OPTIMA

Nº 30

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER

July 1990

SYMPOSIUM

1991 Prize Nominations Invited

George B. Dantzig Prize

The Mathematical Programming Society (MPS) and Society for Industrial and Applied Mathematics (SIAM) are seeking nominations for their joint George B. Dantzig Prize awarded to an individual(s) for original research, which by virtue of its originality, breadth, and depth, is having a major impact on the field of mathematical programming. The contributions eligible for consideration must be publicly available and may address any aspect of mathematical programming in its broadest sense. Preference is given to contributions by individuals under 50 years of age.

The Prize will be presented at the Mathematical Programming Society's triennial symposium to be held August 5-9, 1991, in Amsterdam. Past George B. Dantzig Prize recipients have been: M. J. D. Powell and R. T. Rockefellar in 1982, E. L. Johnson and M. W. Padberg in 1985, and M. J. Todd in 1988.

The Prize Committee members are Thomas L. Magnanti, Chair, Manfred W. Padberg, R. Tyrrell Rockefellar, and Michael J. Todd.

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Beale-Orchard-Hays Prize

Nominations are being sought for the Mathematical Programming Society Beale-Orchard-Hays Prize for Excellence in Computational Mathematical Programming.

Purpose:
This award is dedicated to the memory of Martin Beale and William Orchard-Hays, pioneers in computational mathematical programming. To be eligible a paper or a book must meet the following requirements:

1) It must be on computational mathematical programming. The topics to be considered include:

a) experimental evaluations of one or more mathematical programming algorithms.

b) the development of quality mathematical programming software (i.e. well-documented code capable of obtaining solutions to some important class of MP problems) coupled with documentation of the applications of the software to this class of problems (note: the award would be presented for the paper which describes this work and not for the software itself),

c) the development of a new computational method that improves the state-of-the art in

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D.R. Fulkerson Prize

This is a call for nominations for the D. Ray Fulkerson Prize in discrete mathematics that will be awarded at the XIVth International Symposium on Mathematical Programming to be held in Amsterdam, The Netherlands, August 5-9, 1991.

The specifications for the Fulkerson Prize read:
"Papers to be eligible for the Fulkerson Prize should have been published in a recognized journal during the six calendar years preceding the year of the Congress. This extended period is in recognition of the fact that the value of fundamental work cannot always be immediately assessed. The prizes will be given for single papers, not series of papers or books, and in the event of joint authorship the prize will be divided.

The term "discrete mathematics" is intended to include graph theory, networks, mathematical programming, applied combinatorics, and related subjects. While research work in these areas is usually not far removed from practical applications, the judging of papers will be based on their mathematical quality and significance".

The nominations for the award will be presented by the Fulkerson Prize Committee (Martin

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A.W. Tucker Prize

The Mathematical Programming Society invites nominations for the A. W. Tucker Prize for an outstanding paper authored by a student. The award will be presented at the International Symposium on Mathematical Programming in Amsterdam, The Netherlands (5-9 August 1991). All students, graduate and undergraduate, are eligible. Nominations of students who have not yet received the first university degree are especially welcome. In advance of the Symposium an award committee will screen the nominations and select at most three finalists. The finalists will be invited, but not required, to give oral presentations at a special session of the Symposium. The award committee will

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George B. Dantzig Prize

Please send nominations to Thomas L. Magnanti, Sloan School of Management, M.I.T., Cambridge, MA 02139, U.S.A. Nominations are due by September 30, 1990, and should provide a brief one or two page description of the nominee's outstanding contributions and, if possible, a current resume including the nominee's list of publications.

THOMAS L. MAGNANTI

Beale-Orchard-Hays Prize

computer implementations of MP algorithms coupled with documentation of the experiment which showed the improvement, or

d) the development of new methods for empirical testing of mathematical programming techniques (e.g., development of a new design for computational experiments, identification of new performance measures, methods for reducing the cost of empirical testing).

2) It must have appeared in the open literature.

3) If the paper or book is written in a language other than English, then an English translation must also be included.

4) Papers eligible for the 1991 award must have been published within the years 1987 through 1990.

These requirements are intended as guidelines to the screening committee but are not to be viewed as binding when work of exceptional merit comes close to satisfying them.

Frequency and Amount of the Award:
Previous recipients of the award were Michael Saunders (1985) and Tony J. Van Roy and Lawrence Wolsey (1988). The 1991 prize of $1500 and a plaque will be presented in August, 1991, in Amsterdam at the Awards Session of the International Symposium on Mathematical Programming sponsored by the Mathematical Programming Society.

Judgement Criteria:
Nominations will be judged on the following criteria:

1) Magnitude of the contribution to the advancement of computational and experimental mathematical programming.

2) Originality of ideas and methods.

3) Clarity and excellence of exposition.

Nominations:
Nominations must be in writing and include the title(s) of the paper(s) or book, the author(s), the place and date of publication and four copies of the material. Supporting justification and any supplementary materials are welcome but not mandatory. The awards committee reserves the right to request further supporting materials from the nominees.

Nominations should be mailed to:

Professor Robert R. Meyer
Computer Sciences Department
1210 W. Dayton Street
The University of Wisconsin
Madison, WI 53706
USA

The deadline for submission of nominations is November 1, 1990.

ROBERT R. MEYER

D.R. Fulkerson Prize

Grötschel, Chairman, Louis Billera, and Paul D. Seymour) to the Mathematical Programming Society and the American Mathematical Society.

Please send your nominations by January 15, 1991 to:

Prof. Dr. Martin Grötschel
Institute of Mathematics
University of Augsburg
Universitätsstr. 8
8900 Augsburg
WEST GERMANY

MARTIN GRÖTSCHEL

A.W. Tucker Prize

select the winner and present the award prior to the conclusion of the Symposium. The members of the committee for the 1991 A. W. Tucker Prize are: Richard W. Cottle, Stanford University; Thomas M. Liebling, Swiss Federal Institute of Technology, Lausanne; Richard A. Tapia, Rice University; Alan C. Tucker, State University of New York at Stony Brook.

Eligibility

The paper may concern any aspect of mathematical programming; it may be original research, an exposition or survey, a report on computer routines and computing experiments, or a presentation of a new and interesting application. The paper must be solely authored, and completed after January 1988. The paper and the work on which it is based should have been undertaken and completed in conjunction with a degree program.

Nominations

Nominations must be made in writing to the chairman of the award committee

Richard W. Cottle
Department of Operations Research
Stanford University
Stanford, California 94305-4022

by a faculty member at the institution where the nominee was studying for a degree when the paper was completed. Letters of nomination must be accompanied by four copies each of: the student's paper; a separate summary of the paper's contributions, written by the nominee, and no more than two pages in length; and a brief biographical sketch of the nominee.

The award committee may request additional information. Nominations and the accompanying documentation are due on or before January 5, 1991.

RICHARD W. COTTLE

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.

IN PREPARATION

Nonlinear Dynamic Systems in Economics and Management

Editor: G. Feichtinger, Technical University Vienna

Data Perturbations

Editor: A.V. Fiacco, George Washington University

Networks

Editors: D. Klingman, University of Texas, and **F. Glover,** University of Colorado

Automated Manufacturing Systems

Editor: J.B. Mazzola, Duke University

Tabu Search

Editors: D. de Werra, Technical University Lausanne, and **F. Glover,** University of Colorado

Stochastic Programming

Editors: R. Wets and J. Birge

Intransitive Preferences

Editor: W.V. Gehrlein, University of Delaware

This collection represents 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.

Topological Network Design

Editors: J. MacGregor Smith, University of Massachusetts and **P. Winter,** University of Copenhagen

This volume presents the refereed proceedings of a NATO workshop. Papers presented in the workshop were written by Colbourn, Gavisch, Clover, Hammer, Hwang, Klingman, Korte, Krarup, Lawler, Lanstra, Rinnooy Kan, and others. The main subjects discussed at the meeting include graph theoretical aspects of topological network design, VLSI design, network reliability, routing and scheduling, parallel computations, interactions of AI and OR, Steiner network and computational geometry, computer and communication networks, etc. The volume will present a comprehensive view of the state of the art in this rapidly developing area.

Production Planning and Scheduling

Editor: M. Queyranne, University of British Columbia

The volume presents the state of the art of operations research 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. Contributors include: Coffman, de Werra, Glazebrook, Lasserre, Lawler, Magazine, Posner, Thizy, Van de Velde, Weiss, Yannakakis etc.

AVAILABLE VOLUMES:

22: Ed. B. Rosen, **Supercomputers and Large-scale Optimization,** 1990

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

4-5: Ed. C.L. Monma, **Algorithms and Software for Optimization,** 2 vols. 1986

3: 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. 1-22, 1984-1989. 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

Stockholm Optimization Day

The Royal Institute of Technology, Stockholm, Sweden
June 7, 1990

The first Stockholm Optimization Day was held June 7, 1990, at the Royal Institute of Technology (KTH) under the sponsorship of the Swedish National Board for Technical Development. It was organized by P. O. Lindberg, Director of the Optimization Group, Department of Mathematics.

Papers in computational and theoretical mathematical programming were given by Phillipe Toint (Namur), Athanasios Migdalas (Linkoping), Walter Murray (Stanford), Don Hearn (Florida) and Rob Freund (MIT). Efficient numerical optimization methods for problems in structural optimization were given by Krister Svanberg (KTH) and Ulf Ringertz (Aeronautical Research Institute of Sweden). P.O. Lindberg gave a summary of research activities at KTH. Participants enjoyed dinner and an evening sail on the Baltic following the conference.

Summer School Scuola Mathematica Interuniversitaria

Corso Estivo di Mathematica "Ottimizzazione Combinatorica"
Cortona, Italy
July 29 - August 18, 1990

This summer school is being orgainzed by Achim Bachem and Bruno Simeone. Interested students should contact:

Prof. Giovanni Monegato
Director of the
Scuola Mathematica Interuniversitaria
Politecnico di Torino
Corso Duca degli Abruzzi, 24
10129 Torino
ITALY
ACHIM BACHEM

International Symposium Applied Mathematical Programming and Modelling

APM9D91
Venue: London
January 14-16,1991

This international symposium in Europe supported by the Mathematical Programming Society sets the scene for Mathematical Programming in the 1990s and is a forerunner to the 14th Mathematical Programming Symposium which will be held in Holland in August 1991. Contributions from America and Eastern Countries are also invited and solicited. The symposium is intended to attract specialists with different backgrounds such as hardware manufacturers, industrial research workers, software houses and academic researchers. The common theme drawing them together concerns the application of mathematical programming and modelling to solve large, difficult and real problems of industry and commerce.

Contact:

Gautam Mitra
Brunel University
Department of Mathematics and Statistics
Uxbridge, Middlesex UB8 3PH
UNITED KINGDOM
Telephone: Uxbridge (0895) 7400
Email: Mitra@cc.brunel.ac.uk

CONFERENCE NOTES

Second International Conference on Numerical Optimization and its Applications

Xi'an Jiaotong University
Xi'an China
June 24-27, 1991

This conference is being organized by the Institute for Computing and Applied Mathematics, Mathematics Department of Xi'an Jiaotong University and is sponored by the National Natural Science Foundation of China. The focus will be on new results, algorithms on numerical optimization and their applications. Specific topics will include algorithms for Linear and Nonlinear Programming, Parallel Algorithms for Optimization, Methods for Global Optimization, Nonsmooth Optimization, Numerical Methods for Nonlinear Systems of Equations, Interval Analysis Methods for Nonlinear Problems, Optimal Numerical Approximation for Nonlinear Operator Equations and Applications of Optimization.

The conference committee will also award prizes for excellent papers contributed by young researchers under 30 years old.

Before January 31, 1991, anyone interested in attending the conference or submitting a paper should contact:

Dr. Chengxian Xu
Institute for Computing and Applied Mathematics
Xi'an Jiaotong University
P. R. China
Tel: 335011 ext. 744
Telex: 70123 XJTU

11th European Congress on Operational Research

EURO XI
Aachen
July 16-19, 1991

EURO XI will be held at the "RWTH", the largest European Institute of Technology. It is located in Aachen (Fed. Rep. of Germany), three miles each from Belgium andThe Netherlands. Aachen, in which Charles the Great, then Emperor of Europe, resided in the 8th Century, is a medieval town. Here the charm of 1200 years of history merges with most advanced technological research.

Papers on all subjects related to Operations Research will be welcome. Special emphasis will be given, however, to developments which bear on future technologies.

There will be plenary sessions, semi-plenary sessions devoted to topics of actual interest, parallel sessions for presenting research contributions, research reviews or tutorials, software sessions, and a software fair.

Participants are invited to a) present a paper, b) present a formal software demonstration in a software session, c) organize one or several sessions (two to four papers by session), or d) present software in the software fair.

Dates and Deadlines

Dec. 1990: Deadline for abstracts

May 15, 1991: Deadline for early registration

Early Registration Fee: DM 300,-

Late Registration Fee: DM 450,-

Mailing Address: Prof. Dr. Dr. h.c. H.-J. Zimmermann, Operations Research, RWTH Aachen, Templergraben 64, 5100 Aachen (F.R.G.). FAX: 0241-80 61 89.

Technical Reports & WORKING PAPERS

RUTCOR
Rutgers Center for Operations Research
Hill Center, Busch Campus
Rutgers University
New Brunswick, New Jersey 08903

G. Ding and C. Wang, *"Threshold Digraphs,"* RRR# 50-89.
M.-S. Chern, *"A Note on the Computational Complexity of Reliability Redundancy Allocation in a Series System,"* RRR# 51-89.
G. Ding, *"Monotone Clutters,"* RRR# 52-89.
G. Ding, *"Order the Vertices of a Graph Linearly,"* RRR# 53-89.
G. Isaak, *"A Generalized Blossom Algorithm for Packing Odd Subtrees,"* RRR# 54-89.
P. Hansen and M. Zheng, *"Algorithms for Determining a Lorenz Point on Trees and Networks,"* RRR# 55-89.
U.N. Peled and F. Sun, *"Enumeration of Labeled Difference Graphs and an Identity of Stirling Numbers,"* RRR# 56-89.
B.A. Tesman, *"T-Colorings, List T-Colorings, and Set T-Colorings of Graphs,"* RRR# 57-89.
M.P. de Aragaö, *"Column Generation Methods for Probabilistic Logic,"* RRR# 58-89.
U.G. Rothblum, H. Schneider and M.H. Schneider, *"Characterizations of Max-Balanced Flows,"* RRR# 1-90.
G. Isaak, S.-r. Kim, T.A. McKee, F.R. McMorris and F.S. Roberts, *"2-Competition Graphs,"* RRR# 2-90.
M. Blidia, P. Duchet, F. Maffray, *"On the Orientation of Meyniel Graphs,"* RRR# 3-90.
M.H. Rothkopf, *"Forecasting When the Forecast Can Affect the Outcome: An Impossibility Result,"* RRR# 4-90.
X. Lu, *"Hamiltonian Games,"* RRR# 5-90.
X. Lu, *"Claws Contained in All n-Tournaments,"* RRR# 6-90.

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ICIAM 91

July 8–12, 1991 • Washington, D.C. • USA

Call for Contributed Presentations— Poster and Lecture Formats

Participate in ICIAM 91 by submitting a paper, which you may present in lecture or poster format. The ICIAM 91 Program Committee is encouraging contributors to present their papers in poster form to increase communication among participants, foster the development of international friendships, and reduce the need for large numbers of parallel sessions.

Authors will have approximately 15 minutes for contributed presentations (lecture format), with an additional five minutes for questions. Alternatively, they may elect the poster format, which encourages interactive discussions with individuals interested in their work using flip charts and other visual aids.

If you desire to present a paper (lecture or poster format), you must submit a summary not exceeding 100 words on an ICIAM 91 contributed paper/poster presentation form or facsimile. You may also submit an abstract via e-mail. Macros are available in LaTeX or TeX. To receive macros via e-mail, contact SIAM at *iciam@wharton.upenn.edu*. Papers will be reviewed by the program committee. Everyone who submits a paper will be notified by mail regarding acceptance.

Deadline date for submission of contributed presentation forms: September 30, 1990.

Local Attractions

Washington D.C. is a world capital and an international city. ICIAM 91 participants will have opportunities during the conference to visit government buildings, museums, and more than 100 well-known historic sites. Travelers to Washington may enjoy the city's stately memorials, the Smithsonian complex of 14 museums and galleries (including the Air and Space Museum), the Capitol Building, and the White House.

These are just a few of the historic sites, 80% of which offer free admission and are open to the public seven days a week.

Sponsoring Societies

- GAMM
- IMA
- SIMAI
- SMAI
- SIAM

With the cooperation of INRIA
Hosted by SIAM

Accommodations

The conference will take place in Washington, D.C., at the Sheraton Washington, a modern air-conditioned hotel with 2,000 guest rooms, 25 meeting rooms, an exercise room, a large outdoor swimming pool, and several restaurants. The hotel boasts a multi-lingual staff fluent in 20 languages, a foreign currency exchange, electric adapters, and many other benefits geared toward international attendees.

The Sheraton is within a few blocks of the National Zoo, the National Cathedral, Embassy Row, and historic Georgetown. The hotel is also located on the city's "Metro" subway system, which provides easy, inexpensive access to most points of interest, as well as shopping and dining sites throughout the city and in nearby Virginia and Maryland.

For more economical accommodations, there will be dormitory rooms available at nearby George Washington University.

Contributed Presentation, Registration, and Announcement Information

To obtain a form and guidelines for submitting a paper, or to receive a list of invited presentations, committee members, future announcements, and ICIAM 91 program/registration information, please get in touch with SIAM promptly by contacting: ICIAM 91 Conference Manager, c/o SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688 USA. Fax (Telecopy): (215) 386-7999; Telephone: (215) 382-9800; E-mail: iciam@wharton.upenn.edu

Technical Reports & Working Papers

M.H. Rothkopf and R. Engelbrecht-Wiggans, *"Sealed-Bids vs. Open Auctions for Federal Timber: Theory Reconsidered and Data Reinterpreted,"* RRR# 7-90.
Y. Liu, *"On the Rectilinear O-Embeddability of Graphs,"* RRR# 8-90.
P.-C. Chen, P. Hansen and B. Jaumard, *"On-Line and Off-Line Vertex Enumeration by Adjacency Lists,"* RRR# 9-90.
O. Gross and U.G. Rothblum, *"Approximations of the Special Radius, Corresponding Eigenvector and Second Largest Modulus of an Eigenvalue for a Square Nonnegative Irreducible Matrices,"* RRR# 10-90.

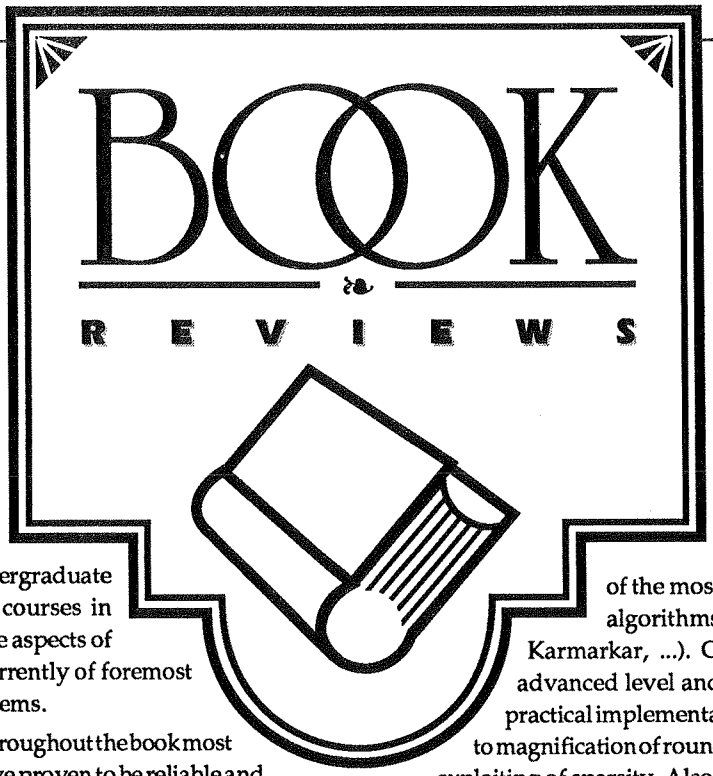
Systems of Optimization Laboratory
Department of Operations Research
Stanford University
Stanford, CA 94305-4022

F. Prieto, *"Sequential Quadratic Programming Algorithms for Optimization,"* SOL 89-7.
A. Diener, *"Near-Optimal Operation of a Multi-Plant Manufacturing System with Central Procurement,"* SOL 89-8.
A. Diener, *"Near-Optimal Operation of a Single Machine with Continuous Buffer Feed,"* SOL 89-9.
P.F. de Mazancourt, *"A Matrix Factorization and its Application to Large-Scale Linear Programming,"* SOL 89-10.
A.L. Forsgren, P.E. Gill and W. Murray, *"On the Identification of Local Minimizers in Inertia-Controlling Methods for Quadratic Programming,"* SOL 89-11.
A.L. Forsgren, P.E. Gill and W. Murray, *"A Modified Newton Method for Unconstrained Minimization,"* SOL 89-12.
G. Infanger, *"(Importance) Sampling within a Benders' Decomposition Algorithm for Stochastic Linear Programs,"* SOL 89-13.
B.C. Eaves and U.G. Rothblum, *"A Class of "ONTO" Multifunctions,"* SOL 89-14.
J-C. Yao, *"Generalized Quasi-Variational Inequality and Implicit Complementarity Problems,"* SOL 89-15.
J-C. Yao, *"A Basic Theorem of Complementarity for the Generalized Variational-like Inequality Problem,"* SOL 89-16.
R.E. Entriken, *"The Parallel Decomposition of Linear Programs,"* SOL 89-17.
J-C. Yao, *"On Mean Value Iterations with Application to Variational Inequality Problems,"* SOL 89-18.
J-C. Yao, *"Fixed Points by Ishikawa Iterations,"* SOL 89-19.
S.K. Eldersveld and M.C. Rinard, *"A Vectorization Algorithm for the Solution of Large, Sparse Triangular Systems of Equations,"* SOL 90-1.
S.K. Eldersveld and M.A. Saunders, *"A Block-LU Update for Large-Scale Linear Programming,"* SOL 90-2.
P.H. McAllister, J.C. Stone and G.B. Dantzig, *"An Interactive Model Management System: User Interface and System Design,"* SOL 90-3.
G.B. Dantzig and Y. Ye, *"A Build-up Interior Method for Linear Programming,"* SOL 90-4.
J-C. Yao, *"A Generalized Complementarity Problem in Hilbert Space,"* SOL 90-5.

ONR Computational Combinatorics URI
Institute for Interdisciplinary Engineering Studies
304A Potter Engineering Center
Purdue University
West Lafayette, IN 47907

S.S. Abhyankar, T.L. Morin and T.B. Trafalis, *"Efficient Faces of Polytopes: Interior Point Algorithms, Parameterization of Algebraic Varieties, and Multiple Objective Optimization,"* CC-89-1.
V. Chandru and J.N. Hooker, *"Extended Horn Sets in Propositional Logic,"* CC-89-2.
G.N. Frederickson and D.J. Guan, *"Nonpreemptive Ensemble Motion Planning on a Tree,"* CC-89-3.
G.N. Frederickson and D.J. Guan, *"Preemptive Ensemble Motion Planning on a Tree,"* CC-89-4.
V. Chandru, D. Dutta and C.M. Hoffmann, *"Variable Radius Blending Using Dupin Cyclides,"* CC-89-5.
R.G. Jeroslow, R.K. Martin, R.L. Rardin and J. Wang, *"Gainfree Leontief Flow Problems,"* CC-89-6.
G.N. Frederickson, *"Using Cellular Graph Embeddings in Solving all Pairs Shortest Paths Problems,"* CC-89-7.
A.K. Gupta and S.E. Hambrusch, *"Multiple Network Embeddings into Hypercubes,"* CC-89-8.
S. Hambrusch and M. Luby, *"Parallel Asynchronous Connected Components in a Mesh,"* CC-89-9.
S. Hambrusch and L. TeWinkel, *"Parallel Heuristics for the Steiner Tree Problem in Images without Sorting or Routing,"* CC-89-10.
S. Hambrusch, *"An Optimal Parallel Algorithm for Determining w-Connectivity in Images,"* CC-89-11.
D.K. Wagner and H. Wan, *"A Polynomial-Time Simplex Method for a Class of Transshipment Problems,"* CC-89-12.
M.C. Fields and G.N. Frederickson, *"A Faster Algorithm for the Maximum Weighted Tardiness Problem,"* CC-89-13.
R. Swaminathan and D.K. Wagner, *"A Forbidden-Minor Characterization of Orientable Graph-Tree Pairs,"* CC-89-14.
C.R. Coullard, J.G. del Greco and D.K. Wagner, *"Uncovering Generalized-Network Structures in Matrices,"* CC-89-15.
C.R. Coullard, J.G. del Greco and D.K. Wagner, *"Recognizing a Class of Bicircular Matroids,"* CC-89-16.
G.N. Frederickson, *"The Information Theory Bound is Tight for Selection in a Heap,"* CC-89-17.
V. Vinay and V. Chandru, *"The Expressibility of Nondeterministic Auxiliary Stack Automata and Its Relation to Treesize Bounded Alternating Auxiliary Pushdown Automata,"* CC-89-18.
M.J. Kaiser, T.L. Morin and T.B. Trafalis, *"Centers and Invariant Points of Convex Bodies,"* CC-90-1.

BOOK REVIEWS



Practical Methods of Optimization

by R. Fletcher
Wiley, Chichester, 1987
ISBN 0-471-92547-5

The book under review is the second edition of a textbook for senior, undergraduate and postgraduate students taking courses in optimization. It aims to present those aspects of optimization methods which are currently of foremost importance in solving real life problems.

With an emphasis on practicability, throughout the book most attention is given to methods that have proven to be reliable and efficient. For each of these methods, the basic features are described together with heuristics which can be valuable in making the methods better perform in practice. Also detailed numerical evidence gives an idea of the relative strength and weakness of each method. Though the theoretical background is assigned an important role, it is presented not from the viewpoint of theory for theory's sake but in close connection with practical aspects of the methods.

Part I (Chapter 1 to Chapter 6) is devoted to unconstrained optimization. After an illuminating introduction, Chapter 2 discusses the structures of iterative methods and explains some general schemes of unconstrained optimization as well as certain desirable features like convergence, stability and use of quadratic model. Chapter 3 describes Newton-like methods. An important place is given to the BFGS formula which is currently regarded as the best quasi-Newton method. Also numerical experiments are discussed which provide useful information about the behaviour of the methods in practical implementation. Chapter 4 describes conjugate direction methods. It is shown in particular how conjugate gradient methods are both less efficient and less robust than quasi-Newton methods (therefore would not be preferred in normal circumstances) but may be the only methods applicable to large problems. Chapter 5 presents an extensive treatment of restricted step methods or trust region methods which retain rapid rate of convergence of Newton's but are generally applicable and are globally convergent. Finally, Chapter 6 discusses sums of squares and nonlinear equations. Since these are encountered in data fitting problems which are the most frequently solved of all optimization problems, they are thoroughly treated, in line with the practicability theme of the book. In particular, the treatment includes the Dennis-Moré theorem characterizing superlinear convergence in nonlinear systems and its significance.

On the whole, Part I provides the reader with an up-to-date knowledge of the basic theoretical background and standard techniques of unconstrained optimization.

Part II (Chapter 7 to Chapter 13) is devoted to constrained optimization which is a subject of greater complexity than that treated in Part I. In fact, since the study of constrained optimization is much less advanced than that of unconstrained optimization (e.g. suitable test problems are lacking), numerical evidence is given much less attention here than in Part I. After an introduction (Chapter 7), linear programming is presented in Chapter 8 in much more detail than in the first edition, in view of the most recent developments in polynomial algorithms for linear programming (Khachian, Karmarkar, ...). Of course, the presentation is at an advanced level and stresses features directly related to practical implementation, such as numerical problems due to magnification of round-off errors, stability, degeneracy, and exploiting of sparsity. Also a succinct description is given of the ellipsoid algorithm and Karmarkar's algorithm. Chapters 9, 10 and 13 describe the standard theory of constrained optimization (Lagrange multiplier, first and second order conditions, convexity) together with some advanced features (complementary pivoting and the like) and techniques for general linearly constrained optimization. Emphasis is placed on active set strategies which are rightly regarded as most intuitive and flexible. On the other hand, convexity and duality are given a relatively modest role. The most interesting Chapter of Part II is perhaps Chapter 11 devoted to nonlinear programming. Although, as the author says, there is no general agreement on the best approaches and much research is still to be done in nonlinear programming, this chapter offers an excellent and up-to-date account of the situation. Penalty and barrier functions, multiplier penalty function, and L1 exact penalty function are treated extensively. The SQP method, which can be motivated as a Lagrange-Newton's method (Newton's method applied to find the stationary point of the Lagrangian function) is discussed in detail. It is shown that this method has local second order convergence and thus has the same convergence rate for nonlinear programming as Newton's method does for unconstrained minimization. New developments, particularly in the case where only the reduced Hessian matrix is used, convince the reader of the importance of this method. Since SQP requires computing second derivatives, a quasi-Newton version is presented which should be successful on small and medium size problems. The Maratos effect is also discussed, showing the complexity of the problem. The last two chapters, 13 and 14, are devoted to other optimization topics such as integer programming, geometric programming, network programming, and nonsmooth optimization.

As compared with the first edition of the book, the presentation in this second edition has been very much improved and updated. No doubt this is not only an excellent textbook for students but also a very useful tool for researchers and anyone who has to solve practical problems in real life by optimization methods.

HOANG TUY

CONTINUES

Classical Principles and Optimization Problems

by B. S. Razumikhin
Reidel, Dordrecht, 1987
ISBN 90-277-2605-1

The book is devoted to mathematical programming and optimal control problems, but the main idea is to use laws and tools of mechanics and thermodynamics for foundation and derivation of numerical methods. So there is a new and important connection between physics and modern methods of optimization and OR. According to the author's opinion, the book is not only written for specialists in the field of optimization but for a wider group of readers.

In chapter 1 the principle of virtual displacement (the initial formulation was given by Bernoulli) is treated. Using the contribution of Lagrange (analytical statics and analytical dynamics by unifying that principle with d'Alembert's principle), the author points out that in a conservative field the equilibrium of systems under unilateral and bilateral constraints is mathematically equivalent to the general problem of mathematical programming.

By realizations of the detachment principle some optimization methods (i.e. penalty methods) can be derived (chapter 2). After investigation of the well-known energy theorem, interesting consequences follow for duality theory and for numerical methods. We refer especially to application of the principles of maximum work and of minimum work (chapter 3). Chapter 4 covers physical models for systems of linear equations and inequalities and shows connections to the alternative theorems and the methods of surplus constraints and surplus variables. Chapters 5 and 6 mention the hodograph method LP and algorithms for shifting elastic constraints for LP problems. Other essential topics of mathematical programming are investigated in the next three chapters: maximum flow in networks (chapter 7), the transportation problem (chapter 8) and decomposition methods in LP (chapter 9). Moreover, a general approach to gradient methods is given (chapter 10) and the aggregation of constraints is stressed (chapter 11).

Chapter 12 is devoted to the laws of thermodynamics. Studying quite different systems (economical, physical, social and others), processes exist which are to be considered as transfer or distribution of resources. Such problems can be found in chapters 13-15; we refer especially to models of economic equilibrium and to von Neumann's model of economic growth. The last three chapters of the book deal with analytical dynamics and optimal control (chapters 16-18). The author gives good insight into some variational principles, emphasizing the historical developments. As is known, the initial foundation of the calculus of variations is closely related to the Lagrange-Hamilton integral extremal principles of analytical dynamics. In addition to some basic results about such principles, a variety of tools and methods is presented. Thus the book is full of interesting ideas for combining physical (mechanical) principles with both theoretical results and numerical methods of optimization. It is a good and fundamental contribution for understanding the basic ideas of important and often used classes of such methods. Although there have been some earlier relevant papers, the book presents a really new look at optimization theory and optimization methods, demonstrating the value of analogies.

K.-H. ELSTER

Probabilistic Analysis of Algorithms

by M. Hofri
Springer, Berlin, 1987
ISBN 3-540-96578-5

The judgement of algorithms based on probabilistic criteria about their efficiency has gained importance during the last decade. This is due partly to the fact that the growing capacity of computers enables us to attack (at least try) very high-dimensional problems. As long as these problems stem from real-world applications, our interest is mostly success-oriented, not generality-oriented. That means that we are content to have a solution for our specific problem-instance, and we do not pay much attention to the possibility of generalizing our solution-method to a large class (or all) problems of the given type. Hence a bad "worst case-behavior" may not adequately describe an algorithm because the method could be very efficient in "most of the cases". In the latter case it could be recommended to make use of that algorithm - quite in contrast to recommendations in the early days of theoretical computer science.

Another question is how to get probabilistic criteria. One way would be the random generation of problems and their experimental solutions followed by statistical evaluations of the observed efficiency of the employed algorithms. However, the disadvantages are many: Numerous experiments have to be executed until our statistical results are reliable. This requires a tremendous amount of computer capacity. (Didn't we want to save capacity by studying the efficiency?) Judgements on the behavior for very high dimensions and asymptotic (more qualitative) statements are impossible per se, because the capacity is limited. And our statistical evaluation provides us with numbers but not with an insight into how the algorithm works. Misinterpretations of the statistical data are a frequent consequence.

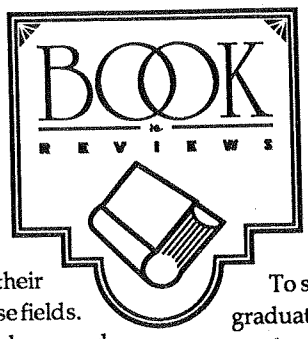
The second way to get probabilistic criteria, which is more complicated but also more rewarding, is as follows:

Step 1: Define a stochastic model about the distribution of the problem-instances.

Step 2: Characterize the principal behavior of the algorithm on a given and fixed set of data so that this behavior can be interpreted as a random variable.

Step 3: Derive probabilistic statements on that random variable by accumulating overall possible problem-instances.

The art of carrying out such a probabilistic analysis is what the author deals with. It turns out immediately that every such project is a very hard task. This is impressively demonstrated in this book.



After a short introductory chapter, much attention is paid to the mathematical tools for doing the evaluation step. These tools stem from different fields of mathematics and their application requires a certain amount of knowledge in these fields. In chapter 2 the author deals with Bernoulli numbers and polynomials, generating functions for probabilities and moments, Lagrange Expansions, Poisson transforms, Laplace transforms, Mellin transforms and summation formula. Further topics are the symbolic operator methods, asymptotics from generating functions (mainly complex functions-theory). Following this is a paragraph with selected results (the most useful ones) from probability theory. So far we have a large collection of tools, tricks and ideas which could be useful for Step 3. However, there is still no direct and inevitable connection to probabilistic analysis of algorithms. The following three chapters (3, 4, 5) accomplish this purpose.

Chapter 3 deals with algorithms for determining the maximal value among n numbers and for sorting them. Here and in the following chapters we get a hint of what is to be done in Step 2; and Step 3 is given in detail. Chapter 4 describes algorithms for communication networks. Here the interest is directed towards the capacity or the average number of useful messages such a network can carry under a variety of different modes of communication requirements. Further issues are collision resolution, message delay, etc. This chapter is, in my view, much more complicated than the others.

Chapter 5 reports on probabilistic evaluation of bin packing heuristics, particularly the next-fit and next-fit decreasing packing methods. Here results on the average number of bins, on the number of pieces packed into the specific bins and on the total load in these bins are derived under uniform distribution on $[0, 1]$ respectively $[0, a]$ with $a < 1$, where the bin capacity is constantly 1. An appendix provides the reader with many additional formulas for the evaluation.

The three main chapters are meant to give typical examples for probabilistic analyses. It cannot be the aim of such a book to give a complete overview. In the latter case it would have been necessary to dispense with the derivations. But here the strong emphasis on the techniques sometimes leads to a situation where the main theorems and results get into the background.

Every paragraph is followed by many interesting, instructive and challenging exercises. (This is true of the whole book.) It takes a great deal of mathematical effort for the reader to verify all the technical derivations. Simultaneously, the reader is provided with a significant number of evaluation concepts and techniques. It may be relevant to mention that I could solve a long open problem by use of one trick which I had found in the book.

As in the closely related book of Kemp, *Fundamentals of the Average Case Analysis of Algorithms*, the emphasis is put on the evaluation side and hence the reader has the impression of having a "textbook of mathematical tricks" in hand. Thus there is a definite need for a book which covers the difficulties and ideas of Step 2, i.e. of making an algorithm or problem analyzable and of recognizing which algorithms could be attacked successfully.

To summarize, this is a book of very high standard, suited for graduate students with a broad education in mathematics. It is also extremely useful for people doing research in that field by providing them with many technical tricks. And it is very interesting for mathematicians in general who want to learn which and how many fields of mathematics enter this theory. It is another proof that mathematics is a unit. It is not all a survey and it emphasizes the evaluation aspect very strongly. For people willing to invest a lot of effort in reading and in following the ideas of the author, I can definitely recommend this book.

KARL HEINZ BORGWARDT

Algorithmics: Theory and Practice

by B. Brassard and P. Bratley
Prentice Hall, New Jersey, 1988
ISBN 0-13-023243-2

After reading or browsing through this book, many teachers will feel stimulated to teach a course on algorithms and their analysis. I am also certain that many students will be excited enough to go out and program some of the algorithms analysed or suggested as exercises in the book.

The first chapter introduces most of the concepts that are needed: algorithms, average and worst case analyses and their importance, as well as some of the examples and the important data structures that crop up throughout the book. In the second chapter the reader gets down to the serious business of analysing the efficiency of algorithms. Asymptotic notation is introduced in a somewhat nonstandard form, and then several sorting algorithms including heapsort, Euclid's algorithm and set merging algorithms are analysed. This leads naturally to a clear section on the study of recurrence relations. These two important chapters are not simple, and as the authors suggest this is a book for advanced undergraduate or graduate courses. However, there are many examples, sections and ideas that could be used somewhat earlier in discrete mathematics and algorithm courses.

The book continues with chapters on greedy algorithms, divide and conquer and dynamic programming. That on greedy algorithms looks at tree and shortest path problems on graphs, scheduling problems, such scheduling unit processing time jobs with deadlines, for which the greedy algorithm is optimal, and terminates with a section on greedy heuristics, which is disappointingly brief given their wide application. The section on divide and conquer deals with many important examples of recursion and top-down decomposition or simplification. Binary search, quicksort and median finding algorithms, and the recurring problem of multiplication of large integers are tackled. Dynamic programming is presented in contrast as a bottom-up approach with chained matrix multiplication, shortest paths and optimal search trees as the main examples.

CONTINUES

The authors suggest that a one semester course should consist of the above five chapters and a selection from the remainder, entitled respectively: exploring graphs; preconditioning and precomputation: probabilistic algorithms: transformations of the domain and introduction to complexity. Each is fascinating, though my preference goes to the first three. The chapter on graphs, which I would also consider as basic and would introduce much earlier, treats the obvious but important topics of traversing trees and the connectivity questions that can thereby be treated. Finally it examines the concepts of backtracking and branch and bound using the 8 queens problem as a fascinating example.

Preconditioning is presented via the problems of repeated evaluation of a polynomial and string searching problems. The long chapter on probabilistic algorithms is compulsive reading, presenting clearly the different possible approaches. One section deals with randomness in numerical problems as in simulation or numerical integration. Another treats Monte Carlo algorithms that with a small probability give a wrong answer such as those for primality testing or testing the equality of two sets. A third deals with Las Vegas algorithms that occasionally fail to give a solution, with, as examples, the problems of finding square roots modulo an integer, and of factorisation. Searching and hashing algorithms make up another section in which the random choices lead to an algorithm whose worst case expected running time on any given instance is improved.

The penultimate chapter is mainly devoted to the fast Fourier transform and the multiplication of large integers, and the final chapter on complexity introduces decision trees, the concept of reduction for matrix graphical and polynomial problems, and NP-Completeness.

Altogether there is a world of material in this book, and mathematical programmers from all walks of life should find topics to amuse, interest or stimulate them.

LAURENCE A. WOLSEY

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Gallimaufry

THE mathematical programming community was saddened by the news in April of the death of **Stella Dafermos** (Brown). Stella, a leading researcher in the transportation science community, made many notable contributions to equilibrium models and algorithms. ¶**Craig Tovey** (Georgia Tech) has been awarded the Jacob Wolfowitz Prize for his paper "Simulated Simulated Annealing" which appeared in volume 8 of the *American Journal of Mathematical and Management Sciences*. ¶ORSA and TIMS awarded the 1990 John von Neumann Prize to **Richard M. Karp** (Berkeley) for his contributions to computational theory and algorithms in operations research and management science. ¶Deadline for the next OPTIMA is October 1, 1990.

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.

Journal contents are subject to change by the publisher.

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