Book Review

P. M. Pardalos and J. B. Rosen (eds), *Computational Methods in Global Optimization*, Annals of Operations Research, Vol. 25, 1990, published by J. G. Baltzer A. G. Scientific Publishing Company, 302 pp. (price $153.60).

This book is a collection of 18 papers on global optimization. Most of the researchers who have significantly contributed to global optimization are represented in this volume. The topics are quite varied, ranging from cutting and covering algorithms to flow applications.

The volume opens with a paper by R. Horst, T. Q. Phong and N. V. Thoai on solving problems with convex and reverse convex constraints (the constraint $g(x) \geq 0$ is said to be "reverse convex" if g is a convex function from $\boldsymbol{R}^n$ to $\boldsymbol{R}$). This kind of global minimization problem is actually quite general, as shown earlier by Tuy, and it is also NP-hard. The authors of this paper present a careful cutting algorithm for the problem with a reverse convex constraint. S. Ben Saad and S. E. Jacobsen in the next paper also consider reverse convex constraints. They present test cases with up to 40 variables for their algorithm. V. P. Bulatov also considers a cutting algorithm, with an application to pipeline layout.

Another theme of the book is global optimization via covering and partitioning. A. T. Phillips and J. B. Rosen discuss a parallel covering algorithm in the case that the problem is partly separable. R. B. Kearfott discusses interval methods, another type of covering approach. In designing covering algorithms, it is necessary to understand approximation to nonconvex objective functions. N. Z. Shor in a short paper discusses estimation of polynomial objective functions using Lagrangian duality. H. D. Sherali and A. Alameddine consider the problem of estimating bilinear functions.

An area of recent interest in nonconvex optimization has been interior point methods. These methods in general are not guaranteed to find global optima although often succeed in practice. Y. Ye presents a nice survey of recent interior point methods for nonconvex problems, including his own progress in this area. A. P. Kamath, N. K. Karmarkar, K. G. Ramakrishnan, and M. G. C. Resende discuss an interior point approach to satisfiability problems (expressed as nonconvex optimization problems), producing solutions for problems with hundreds of variables. H. Konno and T. Kuno use a path-following a approach for bilinear problems.

Another approach to integer and mixed-integer optimization is discussed by A. Aggarwal and C. A. Floudas. Their approach is to decompose the problem into a master problem and subproblem, each with a simpler structure than the original

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problem. F. Al-Khayyal and C. Larsen use a combination of branch-and-bound and underestimation for mixed integer programming.

A paper by H. P. Benson, S. S. Erenguc and R. Horst solves integer problems with a branch-and-bound approach reminiscent of similar approaches to nonconvex continuous problem. F. Tardella gives conditions under which the optimum of a continuous problem is achieved at a vertex of the feasible set.

Several papers consider applications, particularly network flow applications. G. M. Guisewite and P. M. Pardalos survey nonconvex network flow, including applications, complexity results and known algorithms. B. V. Pelzwerger and A. Yu. Shafir formulate a multicommodity problem as concave minimization. J. Pintér investigates the problem of optimally selecting parameters in a dynamical description of an environment problem. A. de Palma and P. Hansen propose an application of one-dimensional optimization to the problem of planning a route through a congested network.

Overall, this volume contains state-of-the-art research in global optimization from many parts of the world. My only criticism is that the computational results presented are not directly comparable because different authors have used different test problems. Recently, C. Floudas and P. Pardalos have published a book on test problems for global optimization. It is hoped that the problems in that other book could provide the means to compare one algorithm against another. Alternatively, perhaps better asymptotic analysis of the algorithms' running time could be developed, thereby providing a basis for comparison.

Anyone interested in algorithms for global optimization should consider obtaining this book, since every topic of importance in the area is covered.

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