OPTIMA
MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER
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Number 12

New Orchard-Hays Prize to be awarded in Boston

William Orchard-Hays has been a leader in the development of mathematical programming software since the original development of a Simplex code for the IBM 701 at the RAND Corp. in the early 1950's.

At the XII International Symposium on Mathematical Programming in Boston, Massachusetts, in August, 1985, The Mathematical Programming Society will confer for the first time the Orchard-Hays Prize for Excellence in Computational Mathematical Programming. The prize for 1985 consists of $500, travel expenses to attend the meeting, and a commemorative plaque.

Topics covered by the term "computational mathematical programming" include new computational methods in the field of mathematical programming together with experimental evidence of their effectiveness, development of methodology for testing mathematical programming software, procedures for improving the efficiency and accuracy of existing algorithms, and procedures for analyzing large-scale mathematical programming models.

Through the awarding of this prize, the Committee on Algorithms (COAL) together with the MPS Council has found an appropriate vehicle for rewarding and recognizing excellence in an important aspect of our field: computation. The screening of books and papers for the 1985 Orchard-Hays prize will be carried out by a committee chaired by Professor George Dantzig. This prize is funded by industry which has long acknowledged the usefulness of computational mathematical programming.

To be eligible for the Orchard-Hays Prize, a book, a paper, or a group of papers must meet the following requirements. (1) It must be on computational mathematical programming. (2) It must have appeared in the open literature. (3) Documentation must be written in a language acceptable to the screening committee. (4) Papers eligible for the 1985 prize must have been published within the years 1979 through 1984.

Judgements will be made by the Committee using the following criteria: (1) The magnitude of the contribution to the advancement of computational mathematical programming, (2) The originality of ideas and methods, (3) Degree to which unification or simplification of existing methodologies is achieved, and (4) Clarity and excellence of exposition.

To be eligible for consideration, the book or paper must be nominated to the Committee. This notice constitutes a call for nominations. Nominations should be sent to: George Dantzig, Chairman, Orchard-Hays Prize Committee, Operations Research Department, Stanford University, Stanford, California.

Nominations must be in writing and include the title(s) of the paper(s) or book(s), 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. All nominations must be received by December 31, 1984, to allow time for adequate review.

The 1985 Orchard-Hays Prize Committee consists of George Dantzig, Alan Goldman, Harvey Greenberg, Karla Hoffman, Robert Schnabel, David Shanno, Douglas Shier and Phil Wolfe.

Karla Hoffman

Recent MP Works chosen by Lanchester Prize Committee

Karl-Heinz Borgwardt is the recipient of the 1982 Lanchester Prize for two papers on the complexity of the simplex method, and a new dynamic programming book by Eric Denardo (Yale) shared honorable mention with the text *Stochastic Models in Operations Research, Vol. 1,* by D. P. Heyman and M. J. Sobel. The prize is awarded annually by the Operations Research Society of America.

The citations of the mathematical programming works are quoted below:

"Honorable Mention to Eric V. Denardo, for *Dynamic Programming, Models and Applications*, Prentice-Hall, Inc. This text is outstanding for its careful, clear presentation of complicated issues, developing our intuition while leading us deep into theory and up to the frontiers of research. Important topics are covered here for the first time in a text book; much material has never been published. The many problems, some extremely challenging, extend coverage to many special topics in the recent literature. This well organized, innovative and unifying work, by one of the major figures in the field, fills a long-felt gap in the literature superbly.

"The 1982 Lanchester Prize to Karl-Heinz Borgwardt for the two articles, *Some Distribution-Independent Results About the Asymptotic Order of the Average Number of Pivot Steps of the Simplex-Method*, Mathematics of Operations Research 7.3 (August 1982) pp. 441-462, and *The Average Number of Pivot Steps Required by the Simplex-Method is Polynomial*, Zeitschrift fur Operations Research Series A: Theory 26.5 (September 1982), pp. 157-177. Until recently there were three major open problems in the field of linear programming:

(1) Are linear programming problems solvable in polynomial time?

(2) Is there a polynomial time version of the simplex method? (see page 2)

CONFERENCE NOTES

Software Fair

The Committee on Algorithms is organizing a NATO Advanced Study Institute (ASI) on Computational Mathematical Programming to be held in Bad Windsheim, West Germany, from July 23 to August 2, 1984. The registrations show that a large percentage of participants are practitioners who need optimization algorithms as a tool in their application models, e.g. in mechanical engineering or operations research. Their main motivation is to learn new solution methods for solving optimization problems. In particular, they are very much interested in obtaining some information about corresponding computer programs. Therefore COAL plans to establish a software fair in the sense that information material about available optimization codes is to be displayed during the ASI and questionnaires are to be published in the conference proceedings. We all know that it is quite difficult to distribute software information to possible users, and COAL offers the chance for making some advertising for mathematical programming codes.

If you want to participate in the software fair, two actions are required:

a) Submit three copies of information material (e.g. code descriptions, user's guides, reports), which will be displayed for inspection during the ASI. Please understand that the available conference budget is limited and cannot be used for refunding your expenses.

b) Type one page of condensed information for each code you want to contribute to the fair, which will be retyped and published in the proceedings of the ASI. The form should contain the following items: name of the code, author(s), mathematical problem, domain of applications, mathematical method, programming language, computer systems where the code has been implemented, special program features, practical application problems solved by the code, condition of availability, charge, address from where the code can be ordered, references.

Please support our efforts to establish a qualified and extensive software fair. Feel free to distribute this request to other colleagues who might be interested in participating. Address your response to: Klaus Schittkowski, Institut für Informatik, Universität Stuttgart, Azenbergstr. 12, D-7000 Stuttgart 1, Germany F.R.

4th MP Symposium held at Kobe

The Fourth Mathematical Programming Symposium Japan was held on November 14 and 15, 1983, at Kobe International Conference Center in Kobe, Japan, with more than 180 attendants. Besides a majority of participants from Japanese universities and firms, several persons from Europe and America visiting Japan also participated.

This symposium has been held since 1980 to cover current topics in M.P., tutorials on a selected field, and real applications from invited speakers. This year four papers on recent developments in mathematical programming, three on Markovian decision processes and four on applications of mathematical programming, were presented. In addition, two guest speakers invited from overseas, Dr. Alan S. Hoffman, IBM, USA, and Professor Hsiang-Yuin Kwei, Academia Sinica, China, delivered special lectures titled *"Greedy Algorithms of Linear Programming"* and *"Some Applications of Mathematical Programming in China,"* respectively.

The proceedings of 233 pages including full papers of all presentations (ten papers in Japanese and four in English) was published.

Next year the Fifth Mathematical Programming Symposium Japan will be held in Fukuoka on October 11 and 12, 1984.

- R. Manabe

"Mathematics possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, sublimely pure, and capable of a stern perfection such as only the greatest art can show." —Bertrand Russell

Prize Committee *from page 1*

(3) How can the extremely good practically observed performance of the simplex method be explained?

"Problem (1) has been solved in a theoretical sense with the invention of the ellipsoid method. This approach provides a polynomial algorithm for linear programming which behaves very poorly in practice. However, it answered a question which had been bothering a large number of prominent scientists for about thirty years. The contributers to the ellipsoid method received the 1982 Fulkerson Prize for their results.

"Problem (2) is still open. It may happen, as in the case of the ellipsoid method, that if a provably polynomial time version of the simplex method is found, it will show bad practical behaviour. This, a positive answer to (2), would not necessarily solve (3).

"Problem (3) has been solved by Karl-Heinz Borgwardt in the papers cited above. Dr. Borgwardt shows that the average running time of a version of the simplex method is bounded by a polynomial in n (the number of variables) and m (the number of rows), i.e. that whenever we take an LP problem we may expect a good performance of the simplex method. Dr. Borgwardt's analysis shows that the examples of Klee and Minty type which force various variants of the simplex method to perform an exponential number of pivot steps are extremely rare.

"Solving an extremely important theoretical question that has defied researchers for decades is always an outstanding contribution to science. But here in addition the analysis is deep, clever and competent, and some beautiful ideas combining results from various areas of mathematics are developed which finally give the desired result. An interesting new version of the simplex method (Shadow Vertex Algorithm) is even designed.

"This work is not the last word to be said on the subject; indeed, there is currently a great deal of activity in the field. It is the opinion of this Committee, shared by many experts on the subject, that Dr. Borgwardt's results constitute a pioneering breakthrough which has excited and motivated others to work on this fundamental problem, and we have therefore selected him to receive the Prize."

1982 Lanchester Prize Committee
Hamilton Emmons, Chairman

C A L E N D A R

This Calendar lists noncommercial meetings specializing in mathematical programming or one of its subfields in the general area of optimization and applications, whether or not the Society is involved. (The meetings are not necessarily 'open'.) Any one knowing of a meeting that should be listed here is urged to inform Dr. Philip Wolfe, IBM Research 33-2, POB 218, Yorktown Heights, NY 10598, U.S.A; Telephone 914-945-1642, Telex 137456.

Some of these meetings are sponsored by the Society as part of its world-wide support of activity in mathematical programming. Under certain guidelines the Society can offer publicity, mailing lists and labels, and the loan of money to the organizers of a qualified meeting.

Substantial portions of meetings of other societies such as SIAM, TIMS, and the many national OR societies are devoted to mathematical programming, and their schedules should be consulted.

1984

June 12-14: SIAM Conference on Numerical Optimization, Boulder, Colorado, U.S.A. Contact: SIAM Services Manager, 1405 Architects Building, 117 South 17 Street, Philadelphia, Pennsylvania 19103, U.S.A. Telephone 215-564-2929.

June 11-16: Fifth Bonn Workshop on Combinatorial Optimization, Bonn, Federal Republic of Germany. Contact: U. Faigle, Bonn Workshop, Institut für Operations Research, Nassestraße 2, D-5300 Bonn 1, Federal Republic of Germany; Telex 886657 unibo d, Telephone (0228) 739285.

July 23 - August 2: NATO Advanced Study Institute on Computational Mathematical Programming, Bad Windsheim, Federal Republic of Germany. Contact: Dr. Klaus Schittkowski, Institut für Informatik, Azenbergerst. 12, 7000 Stuttgart 1, Federal Republic of Germany. Telephone 0711 2078 335. Sponsored by the Society through the Committee on Algorithms.

August 27-29: 9th Symposium on Operations Research, Osnabrück, Federal Republic of Germany. Contact: Professor Dr. P. Brucker, Universität Osnabrück, Fachbereich Mathematik, Postfach 4469, D-4500 Osnabrück, F.R.G. Telephone 0541 608 2564. Sponsored by the German Society for Mathematics, Economics, and Operations Research.

September 10-17: 'International Symposium on Stochastic Optimization', Kiev, U.S.S.R. Contact: Professor Andrzej Wierzbicki, International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria. Telephone 02236 71521, Telex 079137 iiasa a. Cosponsored by the Society through the Committee on Stochastic Programming.

October 11-12: Fifth Mathematical Programming Symposium Japan, Fukuoka, Japan. Recent Topics in Mathematical Programming, Stochastic Programming, and Applications. Contact: Professor Masao Iri (General Chairman), Faculty of Engineering, University of Tokyo, Bunkyo-ku, Tokyo 113, or Professor Nasata Furukawa (Program Chairman), Department of Mathematics, Kyushu University, Fukuoka 812, Japan.

1985

June 11-14: 5th IFAC Workshop on Control Applications of Nonlinear Programming and Optimization, Capri, Italy. Contact: Professor G. Di Pillo, Dipartimento di Informatica e Sistemistica, Università degli Studi di Roma 'La Sapienza', Via Eudossiana 18, 00184 Roma, Italy. Telephone (39) 6-484441.

August 5-9: Twelfth International Symposium on Mathematical Programming in Cambridge, Massachusetts, U.S.A. Contact: Professor Jeremy Shapiro, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA 02139, U.S.A. Telephone 617-253-7165. Official triennial meeting of the MPS.

BOOK REVIEWS

Optimization and Nonsmooth Analysis
By Frank H. Clarke
John Wiley, New York 1983, 308 p.

During the last decade considerable progress was made in the analysis of nonsmooth problems, especially in optimization. One of the basic techniques applied in this field is the use of various kinds of generalized derivatives. A broadly used variant among these consists of Clarke's "generalized gradient", developed in the early 1970's and now presented in this book.

Chapter 1 is devoted to an explanation and overview of the book's contents and provides an introductory exposition of the main concepts. Here and elsewhere the reader finds examples drawn from economics, engineering, mathematical physics, and various branches of analysis. Chapter 2 deals with the calculus of the generalized gradient and relates it to the associated geometric concepts of normal and tangent cones. In Chapter 3 the foundations are laid for the applications to follow. The author considers the problem of minimizing a function over the set of trajectories of a differential inclusion subject to certain constraints and gives necessary and sufficient conditions for optimality. This theory is applied to furnish a nonsmooth calculus of variations (Chapter 4) and nonsmooth optimal control (Chapter 5). Chapter 6 deals with optimization theory in general. It contains sections on Lagrange multipliers, on different types of constraint qualifications, and on sensitivity of nonsmooth problems. The concluding Chapter 7 presents mixed applications in analysis. These range from generalized versions of some classical theorems–like the inverse function theorem–over fixed points of continuous maps, to certain existence results on hamiltonian dynamical systems. Here the techniques developed in Chapters 2 and 3 lead not only to new results, but (as in Chapters 4 and 5) shed new light on classical ones by allowing for novel viewpoints.

Written in a lucid style, Clarke's book may well serve as an introduction into nonsmooth analysis for the non-expert, but equally well (in spite of not being encyclopedic in scope) as a reference work for those in any of the various fields that use optimization.

- G. Wenzel, Erlangen

Polynomials and Linear Control Systems
by Stephen Barnett
Marcel Dekker
New York, Basel 1983

This book treats two major problems related to polynomials: the problem of determining the greatest common divisor of two polynomials and the problem of checking the stability of a single polynomial. Although there is already vast literature on the subject, this book takes another look at these problems and, more specifically, tries to rederive known results using techniques that are more familar to control engineers.

In the first section, for example, the condition for the existence of a (greatest) common divisor between two polynomials is derived via companion forms first and is then linked to other tests such as Sylvester and Bezout forms and tabular arrays (Routh) based on euclidean type recursions.

In the second section, the connections with control theory are carried through by linking these tests to the controllability of a system in companion form. Along the same line, control problems such as canonical forms and pole-placement via feedback are discussed.

The third section is probably the most interesting one. Here, the author again uses classical algebraic tools of control theory (namely the Lyapunov equations as stability test) to derive known stability and root location criteria both for the continuous- and discrete-time case. These are the criteria of Routh, Hurwitz, Lienard-Chipart, Hermite for the continuous-time case and of Jury-Marden, Schur-Cohn and Schur-Cohn-Fujiwara for the discrete-time case. Finally, links are also made with the Sturm sequences and the Cauchy index, which is the more classical approach for discussing the above criteria.

The fourth section is devoted to extending the above results to polynomial matrices, with special emphasis on their use for multivariable systems such as polymial matrix fraction descriptions and feedback. Although the results are much scarcer here, an account is given of some recent results about greatest common divisors using ideas developed in the first section.

The last section is devoted to generalized polynomials or polynomials written in terms of other (for instance othogonal) polynomials. Here again, extensions of some of the results of the previous sections are given.

The book is clearly written for control engineers since concepts familiar to them are used to tackle the problems. The term "control systems" appearing in the title is also justified by the several examples and applications of the two basic problems mentioned above, which are largely extracted from the control area. Yet one should not expect too much from the "control systems" part of the book. The style, although kept very simple, as well as the examples, are still of a rather algebraic (theoretical) nature than what would be expected by "control engineers". Guidelines for chosing and implementing some of these criteria or methods are also too scarce to make it appealing to control engineers. The book is therefore rather meant for what could be called "matheamatical control engineers". Finally, it is worth mentioning that the book contains over 400 references and is therefore a welcome guide in the wealth of (recent) papers in the area.

- Paul Van Dooren, Philips Research Laboratory, Brussels

Theory and Practice of Combinatorics
by A. Rosa, G. Sabidussi, J. Trugeon
Annals of Discrete Mathematics Vol. 12
North-Holland, Amsterdam, 1981

Edited on the occasion of Anton Kotzig's sixtieth birthday this volume contains 28 original papers from different fields of combinatorics. Only one of the contributions is conceived as a survey article (W. T. Tutte: Counting rooted triangulations), whereas the major part is closely connected to results or ideas of the jubilee, as is partly reflected by the nomenclature (Kotzig factorization). In most of the articles graph theoretic problems (partitioning problems, planar graphs) are treated, but additive number theory is also strongly represented. Furthermore, papers on block designs, Hadamard matrices and other design problems and even from algebra can be found. This volume should be of interest to any combinatorialist.

- W. Mader, Universität Hannover

Descartes on Polyhedra, A Study of the De Solidorum Elementis
by P. J. Federico
Springer, Berlin, 1982

The book is a thorough treatment of the history and the content of a manuscript of Descartes on polyhedra ("De Solidorum Elementis"). This manuscript is only known as a copy, made by Leibniz, and it was found as late as 1860, approximately 230 years after it had been written. The manuscript contains a formula of which the Euler formula for polyhedra is an immediate consequence. There are numerous contradictory statements by various authors concerning the priority of Descartes or Euler for this formula, and this was the author's main motivation for writing the book.

It is divided into three main chapters. The first discusses the (very interesting) history of the manuscript itself; the second chapter treats the parts of manuscript dealing with geometric properties of (3-dimensional) convex polyhedra; and the third concerns those parts which deal with figurate numbers associated with polyhedra (especially the regular and semiregular ones).

The second chapter is certainly the most interesting as it deals with the part of the manuscript which contains the most significant results judged from the modern point of view.

The author's clear translation of the Latin text is followed by detailed comments on the mathematical content. The main results of Descartes are subsumed by the author in six Propositions. Except for Proposition 4 (which is an algebraic treatment of the number of regular convex polyhedra) all of them concern relations between different kinds of angles and numbers of faces of 3-polyhedra. Proposition 1 states that the sum of the exterior solid angles is equal to eight right solid angles (unfortunately, Figure 4(b), which is meant to illustrate the planar analogue of this fact, is false and misleading). This result, though it can be interpreted as a consequence of the Gauß-Bonnet Theorem or of the Steiner-formula for parallel convex bodies, seems not to have been explicitly known before the discovery of the Descartes manuscript.

Proposition 6 states: P = 2F + 2V - 4 where P is the number of plane angles (angles at vertices of facets), F the number of facets and V the number of vertices of a polytope. As another statement of the manuscript is P = 2E, where E is the number of edges, it has been asserted by many authors that Descartes actually was aware of Euler's Theorem which by this identity is equivalent to Proposition 6. The author is right in saying that this question can only be answered: "Yes, probably" or "No, probably", and he discusses this in a very detailed way (including the literature on this question). The only thing that one can be safe about is that Descartes, in case he did see the identity E = F + V - 2, certainly did not think it was as significant as his Proposition 6.

The Descartes manuscript certainly represents the "state of the art" in the theory of convex polyhedra for 1630. Its content, its spirit and its historic meaning are carefully elaborated in this book which was a pleasure to read. I recommend it to everybody interested in the history of polyhedra.

- Peter Kleinschmidt (Bochum)

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, W. Germany.

JOURNALS & STUDIES

Forthcoming Mathematical Programming Study
Mathematical Programming with Data Perturbations
Edited by A. V. Fiacco

B. Bank and R. Hansel, *"Stability of Mixed-Integer Quadratic Programming Problems."*

B. Brosowski, *"Parametric Semi-Infinite Linear Programming."*

T. Gal, *"Linear Parametric Programming - A Brief Survey."*

J. Gauvin and F. Dubeau, *"Some Examples and Counterexamples for the Stability Analysis of Nonlinear Programming Problems."*

J. Guddat, H. Wacker and W. Zulehner, *"On Imbedding and Parametric Optimization - A Concept of a Globally Convergent Algorithm for Nonlinear Optimization Problems."*

S. Holm and D. Klein, *"Three Methods for Postoptimal Analysis in Integer Linear Programming."*

R. Janin, *"Directional Derivative of the Marginal Function in Nonlinear Programming."*

K. Jittorntrum, *"Solution Point Differentiability Without Strict Complementarity in Nonlinear Programming."*

D. Klatte, *"A Sufficient Condition for Lower Semicontinuity of Solution Sets of Convex Inequalities."*

M. Kojima and R. Hirabayashi, *"Continuous Deformation of Nonlinear Programs."*

B. Kummer, *"Generalized Equations: Solvability and Regularity."*

R. T. Rockafellar, *"Directional Differentiability of the Optimal Value Function in a Nonlinear Programming Problem."*

T. Zolezzi, *"On Stability Analysis in Mathematical Programming."*

Vol. 28 No. 3

T. Coleman and J. Moré, *"Estimation of Sparse Hessian Matrices and Graph Coloring Problems."*

R. Wong, *"A Dual Ascent Approach for Steiner Tree Problems on a Directed Graph."*

M. Kojima and Y. Yamamoto, *"A Unified Approach to the Implementation of Several Restart Fixed Point Algorithms and a New Variable Dimension Algorithm."*

S. Mizuno, *"An Analysis of the Solution Set to a Homotopy Equation Between Polynomials with Real Coefficients."*

G. Tinhofer, *"Rational Solutions of the Graphsack Problem."*

M. Aganagić, *"Newton's Method for Linear Complementarity Problems."*

Vol. 29 No. 1

M. W. Padberg and L. A. Wolsey, *"Fractional Covers for Forests and Matchings."*

A. Schrijver, *"Proving Total Dual Integrality with Cross-Free Families - A General Framework."*

M. Grötschel and G. Nemhauser, *"A Polynomial Algorithm for the Max-Cut Problem on Graphs Without Long Odd Cycles."*

G. G. Brown and W. G. Wright, *"Automatic Identification of Embedded Network Rows in Large-Scale Optimization Models."*

M. E. Dyer, *"An O(n) Algorithm for the Multiple-Choice Knapsack Linear Program."*

A. Buckley, *"Termination and Equivalence Results for Conjugate Gradient Algorithms."*

B. C. Eaves, *"Permutation Congruent Transformations of the Freudenthal Triangulation with Minimum Surface Density."*

S. Kim, *"Economic Planning with Institutional Price Constraints for a Decentralized Economy."*

J. F. Shapiro, *"A Note on Node Aggregation and Benders' Decomposition."*

M. Bastian, *"Implicit Representation of Generalized Variable Upper Bounds Using the Elimination Form of the Inverse on Secondary Storage."*

Volume 29 No. 2

S. Fujishige, *"Structures of Polyhedra Determined by Submodular Functions on Crossing Families."*

S. Fujishige, *"Theory of Submodular Programs: A Fenchel Type Min-Max Theorem and Subgradients of Submodular Functions."*

M. N. Thapa, *"Optimization of Unconstrained Functions with Sparse Hessian Matrices -- Newton-Type Methods."*

A. Ech-Cherif and J. G. Ecker, *"A Class of Rank-Two Ellipsoid Algorithms for Convex Programming."*

J. Jahn, *"Scalarization in Vector Optimization."*

A. P. Sethi and G. L. Thompson, *"The Pivot and Probe Algorithm for Solving a Linear Program."*

T. F. Coleman and D. C. Sorensen, *"A Note on the Computation of an Orthonormal Basis for the Null Space of a Matrix."*

Vol. 29 No. 3

P. Dubey and L. S. Shapley, *"Totally Balanced Games Arising from Controlled Programming Problems."*

P. Lindstrom and P.-A. Wedin, *"A New Linesearch Algorithm for Nonlinear Least Squares Problems."*

M. J. D. Powell, *"On the Global Convergence of Trust Region Algorithms for Unconstrained Minimization."*

R. E. Wendell, *"Using Bounds on the Data in Linear Programming: The Tolerance Approach to Sensitivity Analysis."*

D. Granot and G. Huberman, *"On the Core and Nucleolus of Minimum Cost Spanning Tree Games."*

S. Fujishige, *"On the Subdifferential of a Submodular Function."*

Technical Reports & Working Papers

The University of Tennessee
College of Business Administration
Knoxville, TN 37996

James K. Ho, *"Equivalent Piecewise Linear Formulations of Separable Convex Programs,"* WP 175.

James K. Ho, *"Convergence Behavior of Decomposition Algorithms for Linear Programs,"* WP 179.

James K. Ho, *"A Parametric Subproblem for Dual Methods in Decomposition,"* WP 185.

James K. Ho, *"High Precision Linear Programming,"* WP 187.

The Johns Hopkins University
Department of Electrical Engineering
and Computer Science
Baltimore, MD 21218

J. O'Rourke and K. R. Sloan, Jr., *"Dynamic Quantization: Two Adaptive Data Structures for Multidimensional Spaces,"* 83/01.

H. Edelsbrunner, J. O'Rourke, and E. Welzl, *"Stationing Guards in Rectilinear Art Galleries,"* 83/02.

R. Melville, *"A New Minimum Spanning Sphere Algorithm,"* 83/05.

J. O'Rourke and R. Washington, *"Curve Similarity via Signatures,"* 83/08.

H. L. Weinert, *"The Complementary Model in Continuous/Discrete Smoothing,"* 83/09.

U. B. Desai and H. L. Weinert, *"A Vector Space Approach to the Indefinite LQR Problem,"* 83/10.

H. L. Weinert, *"On the Inversion of Linear Systems,"* 83/11.

P. Tiwari, *"An Efficient Parallel Algorithm for Shifting the Root of a Depth First Spanning Tree,"* 83/12.

A. Aggarwal and R. C. Melville, *"Fast Computation of the Modality of a Polygon,"* 83/15.

G. G. L. Meyer, *"Convergence Properties of Relaxation Algorithms,"* 83/16.

R. C. Melville, *"An Unusual Algorithm for Finding the Minimum Spanning Circle of a Convex Polygon,"* 83/17.

Erasmus Universiteit Rotterdam
Econometric Institute
P. O. Box 1738
3000 DR Rotterdam
The Netherlands

L. F. M. de Haan, *"A Spectral Representation for Max-Stable Processes,"* 8309/S.

J. K. Lenstra, A. H. G. Rinnooy Kan and L. Stougie, *"A Framework for the Probabilistic Analysis of Hierarchical Planning Systems,"* 8311/O.

J. M. Schumacher, *"Almost Stabilizability Subspaces and High Gain Feedback,"* 8312/M.

V. Stern, *"User Manual to Subroutine Package Minmax for the Dimensioning of a Telephone Network with Nonlinear Blocking Probability Constraints,"* 8313/I.

M. Haimovich and A. H. G. Rinnooy Kan, *"Bounds and Heuristics for Capacitated Routing Problems: Part I,"* 8314/O.

A.H. G. Rinnooy Kan and G.T. Timmer, *"Stochastic Methods for Global Optimization,"* 8317/O.

H. K. van Dijk and T. Kloek, *"Posterior Moments Computed by Mixed Integration,"* 8318/E.

C. G. E. Boender and A. H. G. Rinnooy Kan, *"Bayesian Stopping Rules for a Class of Stochastic Global Optimization Methods,"* 8319/O.

C. G. E. Boender and A. H. G. Rinnooy Kan, *"Nonparametric Bayesian Estimation of a Discrete Probability Distribution with Unknown Domain,"* 8320/O.

C. G. E. Boender and A. H. G. Rinnooy Kan, *"Bayesian Multinomial Estimation of Animal Population Size,"* 8322/O.

J. K. Lenstra and A. H. G. Rinnooy Kan, *"Scheduling Theory Since 1981: An Annotated Bibliography,"* 8324/O.

H. Nijmeijer and J. M. Schumacher, *"Zeros at Infinity for Affine Nonlinear Control Systems,"* 8325/M.

H. K. van Dijk and T. Kloek, *"Experiments With Some Alternatives for Importance Sampling in Monte Carlo Integration,"* 8326/E.

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L. F. M. de Haan and J. Pickards III, *"Stationary Min-Stable Stochastic Processes,"* 8329/S.

H. Nijmeijer and J. M. Schumacher, *"Input-Output Decoupling of Nonlinear Systems With an Application to Robotics,"* 8330/M.

G. van der Hoek, H. W. van den Meerendonk and R. Th. Wijmenga, *"The Elimination of Convexly Dominated Cutting Patterns in Trimloss Problems,"* 8333/O.

J. R. de Wit and C. G. E. Boender, *"How a Claim by Wagner Proves to be False, or the s,Q Model's Algorithm Revisited,"* 8334/O.

University of Bonn
Department of Operations Research
Nassestr. 2
D-5300 Bonn 1, West Germany

"List of Working Papers, 7201-OR - 83300-OR (1972-1983)", WP 83301-OR.

M. Skowronska, M. M. Syslo and C. Zamfirescu, *"An Algorithmic Characterization of Total Digraphs,"* WP 83302-OR.

U. Faigle and R. Schrader, *"Minimizing Completion Time for a Class of Scheduling Problems,"* WP 83303-OR.

B. Korte and L. Lovasz, *"Relations Between Subclasses of Greedoids,"* WP 83304-OR.

U. Derigs, *"Ueber eine Anwendung statistischer Schranken in der kombinatorischen Optimierung,"* WP 83305-OR.

U. Faigle and R. Schrader, *"Zur Maschinenbelegungsplanung unter TNI-geordneten Restriktionen,"* WP 83306-OR.

S. Holm, *"Dual Price Function v. Dual Prices for the Capital Budgeting Problem,"* WP 83307-OR.

U. Faigle and R. Schrader, *"Comparability Graphs and Order Invariants,"* WP 83308-OR.

Y. Wakabayashi and M. Gurgel, *"A Result on Hamilton-Connected Graphs,"* WP 83309-OR.

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Achim Bachem, Associate and Book Review Editor of Optima, has accepted a Professorship at Mathematisches Institute, Universität zu Köln. . . **Darwin Klingman** (Texas) recently received the Outstanding Research Award given by the Golden Key National Honor Society. . .A recent article in the March-April, 1984 issue of the ORSA/TIMS newsletter *OR/MS Today* reviews a microcomputer software package for linear programming which solved problems up to 513 variables and 340 constraints. . .**Paul Boggs** (N.B.S.), an organizer of the June 12-14, 1984 conference on numerical optimization (see Calendar) has initiated a series of articles concerning the topics of the conference in the November, 1983 issue of the *SIAM Newsletter*. . .A conference sponsored by the Design Optimization Laboratory, University of Arizona, Tucson, is scheduled for February 11-15, 1985, and calls for papers in optimization related to CAD/CAM and automation. Contact K.M. Ragsdell.

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