameters derived. The notion of information bounds is outlined, and the construction of $n^{1/2}$-consistent and efficient estimates explained.

In Chapter 3, 'Information bounds for Euclidean parameters in infinite-dimensional models', an overview of information bound and tangent space theory is given. In particular, information bounds obtained via derivatives of functions for the nonparametric case are discussed, as well as information bound calculations via scores for the semiparametric case.

Chapter 4, 'Euclidean parameters: further examples', attempts to classify most of the interesting semiparametric models according to common features of their tangent spaces. The authors consider semiparametric group models, regression models, biased sampling models, mixture models, missing data models and transformation models.

In Chapter 5, 'Information bounds for infinite-dimensional parameters', the authors discuss convolution theorems for regular estimates of infinite dimensional parameters and give eight examples. They analyse the differentiability of functions and give an indicator censoring model as an example. Finally they develop the 'calculus' of efficient score and influence operators. The models considered in this chapter are relatively simple.

In Chapter 6, 'Infinite-dimensional parameters: further examples', information bounds are derived for the more complex models investigated in Chapter 4. Where such bounds are not obtainable, an explanation is given why they cannot exist. The models considered consist of families with various systems of constraints, group models, biased sampling models, mixture models and models with monotonicity constraints, missing data and censoring models and transformation models. Each is illustrated with one or more examples.

In Chapter 7, 'Construction of estimates', some important methods for the construction of $n^{1/2}$-consistent estimates of both Euclidean and abstract parameters are outlined. The familiar M-estimates for Euclidean parameters are first considered, followed by a discussion of generalized M-estimates (GM-estimates) illustrated with several examples. Generalized minimum contrast and GM-estimates corresponding to convex functions are then studied. The chapter concludes with the estimation of P (the distribution function involved) and other infinite dimensional parameters. In addition to the exposition of the methods used, there is a discussion of the consistency and rates of convergence of the estimates. The chapter ends with the estimation of infinite dimensional parameters and the asymptotics of the estimates, the joint estimation of infinite dimensional and Euclidean parameters, and the efficiency of such estimation.

Some parts of the book are rather specialized. The authors themselves recommend that all readers concerned with semiparametric estimation study Chapters 1–3; Chapter 4 is directed to readers who are particularly interested in Euclidean parameters. Chapter 5 is more general and parallels Chapter 3, whereas Chapter 6 is more specialized and parallels Chapter 4. The first four sections of Chapter 7, which are important but relatively elementary, can be read by all.

This book constitutes a considerable achievement in the study of semiparametric estimation; the authors have written a very complete account of the field, carefully set out and clearly exposited. Some of it is oriented towards the specialist in statistical estimation, but much of it will prove rewarding to any interested statistican. It is essential for libraries and will be in constant use by all aspiring students of estimation methods.

Joe Gani
Australian National University
Canberra

Ergodicity and Stability of Stochastic Processes

A. A. Borovkov, 1998
Chichester, Wiley
xxiv + 578 pp., £85.00
ISBN 0 471 97913 9

There is no need to introduce the author of this book, since Professor Borovkov and his school at the Siberian Branch of the Russian Academy of Sciences (located in the city of Novosibirsk) are internationally renowned for their fundamental contributions to stochastics and its applications during the last three or four decades.

Ergodicity and stability of stochastic processes were and continue to be among the most important topics in modern stochastics, and hence of modern mathematics and its applications. Ergodicity, generally speaking, indicates that there are limits of distributions generated by the stochastic processes under the study and the limits are called stationary distributions. Stability shows how the stationary distributions depend on small variations in the local characteristics of the processes.

The book is entirely devoted to stochastic processes of the Markovian type with discrete time parameters but some results are also extended to processes with continuous time. The following three subclasses of discrete time stochastic processes are treated in detail: general Markov chains