Book Reviews

Aimo Törn and Antanas Žilinskas, *Global Optimization*, Lecture Notes in Computer Science, 350, Springer Verlag, 255 pp.

Unsophisticated use of local optimization techniques is normally inefficient for solving global optimization problems involving multimodality. During the last ten years there have been explosive developments in this area. The authors bring together the different approaches that are in use with the purpose of stimulating further research.

The book has eight chapters: (1) Introduction, (2) Covering methods, (3) Methods of generalized descent, (4) Random search methods, (5) Clustering methods, (6) Methods based on statistical models of objective functions, (7) Miscellaneous and (8) Testing and applications.

The problem of global optimization and the difficulties involved in finding the global minimum or maximum of a function are discussed in Chapter 1. It also gives a general survey of the various techniques proposed for global optimization. The rest of the chapters discuss in details different approaches to the problem.

Of particular interest are the methods based on statistical models of objective functions discussed in Chapter 6. They depend on concepts of probability and are useful in solving complex optimization problems.

Chapter 7 describes the computational aspects and the possibility of using parallel computers and reduction of dimensionality. The use of test functions in optimization problems and applications to some practical problems are discussed in Chapter 8.

The book is well written with statements of results and references to original sources for proofs, notes, discussions and conclusions on the limitations and usefulness of different methods. It has an extensive bibliography. The book is recommended for those who wish to know the current state of the art in global optimization.

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G. Anandalingam and T. L. Friesz (eds.), *Hierarchical Optimization*, in Annals of Operations Research, Vol. 34 (1992), J. C. Baltzer A.G., Basel, 1992, iv + 331 pages (price $80).

This volume of Annals of Operations Research contains a collection of papers on hierarchical optimization. Problems of hierarchical optimization have the special

characteristic that their feasible domain is implicitly determined by a series of optimization problems that must be solved in a predetermined sequence. Although much of the literature on hierarchical optimization has focused on the bilevel optimization problem, many recent papers have been devoted to the study of multi-level optimization problems.

Hierarchical optimization has many applications including decision problems involving multiple agents, transportation network design, defense problems, analysis of competitive economies, energy planning, government regulation, conflict resolution, and game theory. I have found this collection of papers very interesting and I recommend the volume for scientists interested in learning more about the methods and applications of hierarchical optimization.

The following list of papers, gives a good idea of the diversity of applications and methods covered in this volume of Annals.

Contents: G. Anandalingam and T. L. Friesz, Hierarchical optimization: an introduction (1–11); Charles Blair, The computational complexity of multi-level linear programs (13–19); Roger L. Tobin, Uniqueness results and algorithm for Stackelberg-Cournot-Nash equilibria (21–36); Joanna M. Leleno and Hanif D. Sherali, A leader-follower model and analysis for a two-stage network of oligopolies (37–72); Yo Ishizuka and Eitaro Aiyoshi, Double penalty method for bilevel optimization problems (73–88); J. J. Judice and A.M. Faustino, A. sequential LCP method for bilevel linear programming (89–106); Anura H. deSilva and Garth P. McCormick, Implicitly defined optimization problems (107–124); Faiz A. Al-Khayyal, Reiner Horst and Panos M. Pardalos, Global optimization of concave functions subject to quadratic constraints: an application in nonlinear bilevel programming (125–147); Thomas A. Edmunds and Jonathan F. Bard, An algorithm for the mixed-integer nonlinear bilevel programming problem (149–162); Patrice Marcotte and Gerald Marquis, Efficient implementation of heuristics for the continuous network design problem (163–176); Tan Miller, Terry L. Friesz and Roger L. Tobin, Heuristic algorithms for delivered price spatially competitive network facility location problems (177–202); Sunduck Suh and Tschangho John Kim, Solving nonlinear bilevel programming models of the equilibrium network design problem: a comparative review (203–218); Omar Ben-Ayed, Charles E. Blair, David E. Boyce and Larry J. LeBlanc, Construction of a real-world bilevel linear programming model of the highway network design problem (219–254); Benjamin F. Hobbs and Sushil K. Nelson, A nonlinear bilevel model for analysis of electric utility demand-side planning issues (255–274); Vijay S. Desai, Marketing-production decisions under independent and integrated channel structure (275–306); Diane J. Reyniers, Supplier-customer interaction ion quality control (307–330).

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Aleksey G. Sukharev, *Minimax Models in the Theory of Numerical Methods*, TDLB 21, Kluwer Academic Publishers, 1992. ISBN 0-7923-1821-8.

Solving a problem in the most efficient way and optimizing the computerized solution process are certainly crucial issues in numerical analysis. This process of optimization, however, depends on the conceptual approach used to deal with the problem. Moreover, the concept of efficiency in dealing with a problem has always been changing stimulating new computational methods and ways of their implementation. Dealing with such issues, the monograph entitled "Minimax Models in the Theory of Numerical Methods" is composed by Aleksey G. Sukharev. Changed from "Minimax Algorithms in Problems of Numerical Analysis", in the Russian edition published in 1989, the new title of the book describes better its content.

In his book, Sukharev approaches efficiency in numerical methods as a general computational model. This global view, which allows problems to be treated in a unified methodology, considers a general model consisting of six main elements. Those elements are the operator to be approximated, which is the problem itself, the class of functions reflecting the available information about the problem, the class of algorithms that can be used for solving the problem, the criterion for estimating efficiency of the algorithm, the optimality concept and, finally, the notion of optimality of an algorithm within the framework of the adopted concept. The concept of optimality adopted for realizations of the general model throughout the book is the concept of minimax optimality. Although all of the elements constituting the general model and its realizations are well covered, a close attention is paid by the author to adaptive sequential algorithms. In some instances, the author shows how supposedly optimal algorithms give solutions far from being optimal, motivating sequentially optimal algorithm. As a result, this approach allows methods of game theory and other methods of operations research and systems analysis to be used in constructing optimal algorithms.

Consisting of five chapters, the 256-page-long book is an English translation, from Russian, that has about 450 references. The first chapter, where a general computation model is discussed, represents the essence of the book. In this chapter, different classes of functions, deterministic algorithms and stochastic algorithms are discussed. Also, the minimax concept of optimality is presented. In addition, adaptive and nonadaptive subclasses of algorithms are compared, and the concept of sequentially optimal algorithms is introduced and analyzed. The remaining chapters are on specific realizations of the general model. Chapter 2 deals with numerical integration in general. Chapter 3 is on the specific realization of recovering functions from their values. Chapter 4 discusses the problem of searching for global extrema. Chapter 5, however, discusses a collection of three different realizations of the general model. Those three realizations are the problem of solving systems of equations, the problem of maximizing a minimum function with coupled variables and multicriteria optimization problems. The list

of references at the end is quite extensive and rich in foreign literature on the subject, although not all of it is related directly to the subject being discussed.

The book is well organized and self contained. The objectives set by the author are well met. Every chapter and section starts with an introduction that outlines the upcoming material to discuss. Author and subject indices are provided at the end, and a glossary of symbols is given at the beginning. It is hard sometimes to translate work from other languages. Olga Chuyan, however, has succeeded in doing so. To summarize in a couple of words, the book is a traditional piece of scientific work and worthy to have.

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