Book Review

Žigljavskij, A. A. and Žilinskas, A. G., *Methods of Search for the Global Extremum* (in Russian), Nauka, Moskva 1991, 248 pp., ISBN 5-020104257-3.

Optimization is a central problem in applied mathematics. Global optimization (GO) is naturally more difficult than local optimization (LO) so that consequently less has been published about GO in comparison with LO. The authors of the present monograph try to direct the specialists' attention even to GO. It can be confirmed that in this book there is nearly all what is known about GO. This is due to a fruitful cooperation of two leading specialists from two different countries.

The book mainly consists of 6 chapters and an appendix. Chapter 1 describes the problem, defines all notions connected with it as well as models for the objective function. It gives ideas for construction of suitable algorithms. The short chapter 2 (6% of the total volume) is devoted to such methods of GO which base on LO as the Fletcher-Powell method, multistart with clustering, tunnelling algorithms and some others. In chapter 3, more extensively but also in concentration described are those algorithms which base on objective functions with bounded growth, i.e., which satisfy a Lipschitz condition. To those algorithms belong grid, covering and interval-arithmetic methods. In a very short chapter 4 it is referred to the applier how in some cases he considerably can reduce the dimensionality of the problem. A larger chapter 5 leads the Reader to so-called statistical models for the objective function. Herein it is understood to interprete the possibly high-degree multiextremal objective function as a realization of a stochastic process, especially of a Gaussian one. Hereby immediately a Bayesian approach is given. Because of its extraordinary difficulty, it succeeded to derive only a nearly Bayes-optimal but quite well working search strategy. Chapter 5 is a reflection of the results of a long research by the second author. The largest sixth chapter (28% of the total volume), written by the first author, is dedicated to random methods of GO. It has a long tradition, is easy to understand and to apply and mainly bases on heuristic ideas. Starting from the Monte-Carlo method with throwing uniformly distributed points on the search region, several generalizations are done. All these are algorithmically described. Convergence theorems are given. Using known limit theorems for extrema of random variables, statistical estimates for the extremum of the objective function are made. There are so much results that they can't reflected in this review. The book closes with an appendix what really could be denoted as chapter 7, because it without doubt belongs to the matter and is connected with chapter 6. It is written by the first author and M.V. Kondratovič. Statistical tests with regard to the essential extremum M of the objective function are made; linear estimates of M are analyzed in detail.

The book is suitable for all who deal with GO: Mathematicians and engineers.

It is mathematically exact – also questions of measurability are discussed – nevertheless to understand by most people. It is a real state-of-the-art report. Especially worthy to notice is the reference list with 431 (!) items. (A minor disadvantage is that the papers are cited in the text by numbers and not by names.) The literature is commented at suitable places of the text. With respect to the rich material, regarding the proofs of the theorems the Reader consequently is referred to the literature of course also to the author's own earlier papers. An exception is the appendix what partly contains entirely news.

It warmly will be recommended, by a translation to make the book accessible to English reading people.

Dresden,   PETER NEUMANN
Germany.