OPTIMA

№ 31

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER *November 1990*

S Y M P O S I U M

Second Announcement Mailed

Amsterdam, August 5-9,1991

ORGANIZERS of the 14th International Symposium on Mathematical Programming have mailed the second announcement of the conference which will be held August 5 - 9, 1991, at the University of Amsterdam and is being chaired by Jan Karel Lenstra, Alexander Rinnooy Kan and Alexander Schrijver.

The meeting will open on Monday, August 5, in the Lutherse Kerk, the main auditorium of the university, with a plenary address by W. R. Pulleyblank. The session will include awarding of the society prizes: Fulkerson Prize (for discrete mathematics, joint with AMS), George B. Dantzig Prize (for major contribution in mathematical programming, joint with SIAM), Beale-Orchard-Hays Prize (for computational mathematical programming) and the A. W. Tucker Prize (for outstanding student paper).

There will be a reception on Monday evening and a banquet on Wednesday evening, both at 18.30. The MPS business meeting will be Wednesday afternoon at 16.30.

One-hour invited lectures by leading experts in all aspects of mathematical programming will highlight the technical program, and there will be many parallel sessions with invited and contributed papers. The invited lecturers will include E. H. L. Aarts, R. E. Bixby, A. R. Conn, T. M. Cook, J. E. Dennis, Jr., C. C. Garcia, M. Grötschel, R. M. Karp, K. Kennedy, L. G. Khachiyan, C. Lemaréchal, K. Mehlhorn, C. H. Papadimitriou, D. F. Shanno, and R. E. Tarjan. Two special memorial sessions will honor Robert Jeroslow and Darwin Klingman.

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Symposium

CONTINUED

Early registration deadline is April 1; the abstracts for contributed papers are due June 1; and hotel reservations should be made by July 1. Registration fees before April 1 are NLG 240 and NLG 340 for members and nonmembers, respectively. After April 1 the fees are NLG 300 and NLG 400. (On Oct 15, 1990, 1 NLG was US $ 0.57.) Student fees are one-half these rates with certification of student status. The banquet fee is NLG 75. Addresses and forms are contained in the second announcement which also includes information on travel and the city. The symposium secretariat address is:

14th International Symposium on Mathematical Programming
c/o NOVEP
Paulus Potterstraat 40
1071 DB Amsterdam
The Netherlands
Telephone +31-20-752120
(+31-20-6752120 after April 1)
Telefax: +31-20-6628136
Electronic mail:
ismp@swi.psy.uva.nl.

NORDIC MPS SECTION FORMED

Thirty mathematical programmers from the Nordic countries gathered in Copenhagen August 25 and 26 for a two-day conference. During the conference it was decided to form a Nordic section of MPS. A board was elected, consisting of Stein W. Wallace, Haugesund Maritime College, Norway (leader); Jens Clausen, University of Copenhagen, Denmark; and Kaj Holmberg, Linkoping Institute of Technology, Sweden. It was decided to run a short meeting in two years and to set up a system for automatic distribution of electronic mail to all members.

The membership has increased from 25 to about 34 during this year. It is felt that the increase is a result of the activities surrounding the formation of the geographical section and the meeting in Copenhagen. The Nordic section covers Norway, Sweden, Denmark, Finland and Iceland.

–STEIN WALLACE

Call for Papers

ORSA Journal on Computing
Special Issue on Computational Geometry

The ORSA Journal on Computing *is dedicating a special issue to the subject of computational geometry. The rapidly growing field of computational geometry has addressed many problems of interest in operations research and has provided new algorithmic techniques for tackling a variety of optimization problems. Conversely, many well-established methods of operations research have contributed to the progress in geometric algorithms. This special issue is designed to stimulate the interplay between computational geometry and operations research and to enhance the application of techniques form computational geometry to problems arising in operations research. The special issue will provide the advantage of grouping together high-quality papers in the area, as well as the benefit of speedy review and minimal publication delays.*

Manuscripts are solicited over a wide range of topics within computational geometry and its applications including but not limited to:

Optimization
Facility Location
Mathematical Programming
Manufacturing, Robotics and Vision
Shortest Paths, Networks
Statistics

All manuscripts will be promptly and carefully refereed. High-quality manuscripts not accepted in the special issue due to space limitations will be considered, with the authors' permission, for inclusion in a regular issue of the journal.

Authors should submit four copies of their manuscript to either of the editors:

Joseph S.B. Mitchell
School of Operations Research and Industrial Engineering
Engineering Theory Center
Cornell University
Ithaca, NY 14853 USA
Tel: (607) 255-9148
Email:
jsbm@gvax.cs.cornell.edu

Jan Karel Lenstra
Department of Mathematics and Computing Science
Eindhoven University of Technology
PO Box 513
5600 MB Eindhoven
The Netherlands
Tel: 31-49-474770
Email: jkl@win.tue.nl

by no later than June 1, 1991. To expedite handling, authors should prepare their manuscripts consistent with the Instructions for Authors that appeared in Volume 2, Number 1 of the ORSA Journal on Computing*; a copy is available from the Editors.*

Annals of Operations Research

Editor-in-Chief: Peter L. Hammer, Rutcor, Hill Center for the Mathematical Sciences, Rutgers University, Busch Campus, New Brunswick, NJ 08903.

THE 1990 PROGRAMME

27: Computational Methods in Global Optimization
Editors: Ed. P.M. Pardalos & J.B. Rosen
Contains a variety of deterministic computational algorithms and new approaches for solving global optimization problems. Papers include, new approaches for solving reverse convex programs, interior point approaches for nonconvex quadratic programming, duality techniques, interval analysis, and branch and bound methods.

26: Automated Manufacturing Systems
Editor: Ed. J.B. Mazzola
Research features state-of-the-art operations-research-based articles on the design, planning, and control of automated production systems. Among the topics addressed in this issue are production planning, layout, routing, and scheduling in flexible manufacturing systems, automated assembly systems, flexible-manufacturing technology investment decisions, and the application of timemarked graphs to model behavior in production systems.

Production Planning and Scheduling
Editor: M. Queyranne
Applications in production planning and scheduling. Topics include hierarchical planning and decomposition approaches, the interface between planning and scheduling functions, surveys of models for production, scheduling, surveys on sequencing theory, implementation of operations research methods in practice.

25: Optimization with Data Perturbations, A Collection of Tutorials
Editor: V. Fiacco
Central themes are the theory and application of sensitivity, stability and parametric analysis of solutions to optimization problems whose data is subject to perturbation. Classes of problems addressed inolude variational inequalities, stochastic, semi-infinite, integer, nonlinear, geometric, linear and multi-objective programs. Results also cover a wide scope, ranging from optimal value and solution point continuity and differentiability to parametric methods for general nonlinear programs, including recent results based on singularity theory and continuation methods. There is even included one paper in the area of simulation optimization and sensitivity analysis, to exemplify recent extensions to discrete event systems. Many important earlier results have been simplified and unified in what promises to be a brilliant collection of tutorial surveys.

24: Operations Research in China
Editor: Yue Minyi
Development of operations research in China goes back for about 35 years. Most of the papers written by Chinese operations researchers were published in Chinese and are rarely accessible to readers outside China. The purpose of this volume is to give a presentation of the development in various branches of operations research in China. The volume contains surveys as well as numerous contributed papers, both on methodological and applied issues.

23: Intransitive Preferences
Editor: W.V. Gehrlein
An important contribution to decision analysis featuring papers on various aspects of this theory. Contributions deal with models ranging from intransitivity and the loss of market efficiency, measurements on finite sets, linear extensions of partial orders, voting theory, preference reversals, expected utilities with nonlinear thresholds, individual judgment statistics for stock market investments, etc.

22: Supercomputers and Large-Scale Optimization
Editor: J. Ben Rosen
Research on algorithms and related software for the solution of large-scale optimization problems on supercomputers and parallel machines. Papers cover various directions of research including: new approaches to solving very large linear programming and related problems on vector and parallel machines; parallel solution of large-scale generalized networks, matrix problems related to optimization, 0-1 integer programs and applications.

AVAILABLE VOLUMES:

21: Ed. H.J. Greenberg & F. Glover, **Linkages with Artificial Intelligence,** 1989

20: Ed. B. Shetty, **Networks Optimization and Applications,** 1989

19: Ed. P.C. Fishburn & I.H. Lavalle, **Choice under Uncertainty,** 1989

18: Ed. F.V. Louveaux a.o., **Facility Location Analysis: Theory and Applications,** 1989

17: Ed. A. Kusiak & W.E. Wilhelm, **Analysis, Modelling and Design of Modern Production Systems,** 1989

16: Ed. R.L. Keeney a.o., **Multi-Attribute Decision Making via O.R.-Based Expert Systems,** 1989

15: Ed. K.E. Stecke & R. Suri, **Flexible Manufacturing Systems: Operations Research Models and Applications II,** 1988

14: Ed. R.R. Meyer & S.A. Zenios, **Parallel Optimization on Novel Computer Architectures,** 1988

13: Ed. B. Simeone a.o., **Fortran Codes for Network Optimization,** 1988

12: Ed. R.G. Jeroslow, **Approaches to Intelligent Decision Support,** 1988

10-11: Ed. T. Ibaraki, **Enumerative Approaches to Combinatorial Optimization,** 2 vols. 1987

8-9: Ed. S.L. Albin & C.M. Harris, **Statistical and Computational Problems in Probability Modelling** 2 vols. 1987

7: Ed. J. Blazewicz a.o., **Scheduling under Resource Constraint: Deterministic Models,** 1986

6: Ed. J.P. Osleeb & S.J. Ratick, **Locational Decisions: Methodology and Applications,** 1986

3-4-5: Out of print

2: Ed. R.G. Thompson & R.M. Thrall, **Normative Analysis for Policy Decisions, Public and Private,** 1985

1: Ed. F. Archetti & F. Maffioli, **Stochastics and Optimization,** 1984

Price per volume incl. postage: $ 153.60, or $ 80.00 for members ORSA/TIMS. Please request extensive prospectus for whole series: vol. 1-27, 1984-1990. Proposals for new volumes should be addressed to Peter L. Hammer, Editor-in-Chief.

How to order: Please send your order either to your usual agent or directly to our Basel Head Office as mentioned below. In the United States please address your order to: J.C. Baltzer AG, Scientific Publishing Company, P.O. Box 8577, Red Bank, NJ 07701-8577.

J.C. BALTZER AG, SCIENTIFIC PUBLISHING COMPANY
Wettsteinplatz 10, CH-4058 Basel, Switzerland

CONFERENCE NOTES

Optimization Days 1991

May 8-9, 1991

All those interested in optimization methods and their present or potential applications are invited to participate. Those who can give talks on new methods of optimization and their applications are especially welcome.

Sessions will consist of invited and contributed talks. Papers presenting original developments as well as those of expository nature will be considered. The languages of the conference will be French and English. Plenary speakers will be:

E. Balas	USA
R. Horst	Germany
D. Shanno	USA
P. Toth	Italy

Contributors are encouraged to submit a paper for publication in a special issue of the journal INFOR devoted to the Optimization Days 1991.

Two copies of a 100-200 word summary defining clearly the content of the paper, together with the registration form, should be forwarded before January 31, 1991, to:

Dr. Martin Desrochers or
Dr. Brigitte Jaumard
GERAD
Ecole de Hautes Etudes Commerciales
5255 avenue Decelles
Montreal, Quebec
CANADA H3T 1V6
Tel: (514) 340-6048
Email: gerad@crt.umontreal.ca
Fax: (514) 340-5665

Authors will be notified of the acceptance of their talks by March 1, 1991. Summaries of the talks will be distributed at the conference. For more information, please contact the above.

15th IFIP Conference on System Modelling and Optimization

Zurich, Switzerland

September 2-6, 1991

At this conference, recent results will be discussed in sessions on Optimization and Systems Theory, Linear and Nonlinear Programming Algorithms, Optimal Control, Stochastic Optimization, and Applied Modelling and Optimization. Further sessions may be organized based on contributed papers.

Plenary talks will be given by I.V. Evstigneev, U.E. Kalman, R. Klötzler, B. Kummer, J.E. Lagnese, D.Q. Mayne, V.S. Michailevich, S.E. Shreve, P.L.M.J. Toint, J.P. Vial and J. Zowe.

Three copies of extended abstracts of papers to be presented should be received by the conference secretariat by January 10, 1991. They should be two to four pages in length (typewritten, single-spaced) and should present original unpublished results by the authors.

Acceptance of contributed papers is decided by the International Program Committee; abstracts arriving after the deadline cannot be considered. Notification of acceptance will be March 15, 1991.

The conference is to be held at the University of Zurich, downtown Zurich, Switzerland. Accommodation will be provided in nearby hotels at the rate of about Swiss Francs 80-150. The registration fee will be Swiss Francs 270 for early registration. A social program is arranged.

The conference language is English. Selected papers will be published in the Conference Proceedings.

The conference Secretariat is:

Dr. K. Frauendorfer
Institute for Operations Research
University of Zurich
Moussonstrasse 15
CH-8044 Zurich, Switzerland
Tel: +41-1-257 37 71
Fax: 01/252 1162 UNI ZH IOR
Telex: 817 260 uniz ch
E-mail: ifip91 at czhrzula (earn or bitnet).

O P T I M A

Technical Reports & WORKING PAPERS

Department of Industrial and Systems Engineering
303 Weil Hall
University of Florida
Gainesville, Florida 32611-2083

C-S. Lin and C-Y. Lee, *"Single Machine Stochastic Scheduling with Dual Criteria,"* RR# 90-3.

R. Uzsoy, C-Y. Lee and L.A. Martin-Vega, *"Scheduling Semiconductor Test Operations: Minimizing Maximum Lateness and Number of Tardy Jobs on a Single Machine,"* RR# 90-4.

W.W. Hager and D.W. Hearn, *"The Dual Active Set Algorithm and Quadratic Networks,"* RR# 90-7.

C-Y. Lee, R. Uzsoy and L.A. Martin-Vega, *"Efficient Algorithms for Scheduling Batch Processing Machines,"* RR# 90-8.

RUTCOR
Rutgers Center for Operations Research
Busch Campus,
Rutgers University
P. O. Box 5062
New Brunswick, New Jersey 08903

F.S. Roberts, *"No-Hole Non-Adjacent Colorings,"* RRR 11-90.

P. Hansen and M. Zheng, *"Shortest Shortest Path Trees of a Network,"* RRR 12-90.

Y. Crama and F.C.R. Spieksma, *"Approximation Algorithms for Three-Dimensional Assignment Problems with Triangle Inequalities,"* RRR 13-90.

P. Hansen and M. Zheng, *"An Algorithm for the Minimum Variance Point of a Network,"* RRR 14-90.

C. Wang, *"On Critical Graphs for Opsut's Conjecture,"* RRR 15-90.

A. Guénoche, P. Hansen and B. Jaumard, *"Efficient Algorithms for Divisive Hierarchical Clustering with the Diameter Criterion,"* RRR 16-90.

P. Hansen, M.V. Poggi de Aragão and C.C. Ribeiro, *"Boolean Queries Optimization and the 0-1 Hyperbolic Sum Problem,"* RRR 17-90.

D.S. Hochbaum and R. Shamir, *"Strongly Polynomial Algorithms for the High Multiplicity Scheduling Problem,"* RRR 18-90.

Y. Pinto and R. Shamir, *"Efficient Algorithms for Minimum Cost Flow Problems with Convex Costs,"* RRR 19-90.

D.S. Hochbaum, R. Shamir and J.G. Shanthikumar, *"A Polynomial Algorithm for an Integer Quadratic Non-Separable Transportation Problem,"* RRR 20-90.

I. Adler and R. Shamir, *"A Randomization Scheme for Speeding Up Algorithms for Linear and Convex Programming Problems with High Constraints-to-Variables Ratio,"* RRR 21-90.

Y. Crama, P. Hansen and B. Jaumard, *"Finding Spurious States of Neural Networks,"* RRR 22-90.

A.E. Roth, U.G. Rothblum and J.H. Vande Vate, *"Stable Matchings Optimal Assignments and Linear Programming,"* RRR 23-90.

E. Boros and P.L. Hammer, *"Cut-Polytopes, Boolean Quadric Polytopes and Nonnegative Quadratic Pseudo-Boolean Functions,"* RRR 24-90.

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Technical Reports & Working Papers

T.J. Carpenter, I.J. Lustig, J.M. Mulvey and D.F. Shanno, *"A Primal-Dual Interior Point Method for Convex Separable Nonlinear Programs,"* RRR 25-90.

I.J. Lustig, R.E. Marsten and D.F. Shanno, *"On Implementing Mehrotra's Predictor-Corrector Interior Point Method for Linear Programming,"* RRR 26-90.

M.J. Rosenblatt and U.G. Rothblum, *"Optimality of 'Cut Across the Board' Rule for Constrained Optimization Problems with an Application to an Inventory Model,"* RRR 27-90.

E. Boros, P.L. Hammer and R. Shamir, *"Balancing Rooted Data Flow Graphs,"* RRR 28-90.

S.R. Arikati and U.N. Peled, *"A Linear Algorithm for the Group Path Problem on Chordal Graphs,"* RRR 29-90.

F. Tardella, *"On the Equivalence Between Some Discrete and Continuous Optimization Problems,"* RRR 30-90.

P. Favati and F. Tardella, *"Convexity in Nonlinear Programming,"* RRR 31-90.

C. Mao-cheng, *"An Algorithm for Optimum Common Root Functions of Two Digraphs,"* RRR 32-90.

C. Mao-cheng, *"An Algorithm for an Eulerian Trail Traversing Specified Edges in Given Order,"* RRR 33-90.

S.D. Flåm, *"Solving Convex Programs by Means of Ordinary Differential Equations,"* RRR 34-90.

M.B. Cozzens and F.S. Roberts, *"Meaningfulness of Conclusions About Greedy Algorithms for T-Colorings,"* RRR 35-90.

J. Kahn, *"Coloring Nearly-Disjoint Hypergraphs with n+o(n) Colors,"* RRR 36-90.

J. Kahn, *"On a Problem of Erdös and Lovász,"* RRR 37-90.

D. Sakai and C. Wang, *"No-Hole (r+1)-Distant Colorings,"* RRR 38-90.

P.C. Fishburn and F.S. Roberts, *"Elementary Sequences, Sub-Fibonacci Sequences,"* RRR 39-90.

A. Bagchi and B. Kalantari, *"New Optimality Conditions and Algorithms for Homogeneous and Polynomial Optimization Over Spheres,"* RRR 40-90.

B. Avi-Itzhak and S. Halfin, *"Non-Preemptive Priorities in Simple Fork-Join Queues,"* RRR 41-90.

Z. Füredi, J. Kahn and P.D. Seymour, *"On the Fractional Matching Polytope of a Hypergraph,"* RRR 42-90.

Operation Research Group
The Johns Hopkins University
Baltimore, MD 21218

U.G. Rothblum, H. Schneider and M.H. Schneider, *"Characterizations of Max-Balanced Flows,"* #90-01.

M. Hartmann and M. Schneider, *"An Analogue of Hoffman's Circulation Conditions for Max-Balanced Flows,"* #90-02.

C. ReVelle and V. Marianov, *"The Probabilistic FLEET Model with Individual Vehicle Reliability Requirements,"* #90-03.

C. ReVelle and D. Serra, *"The Maximum Capture Problem Including Relocation,"* #90-04.

V. Marianov and C. ReVelle, *"The Standard Response Fire Protection Siting Problem,"* #90-05.

R. Klimberg, C. ReVelle and J. Cohon, *"A Multiobjective Approach to Evaluating and Planning the Allocation of Inspection Resources,"* #90-06.

M.H. Schneider, *"Max-Balanced Flows,"* #90-07.

C. Neti, M.H. Schneider and E.D. Young, *"Maximally Fault-Tolerant Neural Networks: Computational Methods and Generalization,"* #90-08.

U.G. Rothblum, H. Schneider and M.H. Schneider, *"Scaling Matrices to Prescribed Row and Column Maxima,"* #90-09.

CORE (Center for Operations Research and Econometrics)
Université Catholique de Louvain
34 Voie du Roman Pays
1348 Louvain-La-Neuve
BELGIUM

L. Qi, *"Bisubmodular Functions,"* D.P. 8901.

J.P. Sousa and L. Wolsey, *"Time Indexed Formulations of Non-Preemptive Single-Machine Scheduling Problems,"* D.P. 8904.

S.P. Anderson, A. de Palma and J.-F. Thisse, *"Social Surplus and Profitability under Different Spatial Pricing Policies,"* D.P. 8910.

C. Bousba and L. Wolsey, *"Finding Minimum Cost Directed Trees with Demands and Capacities,"* D.P. 8913.

R.G. Jeroslow, R.K. Martin, R.L. Rardin and J. Wang, *"Gainfree Leontief Problems,"* D.P. 8915.

A. Wagelmans, S. van Hoesel and A. Kolen, *"Economic Lot-Sizing: An O (n log n)-Algorithm that Runs in Linear Time in the Wagner-Whitin Case,"* D.P. 8922.

L. Wolsey, *"Formulating Single Machine Scheduling Problems with Precedence Constraints,"* D.P. 8924.

J.J. Gabszewicz and J.F. Thisse, *"Location,"* D.P. 8928.

K.M. Anstreicher, *"On the Performance of Karmarkar's Algorithm Over a Sequence of Iterations,"* D.P. 8934.

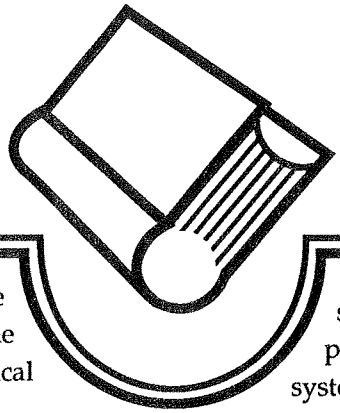
R.K. Ahuja and T.L. Magnanti, *"Some Recent Advances in Network Flows,"* D.P. 8936.

K.M. Anstreicher, *"A Combined Phase I - Phase II Scaled Potential Algorithm for Linear Programming,"* D.P. 8939.

R.L. Rardin and L. Wolsey, *"Valid Inequalities and Projecting the Multicommodity Extended Formulation for Uncapacitated Fixed Charge Network Flow Problems,"* D.P. 9024.

K.M. Anstreicher and P. Watteyne, *"A Family of Search Directions for Karmarkar's Algorithm,"* D.P. 9030.

BOOK REVIEWS



Computer Solutions of Linear Programming

by J. L. Nazareth

OUP USA, 1988

ISBN 0-19-504278-6

This book gives an excellent overview of the numerical techniques that are necessary for efficient computer implementation of the simplex method. Therefore, the book is at the forefront of mathematical programming, numerical mathematics and computer science.

Based on proper matrix algebra knowledge, the book is self-contained. First, basic knowledge of linear programming is presented; detailed studies of numerical algorithms follow; finally, some advanced techniques are discussed.

Although the new methods (Ellipsoid method - Khachian 1979, Interior point methods - Karmarkar 1984) of linear programming are mentioned in the introduction, their numerical algorithms are not discussed in the book. The efficient implementation of interior point methods needs some different numerical techniques. These are important to understand by one who implements linear programming software, but when this book was prepared, the technology of implementation of the interior point methods was not yet clear. Therefore, the book is restricted to the computational and implementation methods of the simplex method.

The first of the three main parts deals with the linear programming problem, with some classical methods (Chapter 1), and contains a description of the simplex method (Chapter 2).

The second part is the body of the book. Numerical techniques and implementational strategies are discussed here. Chapter 3 deals with external and internal representations of linear programming problems. Chapter 4 contains the necessary fundamentals of numerical analysis. Chapter 5 is devoted to the factorization strategies of the basis matrix with LU factorization as the primary tool. Accuracy, stability and strategies to control the density (fill in) are considered as well. Refined updating and solving strategies (Bartels-Golub, Forrest-Tomlin, Fletcher-Matthews) are discussed in Chapter 6. Entering and leaving variable selection strategies are demonstrated in Chapters 7 and 8. The latter discusses selection rules for finding an initial feasible solution (first phase methods), while the former is devoted to second phase pivot rules. The last two chapters of the second part summarize the algorithmic elements and suggest a complete implementation of the simplex method. Further implementational aspects and the usage of mathematical programming systems in practice are also discussed.

The third part of the book contains further issues of linear programming. Chapter 11 discusses duality theory, the dual simplex method and sensitivity analysis. Decomposition algorithms, like Dantzig-Wolfe and Benders decomposition, and their implementational strategies are presented in Chapter 12. The last chapter is a short description of homotopy methods. It presents Dantzig's self-dual parametric simplex algorithm as a specific implementation of the homotopy method.

The book is well written. It can be a useful handbook for researchers, teachers and students who are interested in linear programming or anyone who is a linear programming user and wants to understand more deeply how a linear programming package works. The second part of the book can also be the material for a second semester of an advanced linear programming course.

T. TERLAKY

Simulated Annealing and Boltzmann Machines

by Emile Aarts and Jan Korst

John Wiley, Chichester, 1989

ISBN 0-471-92146-7

Simulated annealing is a method for solving combinatorial optimization problems. It avoids being trapped in local optima, as usually happens with local search. To escape from a neighboring local optimum, a generated feasible solution is accepted with a certain probability, even if it is worse than the preceding one. The Boltzmann machine is a neural network model. One

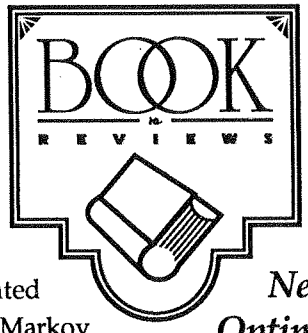
CONTINUES

of its remarkable features is massive parallelism. As such, it is suitable for parallel execution of the simulated annealing algorithm.

In Chapters 1 and 2 of the book the local search and simulated annealing algorithms are introduced, and the analogy of the latter method with the physical annealing process is shown. In Chapter 3 the asymptotic convergence of the simulated annealing algorithm is discussed using the theory of Markov chains. Chapter 4 deals with a polynomial-time implementation of simulated annealing, which provides an approximation of an optimal solution. Chapters 4 and 5 are also devoted to an analysis of the empirical performance of the algorithm and its application in the solving of combinatorial optimization problems, such as: travelling salesman, max cut, independent set, and graph coloring. Chapter 6 discusses how to speed up the algorithm by execution on parallel computers since the efficiency of the simulated annealing method is poor for some problems. Chapter 7 focuses on the subject of neural computing. Chapter 8 introduces different types of Boltzmann machines whose state transitions are studied again using Markov chains to show the analogy with parallel simulated annealing. Chapter 9 shows that 0-1 optimization problems can be associated with Boltzmann machines so that maximizing the consensus function is equivalent to solving the optimization problem. Chapters 10 and 11 deal with how to solve classification problems using Boltzman machines, which are important to pattern recognition, and how a Boltzmann machine is able to learn.

The book gives a clear introduction to simulated annealing and Boltzmann machines, where most propositions are carefully proved and accompanied by worked examples. It also presents many recent research results and provides a detailed survey of the relevant literature. One possible disadvantage of the monograph is that the performance of the simulated annealing algorithm is not compared with that of other modern approaches for solving approximately large combinatorial optimization problems, for instance, tabu search. However, the book can be warmly recommended to graduate students and other researchers in combinatorial optimization, parallel processing, neural networks, and artificial intelligence.

K. NEUMANN



New Computer Methods for Global Optimization

by H. Ratschek and J. Rokne

Ellis Horwood, Chichester, 1988

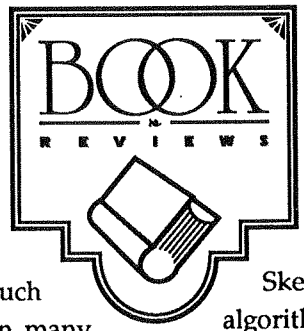
ISBN 0-7458-0139-0

The enormous practical need for solving global optimization problems, coupled with a rapidly advancing computer technology, has allowed one to consider problems which a few years ago would have been considered computationally intractable. As a consequence, we are seeing the creation of a large and increasing number of diverse algorithms for solving a wide variety of multiextremal global optimization problems.

By definition, a global optimization problem seeks at least one global minimizer of a real-valued objective function that possesses (often very many) different local minimizers in the feasible set $D \subseteq R^n$. It is well-known that in practically all disciplines where mathematical models are used, there are many real-world problems which can be formulated as multiextremal global optimization problems.

Standard nonlinear programming techniques have not been successful for solving these problems. Their deficiency is due to the intrinsic multiextremality of the formulation and not to the lack of smoothness. One can observe that local tools such as gradients, subgradients, and second order constructions such as Hessians, cannot be expected to yield more than local solutions. One finds, for example, that a stationary point is often detected for which there is even no guarantee of local minimality. Moreover, determining the local minimality of

such a point is known to be NP-hard in the sense of computational complexity even in relatively simple cases. Apart from this deficiency in the local situation, classical methods do not recognize conditions for global optimality.



For these reasons global solution methods must be significantly different from standard techniques, and they can be expected to be and are much more expensive computationally. Fortunately, in many practical global optimization applications, the multiextremal feature involves only a small number of variables. Moreover, many global optimization procedures take advantage of helpful specific features of the problem structure which are often present. On the other hand, several methods have been proposed recently to solve very general and difficult global problems. In these cases, sufficiently accurate approximations of global solutions can only be detected for small problem sizes. However, general global optimization methods often provide useful tools for transcending local optimality restrictions, in the sense of providing valuable information about the global quality of a given point. Typically, such information will give upper and lower bounds for the optimal objective function value and indicate parts of the feasible set where further investigations of global optimality will not be worthwhile.

One of several directions of recent research in general global optimization methods uses interval analytical tools which have been most successful when incorporated in branch and bound techniques and combined with local methods. This book, which is authored by two well-known experts in the field, gives a thorough introduction to interval analysis and recently proposed interval methods for global optimization.

Chapter 1 gives a very short and rudimentary presentation of some classical nonlinear programming techniques. This chapter reflects very much the intention of the author to demonstrate, in a simple way, how interval methods and local procedures can be combined in principle rather than to provide the state of the art in nonlinear programming. The second chapter contains a nice overview of the basic principles of interval analysis, including interval Newton methods and the Hansen-Greenberg realization. Chapter 3, on unconstrained global optimization, discusses three branch and bound interval methods for globally minimizing a real-valued function over a box in R^n: the algorithm of Moore-Skelboe, the Ichida-Fuy algorithm and the Hansen algorithm. Convergence properties are derived, the advantage of isotone inclusion functions is demonstrated and several acceleration devices are proposed. Chapter 4, which has the somewhat awkward heading, "Unconstrained Optimization over Unbounded Domains," generalizes these methods to the unconstrained minimization problem where, in contrast to Chapter 3, it is not assumed that an initial box containing an optimal solution is known. Such a generalization is achieved by an appropriate compactification of the Euclidean space Rn and its realization on a computer. The final chapter is devoted to constrained global optimization problems which are difficult to handle directly by interval methods. The algorithms discussed are interesting combinations of interval and local methods, but the proposed way to overcome the difficulties arising from constraints by means of relaxation with flexible tolerances needs further investigation and comparison with other methods.

The technical prerequisites for this book are rather modest and are within the reach of most undergraduate university programs. Each method is demonstrated by illustrative examples. An extensive bibliography is given.

Summarizing, this book provides a welcome introduction to the field. It may well serve as a textbook for students, but it contains interesting material for the experts as well.

R. HORST

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CARNEGIE-MELLON has bestowed its highest faculty honor on **Egon Balas** who was named a University Professor in June, 1990. ¶A workshop in large-scale optimization is being organized for July 29-31, 1991 in Coimbra, Portugal. Contact Prof. Joaquim J. Judice, Dept. de Matematica, Universidade de Coimbra. ¶Summer schools in Nonsmooth Optimization and NP-Completeness are being organized for June, 1991 at ERICE (Trapani), Sicily. Contact Prof. F. Giannessi, Universita di Pisa, Dipartimento di Matimatica, via F. Buonarroti, 2-56127, Pisa, Italy, email: diparmat at icnucevm.bitnet. ¶Deadline for the next OPTIMA is February 1, 1991.

Books for review should be sent to the Book Review Editor, Prof. Dr. Achim Bachem, Mathematiches Institute der Universität zu Köln, Weyertal 86-90, D-5000 Köln, West Germany.

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Elsa Drake, DESIGNER

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