



Book Selection

Edited by U Aickelin

K Marti: Stochastic Optimization Methods

P Gardiner: Project Management: A Strategic Planning Approach

MS Bazaraa: Nonlinear Programming: Theory and Algorithms

J Copeland: Colossus: The First Electronic Computer

Stochastic Optimization Methods

K Marti

Springer-Verlag, 2005. 308pp. £61.50

ISBN: 3540222723

The book basically goes through the control problem under stochastic uncertainty, which is drawn from the application of engineering and operational research problems. Although a stochastic optimization problem is used in economics, the main concern of the book is its application of engineering problems. The application is limited to Chapter 7, of Part V.

The most important feature of this book is that it has a collection of solution techniques used in optimization methods.

Optimization problems involve the maximum (or minimum) of a relationship, given some specific constraints. Manufacturing errors, noise terms and cost of factors can be minimized. Unfortunately, there are uncertainties in the world, which prevents the smoothness of the optimization. We can summarize statistical uncertainty and model uncertainty by stochastic uncertainty. The related parameters can be categorized as stochastic. Therefore, the parameters must be modelled by random variables with a certain probabilistic distribution. Generally, only certain values of these distributions are known.

These uncertainties are usually dealt with by choosing nominal values (estimated variables or reasonably chosen parameters) for some unknown parameters. However, instead of ordinary deterministic parameter optimization methods, here the book deals with stochastic optimization methods.

In order to obtain computationally robust optimal decisions (robustness is defined as an optimal decision that is insensitive to random parameter variation), it is necessary to formulate appropriate deterministic substitution problems. As expectations and probabilities in the stochastic problem are defined by multiple integrals, the result often becomes a non-linear and also non-convex deterministic problem. Each of these can only be solved by approximate methods.

The aim of this book is to provide numerical and analytical tools in economic and engineering applications. The author analyses the properties and the problems. Furthermore,

appropriate deterministic and stochastic solution procedures are also presented. Basic properties of substitute problems can be summarized as follows: convexity, continuity and differentiability.

Approximations of deterministic substitute problems in Optimal Design comprise the following three:

- (1) Approximation of the loss function.
- (2) Regression techniques (Response surface method (RSM)).
 - (a) Approximation of state function.
 - (b) Approximation of loss function.
- (3) Taylor expansion methods.

The reliability of the analysis of systems (economic or engineering structures) relies on computational probabilities (this technique is called approximation of probabilities—the probability inequalities. These include: Bonferroni-type inequalities, Tschebyscheff-type inequalities, two sided constraints, two-sided inequalities (Markov-type inequalities).

In Section 2, Chapter 3, derivatives of probability and mean value functions are obtained by the following methods: (1) the Transformation Method uses differentiation by integral transition (in this approach derivatives are also represented by surface integrals), (2) the Stochastic Completion and transition method (numerical computations, integral representation of the probabilities, have been investigated and the sensitivities and structural reliabilities of these methods have been theoretically computed), (3) the Orthogonal Function series, which use Hermite functions, Trigonometric, Legendre and Laguerre Series. There is no indication of experimental applications of these approximation methods.

Chapter 4 shows the approximation of non-convex deterministic substitute problems by convex mean value minimization. In Chapter 5, the author uses hybrid stochastic approximation, which implies using simple stochastic (sub) gradients and deterministic descent direction gradient estimator. This is called the RSM and the mean square convergence is considered. In Chapter 6, various extensions of hybrid stochastic approximation methods are used, by changing variance of the estimation error. Convergence of hybrid stochastic

gradient procedures in terms of the sequence of mean square error procedures is used in Chapter 5. In Chapter 6, the stochastic approximation algorithm with changing error variances and probabilistic convergence properties are studied.

Estimation of the quadratic error is done by assuming a Jacobean function, using the mean variance theorem and function G being Lipschitz continuous with Lipschitz constant β . This leads to convergence properties of sequence (X_n) , which is generated by the specified algorithm. The convergence properties of related approximation functions are also investigated in Chapter 6.

The most interesting part of the book is Chapter 7, where applications to the approximation of survival/failure probabilities for elastoplastic mechanical structure is studied. This included an approximation to stochastic structural optimization. More of these applications on different disciplines such as economics would have made the book accessible for a wider audience and led to a generally more interesting book.

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Project Management: A Strategic Planning Approach

P Gardiner

Palgrave Macmillan, 2005. 450pp. £28.99

ISBN: 0333982223

Project management—a strategic planning approach is a well-structured book with short and concise sections, illustrative exercises embedded in the text, interesting short stories from industry, clear diagrams and tables, and links to additional web resources. The book is also presented in a very readable format. As the title suggests, this book emphasizes the importance of the planning stage in project management and gives a detailed presentation on project scoping and organizational structures to support project management. The book is particularly good at explaining the role that different stakeholders should play when undertaking projects within an organization. Other topics of current relevance included in this book are the management of risk and quality and also health and safety. The book also gives good overviews and references for industry standards and methods related to these issues.

The format in which *Project management—a strategic planning approach* is presented makes it a very readable book overall. However, readers might find that sentences in some paragraphs are too long and wordy which makes perceiving the central idea difficult at times. The book makes numerous references to relevant research on project management and because of this some readers might perceive the book more as a survey than a textbook. The summary bullet points at the end of each chapter are very useful for readers to gather the essence of the material presented. At the time of this review, many of the resources in the companion website for this book still appear as 'to be added'.

Because of its focus on project planning, some readers might find the contents of this book a little unbalanced in the

sense that only two chapters are dedicated to project execution. However, this should not be perceived as a weakness because the detail in which project planning is approached in this book makes it a valuable resource indeed.

Chapter 1 gives an introduction to project management. Chapter 2, 'A systems view of project management', serves well for readers with a background in Systems Theory but other readers could skip reading this material. Chapters 3 and 4, 'Strategy and governance' and 'Investment decision making', give an interesting insight into these strategic organizational issues. Chapter 3 would benefit from a more concise presentation. Soft skills are crucial for successful project management and Chapter 5, 'The project manager, sponsor and other stakeholders', gives an excellent presentation on the topic and also on responsibilities of the different stakeholders. Chapter 6, 'Organisation and procurement', discusses issues that project managers should be aware of but this material could be omitted from a core course on project management. Chapter 7, 'Managing risk and quality' represents a very valuable compilation of contemporary practices to deal with risk and quality assurance in project management. 'Project initiation and team building', the topic of Chapter 8 is very well presented and readers would find here very useful guidelines, mapped to industry stories, of this extremely important stage of project management. Chapters 9 and 10, 'Estimating, scheduling and budgeting' and 'Control, closure and continuous improvement', focus on the execution stage of project management. Chapter 9 introduces network diagrams, Gantt charts, the CPM method, budgeting and other useful tools and techniques with illustrative examples but the reader interested in a more detailed presentation should look elsewhere; for example, budgeting techniques are only briefly discussed. Chapter 10 serves as a good introduction to project control and closure and presents a very detailed presentation of two techniques for project monitoring and control; there are 'milestone monitoring' and 'earned value analysis'.

Overall, *Project management—a strategic planning approach* is a valuable resource for all students and academics interested in Project Management. In particular, this book is an excellent reference for project planning while the presentation of topics related to project execution is less substantial. Its format and written style contribute to making reading this book an enjoyable experience.

University of Nottingham

D Silva

Nonlinear Programming: Theory and Algorithms

MS Bazaraa

John Wiley & Sons Inc., 2006. 872pp. £58.85 (hardcover)

ISBN: 0471486000

I had great expectations in this third edition, so as soon as I saw it was available for review I immediately proposed myself

as a reviewer, both for my interest in the subject and for my knowledge of the second edition. That edition, published in soft cover in 1993, has been the basis of my formation in nonlinear optimization and has formed the nucleus of part of my teaching for many years. For many of us working in optimization ‘*the Bazaraa*’ has always been one of the most respected, cited and used reference books.

I must confess I have been very disappointed from this new edition (something which often happens when expectations are so high). The third edition is, at 99.5%, just the same as the second edition of 13 years ago. Of course re-publishing this volume was a good idea, as computer programmers say, ‘if it is not broken, don’t fix it’—a highly successful volume like this one will find its place on the optimizer’s shelf for many many years. But what disappointed me is that, with tiny (yet very welcome) additions and a few typographical error corrections, this volume does not add anything to the previous one: a reprint might have been more appropriate. Also, from some points of view, in my opinion, this edition is worse than the previous one.

Why? First of all, the publisher decided to retype all the book: it was originally a professionally typeset book, now, apart from the hard (and expensive) cover, it has a very poor typographical appearance: I cannot understand why, in 2006, a professional editor of a mathematical textbook can avoid using professional mathematical typesetting systems and instead produces a book in which, on every page, line spacing is almost random and the overall typesetting quality is so low. It is not just a question of aesthetical pleasure: a badly typeset book does not help in focusing your attention (Donald Knuth taught us how to type well some 30 years ago, we should have learnt his lesson. . .). The figures are now much less professional looking than they used to be. Some errors in the figures have been corrected, but in some cases errors are still there, or they have been worsened: Figure 3.12, for example, was slightly misleading in the original version (it showed an inflection point of a function where the tangent was not perfectly horizontal): in this revised edition, the tangent is even more inclined!

Another peculiarity of this edition are the exercises: with a few exceptions in Chapter 11, they are the same (or just they are minor numerical modifications) of the original ones. Is that bad? No, of course, they were excellent exercises, so why change them? Ok, but, in this case, why did the authors just permute them? Yes, the exercises in each chapter are exactly the same, but in a different order! So for someone quickly browsing the book, they appear to be different, but they are not. I do not see any reason for this.

To be fair, some good news can be given. For the first time, global optimization is included in the book as a respectable discipline. I am extremely glad, as global optimization is my main research field. Up to now most classical books on nonlinear programming, including this one, invariably said in the first chapters ‘we would like to find a global optimum for our problem, but this is a very difficult task, so from now on

we will speak only of local optimization’. Global optimization saw a lot of research in the last few years and eventually reached a respectability that enabled it to appear in this book. It is a very important and welcome recognition for the global optimization community. Unfortunately, global optimization is included as just a part in Chapter 11 within the section on quadratic programming—it just reports one of the book author’s approaches to solving non-convex quadratic problems. There is much more on global optimization, both from the algorithmic and from the theoretical point of view, but in any case the appearance of non-convexity in this book is surely welcome.

What else? I guess this was a lost opportunity to make an already excellent book become even more appealing. Nothing is said on recent developments in polynomial methods for convex programming: the years since 1993 saw an impressive set of new approaches in this field. Even remaining on more classical and well-established topics, something might have been revised or expanded: the treatment of SQP methods, the cornerstone of many practical computer codes for nonlinear programming, is very quick, active set methods are left just as an exercise, numerical examples look a little bit outdated.

In summary, I think this is just a commercial operation. It looks like the publisher wanted to re-vitalize the book with almost no adjustments. The back cover is totally misleading: it says this new edition displays important new features like ‘second interior point methods’ (I confess I do not know what they mean by ‘second’ and I could not find interior point methods in the book), non-convex optimization (this is correct, it is the only significant variation in the book), no-differentiable optimization (it is true, but nothing changed since the second edition), and so on. They cite many new features in this edition, but that is not true: apart from non-convex quadratic optimization, only a few more recent references are included in the volume, nothing else changed.

In conclusion, ‘*the Bazaraa*’ is a must if you are interested in optimization; but if you already have the second edition (or you can find it in your library), keep it (and, possibly, complete it with a few papers on global optimization). Well: I almost forgot to say: this edition is significantly more expensive than the previous one!

University di Firenze

F Schoen

Colossus: The First Electronic Computer

J Copeland

*Oxford University Press, 2006. 480pp. £18.99
ISBN: 019284055X*

Until fairly recently, the story of Colossus—the world’s first large-scale digital computer—was surrounded by a veil of secrecy. The declassification of wartime documents means that the achievements of the team who designed, developed,

built and used the machine to break German codes during World War 2 can now be told. This book, written by an academic who is the Director of the Turing Archive for the History of Computing, tells the story of those who were involved in these ground-breaking activities.

At nearly 500 pages, this is a sizeable book. It comprises seven main parts. Section 1 sets the scene, with a brief history of cryptography (contributed by Simon Singh, author of the popular ‘The Code Book’), and a series of chapters that describe life at Bletchley Park, the home of the British Government Code and Cipher School—forerunner of today’s GCHQ. These capture well the wartime atmosphere—characterized by the arch and waspish intellectualism (and occasional snob-bishness) of the dons and military staff who were forced to work so closely together.

Section 2 focuses on Colossus itself. Thomas Flowers, the architect of the machine, gives a personal view of its genesis; its place in the history of early digital computing is considered; and recent efforts to rebuild one of the machines are recounted. Flowers’ piece shows his genuine bitterness over the lack of recognition for his achievements—both for himself and the team he led, who struggled to make the Colossus machines work reliably, and at the knock-on impact that the veil of secrecy had on the UK’s computing, electronics and telecommunications industries.

Sections 3 and 4 describe the day-to-day life at Bletchley Park, with chapters contributed by those who were there, reminiscing with evident fondness over how Colossus and other tools were used to crack the codes. Section 5 considers the

environment in which Flowers and his team worked, at the Post Office Research Station at Dollis Hill in suburban London, while Section 6 returns to the themes of code breaking. A lengthy series of technical appendices cover some of the techniques used by the code breakers.

The book is a rather curious mix of first-hand recollection of life at Bletchley Park and Dollis Hill, recounted by the female naval ratings and the Post Office engineers, interspersed with very detailed accounts of the algorithms used to break into the coded messages. There is a lot of very interesting material in this book, but it suffers from a lack of focus. A description of the Enigma code machine may be followed by a treatise on how German messages were intercepted, which may be followed by a summary of an aspect of the Colossus machine, which may in turn be followed by more reminiscences of the business of intercepting messages.

More rigorous editing and rationalizing of much of the material would have resulted in a rather slimmer (but still substantial) and focussed book that would be easier to read and which would not induce so frequently the *deja vu* feeling of covering the same ground two or three times.

This is a valuable addition to the collection of books associated with the exploits of WW2 code breakers, as the issues of how Britain failed to commercially exploit the achievements of its engineers and mathematicians in this area are important. However, with a rather firmer editorial hand, it could so easily have been a much easier and more satisfying read.

QinetiQ

B Spedding