OPTIMA

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER

No 43 July 1994

After three meetings, the IPCO (Integer Programming and Combinatorial Optimization) conferences are establishing themselves as important events for the integer programming community. The following article describes the meetings.

Fourth IPCO Conference

Copenhagen, 1995

A call for papers currently is being distributed.

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History and Scope of IPCO

BY KAREN AARDAL, RAVI KANNAN AND WILLIAM R. PULLEYBLANK

There are two key features of the IPCO conferences: **FIRST**, there are no invited talks; instead, a program committee selects the contributions on the basis of extended abstracts submitted by prospective participants. **SECOND**, the papers at the meeting are presented in a single stream (no parallel sessions), and preliminary versions of all papers are provided to participants at the time of the meeting.

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The format of IPCO, although new to our community, has been used by computer scientists for many years. It was the STOC and FOCS meetings, organized by ACM and IEEE, that gave Ravi Kannan and William Pulleyblank the idea to propose a conference with this format. They presented their idea to the Mathematical Programming Society in 1987, and the Society responded positively and agreed to be an official sponsor. The first IPCO conference took place May 28-30, 1990, at the University of Waterloo, Canada, organized by Kannan and Pulleyblank. The following two meetings were held at Carnegie-Mellon University May 25-27, 1992, organized by Kannan, Egon Balas and Gerard Cornuejols, and at Centro Ettore Majorana in Erice, Italy, from April 20 to May 1, 1993, organized by Laurence Wolsey and Giovanni Rinaldi. The meetings are held every year in which no International Symposium on Mathematical Programming takes place, which means the next ones will be held in the spring of 1995 and 1996. The location and dates are Copenhagen, May 29-31, 1995, with Balas, Jens Clausen and Jörgen Tind as organizers, and Vancouver, probably in the week of June 3, 1996, organized by William Cunningham and Maurice Queyranne. More information about the Copenhagen conference is presented on Page 3.

The two themes — integer programming and combinatorial optimization — are viewed in a broad sense, to include algorithmic and structural results in topics such as geometry of numbers, graph theory, matroids and submodular functions, in addition to more traditional fields. IPCO is not restricted to theory. Computational and practical work belongs to our field, and significant contributions involving implementations and applications are most welcome.

The main acceptance criteria used by the program committee are the quality and originality of the research, plus its interest to people working in the field. These acceptance criteria have made it possible for younger, less established researchers to present their results in an attractive format to a large audience of active researchers. In the first three meetings, a substantial portion of the presentations were given by graduate students and recent Ph.D. graduates, which is a sign of vitality in the field.

For the first three meetings, there were 76, 74 and 83 submissions, respectively. In each case, approximately 35 were selected for presentation.

Submission deadlines for IPCO conferences have been in the late fall of the year preceding the meeting. The submissions are in the form of extended abstracts of at most 10 pages. All submissions are read by the program committee and the decisions regarding which papers will be included in the meeting are made within about two months.

The program committee normally consists of established researchers from a broad variety of fields. Therefore, someone preparing an extended abstract can safely assume that a large portion of the committee will not be experts in the topic of the paper. These are precisely the readers to whom the abstract should be directed. Of course, correctness and newness of the claimed results is necessary, but this alone generally is not sufficient. It also is crucial that the importance of the work be understood by the committee.

Authors of accepted papers are asked to submit a final version, which may again be an extended abstract or a full paper. These are printed in the Proceedings, which are provided to all participants at the conference. These Proceedings serve as a conference record as well as a means of rapid dissemination of results, since they are published within about six months of submission. Most journals, including *Mathematical Programming*, do not view publication of an early version of a paper in an IPCO Proceedings as a prior publication, which could make the paper unacceptable.

The tight timing constraint places a heavy demand on the Program Committee members. It is appropriate here to remind authors that the submission of an extended abstract constitutes a commitment that if the paper is accepted, they will provide a Proceedings version, and at least one of the authors will be present at the conference to present the paper. At two of the three IPCOs so far, it has been possible to provide very limited support for some participants who need it. This may or may not be possible at future meetings.

Presentations at the conference are 30 minutes in length. Similar guidelines apply to them as to the extended abstracts: It is generally neither necessary nor desirable that presentations give full proofs or justifications (the proceedings serve this purpose better); they should convey the main results, an idea of why they are true and their relevance.

Fourth IPCO Conference, Copenhagen, 1995

By Jörgen Tind, University of Copenhagen

It is a pleasure for me to tell you a little about the local community surrounding the next IPCO conference to be held in Copenhagen May 29-31, 1995.

The scope of IPCO is integer programming and combinatorial optimization. So, clearly the program will be selected according to the chosen themes. However, these two disciplines are only a part of the entire optimization area. In fact, the area as such contains many examples of rich interaction between continuous and discrete optimization and receives a lot of valuable input from, for instance, computer science and mathematics.

This observation is from a scientific point of view but also applies when it comes to the role of the local environment surrounding the IPCO in Copenhagen. Here, it is natural to mention the schools, where optimization in general plays a major role, and names of senior people in some departments. This is done with no attempt to generate a complete list of schools or names, so please take the names mentioned just as a kind of address for their institutions.

Probably the Technical University of Denmark has the largest tradition. Recently, some of the optimization activities have merged and created a new department called the Institute for Mathematical Modeling. This rather unusual name is the result of a compromise, and it might change later. This institute has research activities in nonlinear optimization and in model and algorithm development for a range of optimization problems (Soeren Kruse Jacobsen, Kaj Madsen, Oli B.G. Madsen and R.Victor V. Vidal). In addition, at the Institute of Mathematics there is activity around optimization and graph theory (Martin Bendsoe, Carsten Thomassen). Since those institutes are located in an engineering school, the research has close links to problems in engineering. However, many projects also deal with planning and development in general.

The University of Copenhagen has two departments with activities in optimization. The Department of Computer Science has projects dealing with development and testing of algorithms to solve problems in combinatorial optimization (Jens Clausen, Jakob Krarup and Pawel Winter). Recently, optimization activities have started at the Institute of Mathematics. This is due to a joint program in mathematics and economics that is very popular and has attracted many students. (Recently I moved from the University of Aarhus, where a similar program has existed for 25 years, to Copenhagen to take part in this development.)

Since IPCO is in the frame of the Mathematical Programming Society, I should mention the Nordic section of MPS. A series of Nordic symposia on mathematical programming has taken place. The latest one was held May 8-10, 1994, in Linköping, Sweden, organized by Kaj Holmberg, University of Linköping, and Stein Wallace, University of Trondheim. The purpose was to discuss research projects linking together aspects of integer and stochastic programming.

With this background, the IPCO conference shall receive all the support it deserves from our local community to create a nice conference in cooperation with the international program committee. We also shall do our best for you to enjoy all other aspects of Copenhagen. The springtime in Copenhagen is beautiful, with a wealth of activities to enjoy inside and outside the city and conference buildings, at the sea, in restaurants and, of course, in Tivoli. See you in Copenhagen.

A call for papers currently is being distributed. Members of the program committee are: E. Balas, Carnegie-Mellon University (chair); R. Burkard, Graz Technical University; V. Chvatal, McGill University, Montreal; J. Clausen, University of Copenhagen; M. Fischetti, University of Padova; W. Pulleyblank, IBM T.J. Watson Research Center; J. Tind, University of Copenhagen; and C. Tomassen, Technical University of Denmark.

The organizers are Jens Clausen and Jörgen Tind, University of Copenhagen.

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The deadline for submission of extended abstracts of papers is Oct. 31, 1994.

Council NEWS

New Editors Selected

The Mathematical Programming Society Executive Committee met in Atlanta on Feb. 10, 1994, to recommend new editors for society publications. The full Council subsequently approved the choices.

Don Goldfarb (Columbia University, New York) has been appointed to a three-year term as Editor of ***Mathematical Programming Series A,*** starting Aug. 15, 1994. Goldfarb replaces Bob Bixby of Rice University, Houston, TX.

John Birge (University of Michigan, Ann Arbor) has been appointed to a three-year term as Editor of ***Mathematical Programming Series B,*** starting Aug. 15, 1994. Birge replaces William Pulleyblank of the IBM T.J. Watson Research Center.

New Nordic Section Leaders Elected

The Nordic Section of the Mathematical Programming Society held its third meeting in Linköping Feb. 11-13, 1994. About 25 people took part, coming from Norway, Sweden, Denmark and Iceland, plus Spain Portugal and Germany. The new group of leaders selected are:

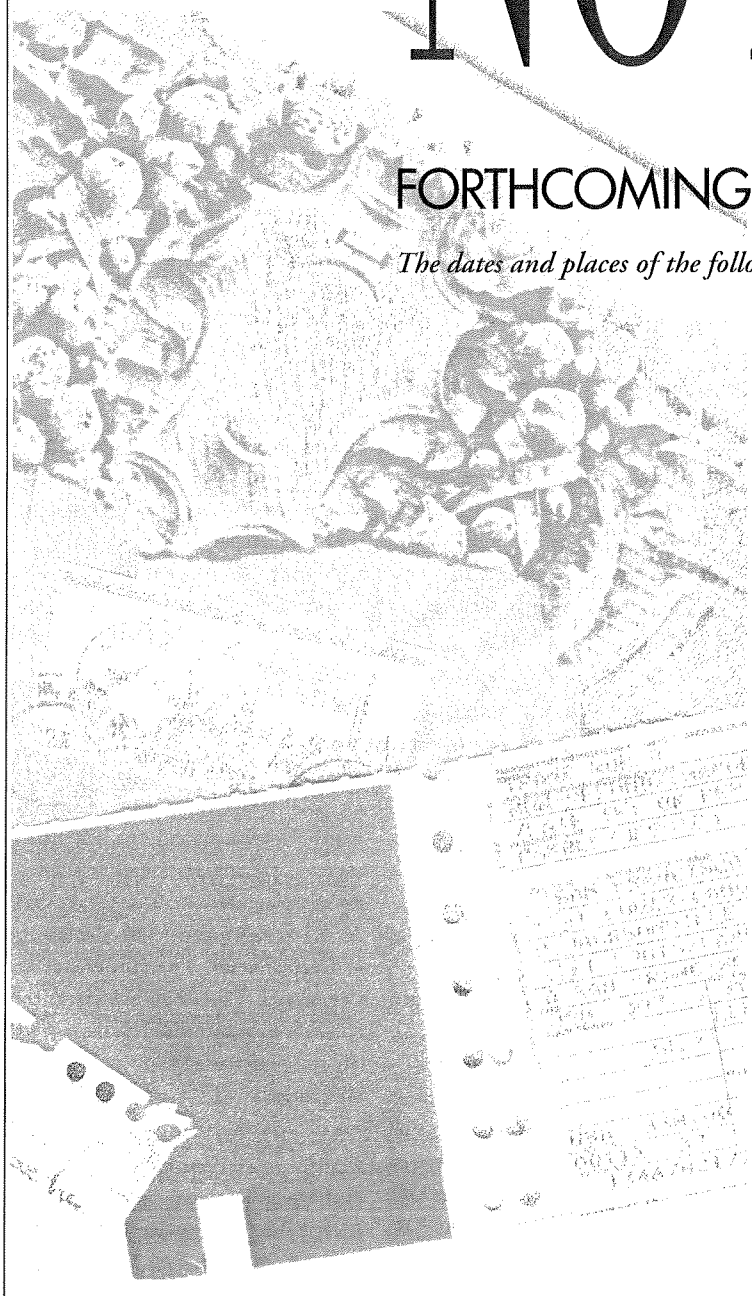
Kaj Holmberg (Linköping, Sweden, leader) `kahol@math.liu.se`

Kim Allan Andersen (Aarhus, Denmark) `kim@mi.aau.dk`

Dag Haugland (Stavanger, Norway) `haugland@hse.no`

It also was decided to run the fourth meeting of Nordic MPS in Aarhus in 1996, with Kim Allan Andersen as the main organizer.

CONFERENCE NOTES



FORTHCOMING CONFERENCES

The dates and places of the following conferences have been set:

The XVI International Symposium on Mathematical Programming will be held in Lausanne, Switzerland, in August 1997. Tom Liebling will chair the Organization Committee. Dominique de Werra will chair the International Program Committee.

The Fourth Conference on Integer Programming and Combinatorial Optimization will be held in Copenhagen, Denmark, on May 29-31, 1995. Jens Clausen and Jörgen Tind will chair the Organization Committee, and Egon Balas will chair the Program Committee.

The Fifth Conference on Integer Programming and Combinatorial Optimization will be held in Vancouver, Canada, in early June 1996. Maurice Queyranne will chair the Organization Committee and Bill Cunningham will chair the Program Committee.

Wilkinson PRIZE

for Numerical Software

*i*n honor of the outstanding contributions of James Hardy Wilkinson to the field of numerical software, Argonne National Laboratory, the National Physical Laboratory and the Numerical Algorithms Group award a numerical software prize of US $1,000. The first prize was awarded at the International Conference in Industrial and Applied Mathematics (ICIAM 91) to Linda Petzold for DASSL. The second prize will be awarded at ICIAM 95 in Hamburg, Germany, July 3-7, 1995.

Rules for Submission

Each author of an entry must be under 40 years old on Jan. 1, 1995. Each entry must contain the following: ▲ Software written in a widely available, high-level programming language. ▲ A paper describing the algorithm and the software implementation. The paper should give an analysis of the algorithm and indicate any special programming features. ▲ Documentation of the software, which describes its purpose and method of use. ▲ Examples of use of the software, including a test program and data. ▲ A one- or two-page summary of the main features of the algorithm and software implementation.

Submissions must be in English. Entries must be received by Nov. 1, 1994.

The awards will be made to the entry that best addresses all phases of the preparation of high-quality numerical software, including clarity of the paper and software implementation and documentation; portability, reliability, efficiency and usability of the software implementation; depth of analysis of the algorithm and the software; importance of application addressed in the software; and quality of the test software.

Software can be submitted on 3.5-inch high-density (1.44 MB) diskettes, one-quarter cartridge tape (60 MB or 150 MB), 8mm cartridge tape (2GB), or sent by e-mail. Submissions should be in the form of a tar archive with a *README* file describing the contents of the archive. Makefiles for executing test programs must be included. Submissions can be sent by e-mail to `wilkinson_prize@mcs.anl.gov`, or to the Board of Trustees, Wilkinson Prize for Numerical Software, at one of the following two addresses.

Argonne National Laboratory
Mathematics and Computer Science Division
9700 S. Cass Ave.
Argonne, IL 60439
United States

Numerical Algorithms Group Ltd.
Wilkinson House
Jordan Hill Road
Oxford, OX2 8DR
United Kingdom

Humbolt Scholarships, Fellowships Offered

The Alexander von Humbolt Foundation of Bonn, Germany, promotes international scholarly cooperation through research and supporting activities. Since 1953, the Foundation has enabled more than 3,000 highly qualified individuals from the United States to participate in collaborative research projects conducted in Germany. The Foundation's North American Office in Washington, DC, provides information on collaborative research opportunities to American scholars. The Foundation is offering numerous programs and awards to promote this cooperative research.

For more information about the Alexander von Humbolt Foundation and its programs, please contact Bernard Stein, the Alexander von Humbolt Foundation, Suite 903, 1350 Connecticut Ave., NW, Washington, DC 20036; Tel: (202) 296-2990; Fax: (202) 833-8514.

O P T I M A

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JOURNALS

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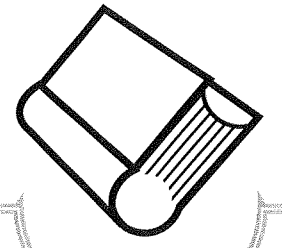
BOOK REVIEWS



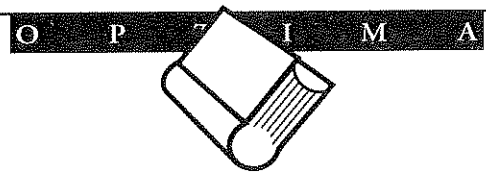
Nonlinear Programming: Theory and Algorithms

by M.S. Bazaraa, H.D. Sherali and C.M. Shetty
Interscience Series in Discrete Mathematics and Optimization
John Wiley, Chichester, 1993
ISBN 0-471-599973-5

This book deals with topics on the foundation of optimization and computational methods for nonlinear programming. This second edition contains new material. It consists of 11 chapters, two appendices, a subject index and a bibliography. Each chapter begins with an outline and terminates with extensive exercises, notes and references. The path to be followed is discussed in the preface.

Chapter 1, "Introduction," presents the nonlinear programming problem and gives some interesting real-life examples taken from different engineering disciplines. Chapters 2 and 3 cover the topics of "convex sets" and "convex functions and generalizations." As applications, Chapter 2 also reviews the well-known simplex and other related methods for linear programming. Chapter 4 derives "The Fritz John and the Karush-Kuhn-Tucker Optimality Conditions" for inequality and equality-constrained problems, while Chapter 5, "Constraint Qualifications," develops the latter conditions directly without first deriving the former ones. Second-order necessary and sufficient conditions also are derived.

Chapter 6 deals with "Lagrangian Duality and Saddle Point Optimality Conditions" and briefly discusses linear and quadratic programs. Chapter 7 studies "The Concept of an Algorithm." Unconstrained optimization is the subject of Chapter 8. This chapter contains theoretical background and standard techniques such as line search and trust region methods, Newton and quasi-Newton methods, and conjugate direction methods. It also studies a subgradient method for nonsmooth optimization.



"...throughout the book, the authors have successfully attempted to ensure that relevant material is illustrated by many interesting examples, graphs and extensive exercises."

Chapters 9, 10 and 11 are, respectively, devoted to "Penalty and Barrier Functions," "Methods of Feasible Directions" and "Linear Complementary, Quadratic, Separable, Fractional and Geometric Programming Problems." Methods for linear programming also are discussed on the basis of the material in Chapters 9 and 10. Appendix A (11 pages) provides some basic definitions and mathematical concepts (related to vectors, matrices and real analysis), which frequently are used in the book. Since several definitions and results were introduced in the text, the authors have provided Appendix B (11 pages), which gives a summary of the relevant results on convexity, optimality conditions and duality.

It would have been nice if the book also had an appendix containing a summary of the notations used in the book. However, throughout the book, the authors have successfully attempted to ensure that relevant material is illustrated by many interesting examples, graphs and extensive exercises. The exercises also aim to extend material already covered and explore new areas. For example, the well-known symmetric rank one updating formula was covered in an exercise. In some cases the exercises were useful for mini-research projects, while in other cases the objective within the questions is to provide algorithms. The book provides an impressive 50-page bibliography containing more than 1,200 entries, which allows one to pursue special material in the original papers. However, there are many citation misprints. With the exception of the misprints, the book is quite clean of typos and errors.

As a final analysis, the book is well written and contributes significantly to its field. It is highly recommended as a text for students and practitioners of fields related to optimization techniques. It also is very useful as a reference for researchers in nonlinear programming.

— BY M. AL-BAALI

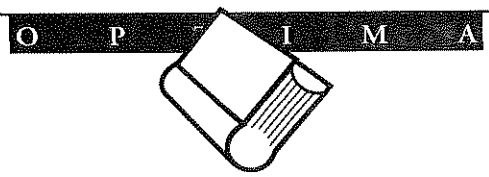
Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computing

J. Dongarra et al., eds.
SIAM, Philadelphia, PA, 1992

ISBN 0-89871-303-X

These excellent proceedings give a wide coverage of the maturing area of parallel processing. They are divided into six sections: Matrix Computations, 22 papers spread over Dense Linear Algebra, Sparse Direct Methods and Iterative Methods; Nonlinear Equations and Optimization, nine papers; Differential Equations, 13 papers; Applications, Modeling and Simulations, 15 papers spread over Biology, Reservoir Simulation, and Simulation and Modeling; Performance Evaluation and Software Tools, 31 papers spread over Performance, Parallel Software Development Tools, Programming Environments and Novel Architectures; and Mathematical Software, four papers.

As the proceedings of a specialist conference, the papers are definitely not for beginners in parallel processing, as authors use terms such as BLAS and GMRES without explanation or reference. On the other hand, most papers, though short, are clearly written. Many have small examples and/or pseudocode. In many of the papers in the Matrix Computations section, the area with which I am most familiar, there is sufficient algorithmic detail to enable the reader to implement an efficient algorithm based on the ideas in the papers.



Virtually all papers give numerical results. Many compared several approaches to a problem implemented on the same machine, or alternatively, the same algorithm or problem implemented on different machines. Both SIMD and MIMD architectures are discussed and include machines with small numbers of processors, typically the iPSC/860 arrays of transputers, some of which were quite large, more intermediate machines such as the nCUBE2, massively parallel machines, of which the CM2 seems to be the most popular, and large vector machines such as the CRAYs and IBM 3090s. A number of heterogeneous networks and special-purpose architectures are described. Almost all codes were written in FORTRAN, sometimes with parallel additions. Now that the field is maturing, there is an interest in portability, and several metalanguages were proposed.

The only universal conclusion was that for the CM2, slicewise processing (using 64-bit chips as the basic unit) gave better performance than fieldwise (single-bit processors as the basic unit). A number of papers showed that a MIMD machine with a modest number of processors (up to 128) or a CM2 could give equivalent performance to a CRAY Y-MP. Just as many papers still favored the large vector supercomputers over other architectures. It was obvious that performance on any machine still is very much a function of the problem type, the parallelization algorithms used and experience with a particular architecture.

Almost all papers were written in TeX, which gave a somewhat more uniform appearance to the volume than is often the case with proceedings. However, editing would have reduced the authors' errors. Particularly for the type of work described here, readers would appreciate an e-mail address for each paper. An index of all authors also would have been helpful.

There is a wealth of useful material here. The book would be a valuable addition to the shelves of any group involved in parallel processing. For anyone wishing to enter the field, it would, with some background reading, provide an excellent overview. Unfortunately, as with all such proceedings, some of the material already is dated. However, the implementation details and problems encountered still would be most useful to anyone tackling a new area, architecture or machine.

This book gave me many stimulating ideas for my own work. I think it would do so for others. It also is an excellent advertisement for future SIAM Conferences on Parallel Processing.

— BY JENNY EDWARDS

"There is a wealth of useful material here. The book would be a valuable addition to the shelves of any group involved in parallel processing. For anyone wishing to enter the field, it would ... provide an excellent overview of the field."

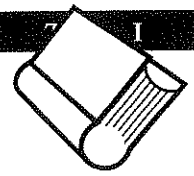
Spline Functions and Multivariate Interpolations

by B.D. Bojanov, H.A. Hakopian and A.A. Sahakian
Kluwer Academic Publishers, Dordrecht,
The Netherlands, 1993

ISBN 0-7923-2229-0

Spline theory is a rich subject. With the benefit of hindsight, one can find pieces of it in papers hundreds of years old and older. One also can give an introduction to it from many different points of view.

By all appearances, the present book serves two masters. Chapters 1-8 give a careful introduction to splines of one variable, with special emphasis on the topics to which the first author has significantly contributed, such as various extremal problems for which splines (monosplines, perfect splines and natural splines) are solutions. Also, periodic splines get detailed treatment. Chapters 9-14 provide a view of splines of several arguments, with special emphasis on the topics to which the second and also the third author have contributed significantly, such as variants of Kergin interpo-



lation and other multivariate polynomial interpolation schemes including interpolation to data given on hyperplanes, and also the approximation from spaces spanned by the integer translates of a so-called box spline.

The expert is delighted to have so readily available, in one volume, this careful presentation of recent results by the authors together with a careful telling of all the background needed. The Western expert can pick up useful clues to the Eastern European literature on splines.

The chapter headings are: 1. Interpolation by algebraic polynomials; 2. The space of splines; 3. B-splines; 4. Interpolation by spline functions; 5. Natural spline functions; 6. Perfect splines; 7. Monosplines; 8. Periodic splines; 9 Multivariate B-splines and truncated powers; 10. Multivariate spline functions and divided differences; 11. Box splines; 12. Multivariate mean value interpolation; 13. Multivariate polynomial interpolations rising by hyperplanes; and 14. Multivariate pointwise interpolation.

The novelty of the material covered is indicated by the fact that Chapter 13 is, in essence, a paper that will appear in print sometime in 1994.

The spelling of names from the Western literature shows the effect of filtering through some other language and alphabet. Thus Birkhoff and Dahmen both often appear without their "h." The fact that English is not the native tongue of the writers expresses itself in the occasional misprint. (My favorite was the "unite cub.")

My only real complaint about the book is that the index is only two pages long.

— BY CARL DE BOOR

"The expert is delighted to have so readily available, in one volume, this careful presentation of recent results by the authors together with a careful telling of all the background needed. The Western expert can pick up useful clues to the Eastern European literature on splines."

Enhanced Nonlinear Programming Code Available

The CFSQP optimization software (C code) has just undergone a major upgrade (the new feature is not available in FORTRAN FSQP). The new version, CFSQP 2.0, includes a new scheme to efficiently handle problems with many sequentially related objectives or constraints (e.g., discretized versions of continuous minimax problems or of problems involving a continuum of constraints—i.e. of semi-infinite problems).

FSQP(Feasible SQP; FORTRAN; developed by J.L. Zhou and A.L. Tits at the Institute for Systems Research, University of Maryland, College Park) and CFSQP (C version of same with enhancements; port and enhancements due to C.T. Lawrence, also with the ISR) are software packages aimed at solving constrained optimization problems, including constrained minimax problems (where the max is taken over a finite number of smooth functions).

(C)FSQP's main distinguishing feature is that all the iterates it generates satisfy the constraints, except for nonlinear equality constraints, for which mere "semi-feasibility" is maintained (given a scalar constraint h(x)=0, if h(x0)<=0 (resp. >=0), then h(xk)<=0 (resp. >=0) for all k). This is of value in many engineering-related problems. Extensive numerical tests show that (C)FSQP's efficiency is comparable to that of the most popular (non-"feasible") codes. Detailed User's Manuals are available.

(C)FSQP is available free of charge to academic and other non-profit organizations (as well as, for an evaluation period, to for-profit organizations), but may not be redistributed without the authors' approval. To obtain FSQP or CFSQP, please contact Andre Tits (andre@eng.umd.edu).

Gallimaufry

O P T I M A

Nº 43 *July*1994

OPTIMA has received a 1993 President's Award for Publication Excellence from the University of Florida. Congratulations to Designer Elsa Drake and Assistant Editor Richard Jones for this much deserved recognition of their fine work. ¶The 17th IFIPTC7 Conference on System Modelling and Optimization will be held July 10-14, 1995 in Prague. Contact the secretariat via phone +42 6641-4554, fax: +42 2 6641-4903, or e-mail: ifip@utia.cas.cz. ¶Deadline for the next OPTIMA is October 1, 1994.

Books for review should be sent to the Book Review Editor,
Professor Dolf Talman
Department of Econometrics
Tilburg University
P.O. Box 90153
5000 LE Tilburg
Netherlands

Journal contents are subject to change by the publisher.

Donald W. Hearn, EDITOR
Dolf Talman, ASSOCIATE EDITOR
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Richard Jones, ASSISTANT EDITOR
Elsa Drake, DESIGNER

Application for Membership

Mail to:
The Mathematical Programming Society, Inc.
c/o International Statistical Institute
428 Prinses Beatrixlaan
2270 AZ Voorburg
The Netherlands

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