Optimum Experimental Designs, with SAS

A. C. Atkinson, A. N. Donev and R. D. Tobias, 2007

Oxford, Oxford University Press

512 + xvi pp., $70.00

ISBN 978-0-199-29659-0 (hardbound)
978-0-199-29660-6 (paperbound)

This book, which is based on the first two authors' 1992 book, is more than a third longer, with completely new materials on computations using SAS among other insertions, and the addition of the third author. Like the 1992 book, this new edition successfully provides a very readable account of practical and algorithmic aspects of optimum experimental designs, and, now with SAS code spread over the book, it should provide a very enticing introduction for practising statisticians who may want to try out ideas of optimum experimental designs on their own problems. The choice of topics that are covered is almost flawless: part I with eight chapters covers many basic but important issues in experimental design, which I strongly recommend reading before jumping into the technical details of optimum design theory and applications in part II, which has 17 chapters, covering from basic theory of optimum designs (Chapter 9 on optimum design theory, Chapter 10 on optimality criteria and Chapters 10 and 11 on *D*-optimal designs and algorithms for reconstruction), to implementations and applications (Chapters 12–25 covering topics on SAS implementations, response surface, mixture experiments, Bayesian design and non-linear models, etc.). For readers who may be more familiar with classical or combinatorial designs, I think that the book can do better by giving more guidance or advice of when optimum experimental designs may be used in situations where classical designs do not have solutions or vice versa. Also for practitioners, there are clearly laid-out strategies of how optimum designs should be applied in a given problem, e.g. choice of criterion, and interpretation and sensibility of the optimum design results. Optimum experimental designs have more fruitful applications when the underlying model is clearly well defined and the goal is for prediction, for instance in computer experiments (e.g. Lu *et al.* (2000), Fang *et al.* (2005) and Uciński (2005)). In summary, this book provides the best potential textbook on this subject at the moment and may serve as a tantalizing guide to this still very underdeveloped area for practical workers.

References

Fang, K. T., Li, R. and Sudjianto, A. (2005) *Design and Modeling for Computer Experiments*. Boca Raton: Chapman and Hall.

Lu, Z. Q., Berliner, L. M. and Snyder, C. (2000) Experimental design for spatial and adaptive observations. *Lect. Notes Statist.*, **144**, 65–78.

Uciński, D. (2005) *Optimal Measurement Methods for Parameter Estimation in Distributed Parameter Systems Identification*. Boca Raton: CRC Press.

Z. Q. John Lu
National Institute of Standards and Technology
Gaithersburg

Applied Asymptotics: Case Studies in Small-sample Statistics

A. R. Brazzale, A. C. Davison and N. Reid, 2007

Cambridge, Cambridge University Press

236 pp., £35

ISBN 978-0-521-84703-2

This is a very welcome book, on a very important topic. The authors demonstrate the use of applied asymptotics for estimation and inference on a wide range of case-studies. Overall the book is a solid and useful contribution to applied statistics. Students of statistics and practising statisticians will find much to study and learn here.

The book offers a very broad collection of data sets and problems, tackled with a view to demonstrating the usefulness and benefits of certain corrections to usual practice. The authors provide intriguing and educational notes about different paths that analyses took, and could have taken. These provide a substantial slice of the book's benefit; they are a window to the statistical thinking of the authors and exemplify creative statistical practice. Its diversity of applications is a real strength.

Furthermore, the authors provide a working Web site, with data and code. The reader can reproduce the authors' analyses with freely available software; this is very welcome.

The content structure is reasonably helpful. I found that I needed to read ahead and behind quite frequently, but that may not be true for everyone. Chapters 2 and 3 introduce the basic ideas, skim the surface of the theory and provide some simple examples as an introduction to the applications. Chapters 4, 5 and 7 demonstrate the breadth of application of higher order asymptotics for discrete and continuous response data, and more varied designs respectively. Data sets are used as exemplars of the techniques, so the analyses can seem cursory or idiosyncratic. Chapter 6 focuses more heavily on some specific applications, tracing the development of three case-studies. Chapter 8 provides a more detailed examination of the motivating theory and is quite heavy going. Chapter 9 is a tonic; it focuses on the development and deployment of the software infrastructure that is necessary for model fitting. Chapter 9 provides welcome evidence of the elegance and simplicity of some of the ideas that are presented, e.g. a higher order generalized linear model is demonstrated by using primitive R functions. The interested reader should consider reading this chapter early. The book concludes with problems and an interesting although brief appendix that summarizes some of the numerical techniques.

Each chapter concludes with bibliographic notes, which are very useful. The authors also provide welcome pointers to the relative levels of complexity for some of the references as well, giving the reader implicit initial directions for exploration.

The analysis of the examples is compactly described, but the broader context, which is the active reader's interest, is sometimes lacking. For example, in one analysis we read

> 'In this exponential family model with canonical parameterization we take q to be the Wald statistic'.

The reader wonders: how broadly can we interpret this? Should we use the Wald statistic for this model, for models in general with canonical parameterization or something else? Probably this question is answered later, but it is not obvious where to go and not obvious when you have arrived. A summary table would have been invaluable, providing an overview of the examples. Also, exact pointers to the clarifying portions of the text would be very helpful.

I also found myself wishing that the authors had been a little more detailed in their signposting, and that they could have done more to use the structure of the book as a device to help the reader to grasp what is central to the analysis and what is merely interesting. Such assistance is somewhat provided by the chapter structure, but it could have been further augmented. Some connecting text is provided, but even then it is in the wrong place—for example the notes that could help us to orient our expectations with respect to Chapters 4 and 5 is at the start of Chapter 6. I would have appreciated more 'For example' and 'In other words', scattered throughout the text.

It seems to me that the dual goal of such a book of case-studies must be to inspire and empower the reader. In my case, studying this book and the analyses in detail has caused me to think about my own work in different and deeper ways than before, some of which are directly connected to the subject matter, and some inspired by ancillary comments that the authors have made. This alone makes the book worth studying. And, I could probably adapt an applied asymptotics model or an analysis routine to my own projects reasonably well from the diverse range that is showcased here. But, my grasp of the ideas still seems *ad hoc*, and unsatisfying. I do not feel that I see the bigger picture with confidence. In short, the book is very good, but also it could be better.

Andrew Robinson
University of Melbourne

Measurement Error in Nonlinear Models: a Modern Perspective, 2nd edn
R. J. Carroll, D. Ruppert, L. A. Stefanski and C. M. Crainiceanu, 2006
Boca Raton, Chapman and Hall–CRC
xxviii + 456 pp., £49.99
ISBN 1-584-88633-1

This is the second edition of a classical text, which provides a comprehensive update of the original material, that was first published in 1995. The book tackles the difficult problem of variables in a prediction model that are themselves subject to error—a rather common problem, which is often overlooked or ignored in practical situations. It presents a variety of approaches to addressing these problems, from both the functional and the structural modelling viewpoints, and provides a wide range of illustrative examples demonstrating the methods for a variety of non-linear models.

Since the first edition, the field of measurement error modelling has been a keen research area, and this new edition both updates and extends previous chapters as well as including some new topics. The chapter on Bayesian methods has been greatly extended, as has some of the more technical material such as issues surrounding score function methods. There are new chapters on measurement errors in mixed and longitudinal models, survival models and semiparametric regression models.

One of the highlights, which has been preserved from the first edition, is the way that chapters are split into descriptions of methods to handle measurement errors, and applications of these methods to specific models. This results in a book which is a valuable resource when attempting to understand the theoretical aspects of measurement error models, while also being useful in practical situations. From the practitioners' viewpoint, although it is said that standard statistical software can be used to fit the models that are described in the book, this is not covered in detail, leaving this very much as a task for the reader.

Overall, this is clearly a book of great value to those with an interest in measurement error modelling in non-linear situations as well as being a