



## Council Discusses Recent Issues

The only occasions on which the geographically dispersed officers of the Society can all get together are the International Symposia. Since at that time newly elected officers replace their predecessors, both groups meet together, and, traditionally, jointly decide whatever issues are at large. The notes that follow, briefly describing some of the main issues before the Council of the Society, are largely drawn from the Minutes of the Council Meetings held on the occasion of the XI International Symposium at Bonn, FRG, August 23-27, 1982, with a little updating.

Meetings were held on Sunday, August 22, and then Wednesday and Thursday, in the Senate Room of the University of Bonn, chaired by Jean Abadie. The formal meetings totalled some twelve hours, involving about twenty people; the old and new officers (listed in the article "Bonn Symposium Highlights" in the previous issue of OPTIMA, No. 8), Committee chairmen, and various guests who were invited or who asked to be heard on some specific issue.

### Finances and Membership

Al Williams, as Chairman of the Executive Committee and incoming Treasurer, reported our finances in good shape. The Society treasury stands at about \$45,000. For 1982, income of about \$53,000 is expected: \$19,000 from membership dues, \$27,500 from North-Holland Publishing Company as royalties and editorial payments, and \$6,500 from interest and miscellaneous sources. Anticipated expenses total \$58,000: \$8,500 for the Secretariat, \$46,000 for publishing activities, and \$3,500 for payment of royalties and miscellaneous activities. The excess of expenditure over income is not likely to recur; in planning for 1982, the Council anticipated further income of \$5,000 from the Bonn Symposium, but in fact no such surplus developed.

The Council felt that the best use of the Treasury's holdings would be in reducing the dues of members. Accordingly, it set the dues for 1983 at \$35 U.S., a reduction from \$40 for 1982. To protect against currency fluctuations, the exchange rates in effect in August 1982 were used to fix the dues in other currencies at: 95 guilders, 72 swiss francs, 230 french francs, 85 deutschmark, and 20 pounds sterling.

Our contract with North-Holland has been revised on favorable terms. Previously, we received from them a substantial editorial fee, and bought subscriptions to the journal from them. While the net income to the Society was positive, the expense to the Society of adding a member (journal subscription plus Secretariat fee) was greater than the membership dues in recent years. The new contract provides for no editorial payments, but provides 500 free subscriptions in return for our editorial services, with additional subscriptions available at a small charge. Since it is now profitable for the Society to have new members, the Membership Committee will use a long list of non-members it has compiled in a new membership drive.

There are presently about 16 Student Members of the Society, whose membership fee is one-half the regular fee. There was some discussion of other classes of reduced price membership, such as for retired people, or spouses of members, and the matter was referred to the Membership Committee.

### Secretariat

Richard Latter, of the International Statistical Institute, which acts as the Society's Secretariat, came to Bonn for a discussion of the services they provide. The Society would like to change the basis on which the ISI charges from the present uniform charge per member to a fixed

charge plus (smaller) marginal charge per member; the matter is still being discussed.

### Publications

In 1982 there was sufficient material already accepted for publication in *Mathematical Programming* to warrant printing three volumes (at no extra cost to the Society.) Editor-in-Chief Cottle sees enough material coming in to justify three volumes per year for several years. Commenting that a *Mathematical Programming Study* took a good deal of energy to edit effectively, Cottle said that he had been discussing with North-Holland the possibility of relaxing the present 180 page requirement for a *Study* to allow for considerably larger or smaller volumes.

Editors Hearn and Bachem were complimented for work on this *Newsletter*. The Council authorized payment of up to \$100 to the author of a feature article in the *Newsletter* (provided it was not written by a Society officer as an official duty).

### Committee on Algorithms

Owing to the change of editorship of the COAL Newsletter, its printing cost will now be a charge to the Society. The Council authorized, for the time being, a budget of no more than \$1,500 per year for support of the COAL Newsletter. Other possibilities, such as including it in OPTIMA for members of the Society and requiring a small charge for others, are under consideration.

There was considerable discussion in Bonn, pro and con, of a proposal to establish a COAL Prize for "excellence in experimental computation". The Committee presently has a small fund that could be used; future funding would be a responsibility of the Society. The Council did not come to a conclusion about that, and is (Continued next page)

awaiting further input from the Committee and the membership.

The Council enthusiastically supported the Committee's plans to hold a COAL conference in Europe adjacent in time to the 1984 TIMS meeting.

#### Committee on Stochastic Programming

The Council authorized the formation of a Committee on Stochastic Programming, subject to the future recommendations on guidelines for such committee it intends to formulate. Andras Prekopa, who proposed the Committee, was designated its Chairman, and hopes to have several meeting in Europe in the near future.

#### Italian Chapter of the Society

The Council pondered the question of the formation of an Italian Mathematical Programming Society as a chapter of the Society. As proposed by Franco Giannessi, the chapter could bring together Italian workers in many areas who have a common interest in optimization which is not well served by any of the existing professional groups. Its main activity would be holding national meetings and stimulating workshops; it would not undertake publishing activities. He believed that making membership in the MPS a condition for membership in such a chapter would be a tolerable condition.

The Council did not immediately act on this proposal, but discussed some of its implications, and asked Giannessi, Prekopa, and Williams to recommend guidelines for the formation of national chapters and for setting up special interest committees like that on stochastic programming.

#### Twelfth Symposium Site

By the time of the Council meeting in August, several organizations in North America had expressed an interest in acting as host for the Twelfth International Symposium in 1985. Jean-Louis Goffin, as Chairman of the Symposium Advisory Committee, agreed to contact these and a considerable further list of possible hosts.

As of the time of writing, the Council has received a number of definite proposals, and the Chairman and Vice-chairman have recommended approval of a specific site to the Council. The final decision should be made in a month or so, and will be announced in the next issue of *OPTIMA*.

—Philip Wolfe

# CONFERENCE NOTES

## FIFTH SYMPOSIUM ON MATHEMATICAL PROGRAMMING WITH DATA PERTURBATIONS Washington, D.C.

May 16-18, 1983

The Fifth Symposium on Mathematical Programming with Data Perturbations will be held at The George Washington University's Marvin Center on 16-18 May 1983. This symposium is designed to bring together practitioners, who use mathematical programming optimization models and deal with questions of sensitivity analysis, with researchers who are developing techniques applicable to these problems.

Papers in mathematical programming will be given in the following areas: 1) Sensitivity and Stability Analysis Results and Their Applications. 2) Solution Methods for Problems Involving Implicitly Defined Problem Functions. 3) Solution Methods for Problems Involving Deterministic or Stochastic Parameter Changes. 4) Solution Approximation Techniques and Error Analysis.

—Tony Fiacco

## SIAM Symposium on the Applications of Discrete Mathematics June 27-29, 1983

Registration information will soon be available for the Symposium on the Applications of Discrete Mathematics, which will be held June 27-29, 1983, at the Massachusetts Institute of Technology in Cambridge, Massachusetts. The Symposium is sponsored by the Society for Industrial and Applied Mathematics (SIAM).

The symposium is a follow-up to a highly successful symposium held by SIAM in June 1981 at Rensselaer Polytechnic Institute.

Objectives of the symposium are to critically examine recent applications of discrete mathematics, to review recent developments in discrete mathematics that have potential applications, and to identify problems that have to be solved to enhance the application of discrete techniques. The symposium will bring together researchers in the various fields of discrete mathematics with users of discrete mathematics in indus-

try and government. Symposium speakers have been invited from academe, industry, and government.

The conference organizing committee consists of Ronald L. Graham, Bell Laboratories, Peter L. Hammer, University of Waterloo, Daniel J. Kleitman, Massachusetts Institute of Technology, and Fred S. Roberts (chairman), Rutgers University.

Registration materials may be obtained by contacting Hugh B. Hair, SIAM Services Manager, 1405 Architects Building, 117 South 17th Street, Philadelphia, PA 19103, telephone (215) 564-2929.

## FRIENDS OF OPTIMIZATION

Friends of Optimization met four times in Fall, 1982. The speakers were Bobby Schnabel (Colorado), "Tensor Models for Nonlinear Equations;" John Dennis (Rice), "Iterative Methods for Zeros of Inaccurately Computed Functions;" Harlan Crowder (IBM), Ellis Johnson (IBM), and Manfred Padburg (NYU), "PIPEX: A Pure Zero-One Integer Programming Solver;" and Paul Zipkin (Columbia), "Aggregation in Optimization Problems."

The schedule of talks for this spring is given below.

Friday, February 11, 1983 - 10:30 am  
Michael Overton (Courant Institute, NYU)  
"Nonsmooth Optimization"

Friday, March 11, 1983 - 10:30 am  
Richard Van Slyke  
(Stevens Institute of Technology)  
"On Multi-Covering Problems"

Friday, April 8, 1983 - 10:30 am  
Zvi Galil (Columbia University)  
"An Efficient Algorithm for Finding Maximal Matchings in Graphs"

Friday, May 6, 1983 - 10:30 am  
Monique Guignard (Wharton School, University of Pennsylvania) and Kurt Speilberg (Decision Science Support Center, IBM)  
"Location Problems and Networks with Fixed Costs"

All of the FOP meetings this Spring will be held in Room 520 in the S.W. Mudd Engineering Building at Columbia University. The Mudd Building is located on the southwest corner of 120th Street and Amsterdam Avenue. It is a short walk across the Columbia Campus from the 116th Street stop on the Broadway IRT subway. For those coming by car, on-campus parking can

be arranged if you call Barbara Korngold, the administrative assistant for the Industrial Engineering and Operations Research Department at 280-2941 at least two working days before the meetings.

MPS members visiting the New York area are welcome.

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## IFORS '84

The tenth IFORS (International Federation of O.R. Societies) conference will be held in Washington, D.C., August 6-10, 1984.

The theme of this conference is - "Co-operation - The Culture for O.R. Success". Three groups of sessions are being organized: Mainstream (dealing with the theme), Applications, and Techniques. These will comprise contributed and invited papers. Abstracts of contributed papers should be less than 100 words (with 5 key words) and sent to the Program Chairman before October 15, 1983.

Other features of the conference will be - special Workshops, a Software and Book Exhibition, and a Microcomputer Software Fair. For any questions or suggestions, please contact the Program Chairman or the Conference Chairman.

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# Technical Reports & Working Papers

STICHTING MATHEMATISCH CENTRUM  
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Postbus 4079 1009 AB Amsterdam

International Institute for Applied Systems Analysis  
System and Decision Sciences Area  
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J.K. Lenstra and A.H.G. Rinnooy Kan, "Theorie de la Complexite de Calcul Appliquee aux Problemes de Couplage, Recouvrement et Partitionnement," BW 125 Price f 3.15.

J.K. Lenstra and A.H.G. Rinnooy Kan, "Introduction a l'Ordonnement de Plusieurs Machines," BW 126 Price f 3.15.

K.R. Baker, E.L. Lawler, J.K. Lenstra and A.H.G. Rinnooy Kan, "Preemptive Scheduling of A Single Machine to Minimize Maximum Cost Subject to Release Dates and Precedence Constraints," BW 128 Price f 3.15.

H. Nijmeijer, "Controlled Invariant Distributions for Affine Systems on Manifolds," BW 130 Price f 3.15.

K. Nafajima, S.L. Hakimi and J.K. Lenstra, "Complexity Results for Scheduling Tasks in Fixed Intervals on Two Types of Machines," BW 131 Price f 3.15.

H. Nijmeijer, "Controlled Invariance for Affine Control Systems," BW 133 Price f 3.15.

A.K. Lenstra, J.K. Lenstra, A.H.G. Rinnooy Kan and T.J. Wansbeek, "Two Lines Least Squares," BW 134 Price f 3.15.

H.C. Thijms and M.H. van Hoorn, "Computational Methods for Single-Server and Multi-Server Queues with Markovian Input and General Service Times," BW 135 Price f 3.15.

H. Nijmeijer and H. A. van der Schaft, "Controlled Invariance for Nonlinear Systems," BW 136 Price f 3.15.

B.J. Lageweg, E.L. Lawler, J.K. Lenstra and A.H.G. Rinnooy Kan, "Computer Aided Complexity Classification of Combinatorial Problems," BW 137 Price f 3.15.

R.W. Brockett, "Nonlinear Systems and Nonlinear Estimation Theory," BW 139 Price f 3.15.

H. Nijmeijer, "Controllability Distributions for Nonlinear Control Systems," BW 140 Price f 3.15.

J.H. van Schuppen, "The Probabilistic Realization Problem for Finite Dimensional Gaussian Random Variables," BW 141 Price f 3.15.

M.A.H. Dempster, M.L. Fisher, L. Jansen, B.J. Lageweg, J.K. Lenstra and A.H.G. Rinnooy Kan, "Analysis of Heuristics for Stochastic Programming: Results for Hierarchical Scheduling Problems," BW 142 Price f 3.15.

A.M.A. Hariri and C.N. Potts, "An Algorithm for Single Machine Sequencing with Release Dates to Minimise Total Weighted Completion Time," BW 143 Price f 3.15.

H. Attouch, R. J.-B. Wets, "A Convergence of Bivariate Functions aimed at the Convergence of Saddle Functions," CP-82-065.

J. -P. Aubin, "Lipschitz Behavior of Solutions to Convex Minimization Problems," WP-81-076.

J. -P. Aubin, A. Cellina, "Differential Inclusions and Viability Theory," WP-82-051.

J. -P. Aubin, "Fuzzy Games: The Static and Dynamical Points of View," CP-82-031.

J. -P. Aubin, "Minimax Theory: A Summary," WP-82-061.

G. B. Dantzig, M. A. H. Dempster, M. J. Kallio, "Large-Scale Linear Programming," CP-81-S01.

M. A. H. Dempster, "The Expected Value of Perfect Information in the Optimal Evolution of Stochastic Systems," WP-81-055.

Y. M. Ermoliev, "Stochastic Quasigradient Methods and Their Application in Systems Optimization," WP-81-002.

Y. M. Ermoliev, G. Leonardi, J. Vira, "The Stochastic Quasi-Gradient Method Applied to a Facility Location Problem," WP-81-014.

Y. M. Ermoliev, A. A. Gaivoronski, "Simultaneous Nonstationary Optimization, Estimation and Approximation Procedures," CP-82-016.

Y. M. Ermoliev, C. Nedeva, "Stochastic Optimization Problems with Partially Known Distribution Functions," CP-82-060.

M. Grauer, J. -L. Brillet, "About the Portability of the DIDASS-Package (an IBM Implementation)," CP-82-004.

K. Kiwiel, "A Globally Convergent Quadratic Approximation for Inequality Constrained Minimax Problems," CP-81-009.

K. Kiwiel, "A Variable Metric Method of Centers for Nonsmooth Minimization," CP-81-023.

A. Lewandowski, M. Grauer, "The Reference Point Optimization Approach - Methods of Efficient Implementation," WP-82-026.

A. Lewandowski, "A Program Package for Linear Multiple Criteria Reference Point Optimization," WP-82-080.

M. Makowski, J. Sosnowski, "Implementation of an Algorithm for Scaling Matrices and Other Programs Useful in Linear Programming," CP-81-037.

L. Nazareth, "Analogues of Dixon's and Powell's Theorems for Unconstrained Minimization with Inexact Line Searches," WP-82-100.

L. Nazareth, "Implementation Aids for Optimization Algorithms that Solve Sequences of Linear Programs by the Revised Simplex Method," WP-82-107.

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## Technical Reports & Working Papers, continued

- E. A. Nurminski, "On a Decomposition of Structured Problems," WP-81-031.
- E. A. Nurminski, "Decomposition of Two-Block Optimization Problems," WP-81-073.
- E. A. Nurminski, "Convergence and Numerical Experiments with a Decomposition Algorithm," WP-82-008.
- E. A. Nurminski, "Bibliography on Nondifferentiable Optimization," WP-82-032.
- E. A. Nurminski, "Decomposition Algorithm Based on the Primal-Dual Approximation," WP-82-046.
- E. A. Nurminski, "Subtraction of Convex Sets and Its Application in  $\epsilon$ -Subdifferential Calculus," WP-82-083.
- E. A. Nurminski, T. Balabanov, "Decomposition of a Large-Scale Energy Model," WP-82-095.
- E. A. Nurminski, "Progress in Nondifferentiable Optimization," CP-82-S08.
- R. T. Rockafellar, "Favorable Classes of Lipschitz Continuous Functions in Subgradient Optimization," WP-81-001.
- R. T. Rockafellar, "Augmented Lagrangians and Marginal Values in Parameterized Optimization Problems," WP-81-019.
- R. T. Rockafellar, R. J. -B. Wets, "Deterministic and Stochastic Optimization Problems of Bolza Type in Discrete Time," WP-81-069.
- R. T. Rockafellar, R. J. -B. Wets, "On the Interchange of Subdifferentiation and Conditional Expectation of Convex Functionals," WP-81-089.
- R. J. -B. Wets, "A Formula for the Level Sets of epi-Limits and Some Applications," WP-82-081.
- R. J. -B. Wets, "Stochastic Programming: Solution Techniques and Approximation Schedules," WP-82-084.
- R. J. -B. Wets, "On the Continuity of the Value of a Linear Program," WP-82-106.
- A. P. Wierzbicki, "Note on the Equivalence of Kuhn-Tucker Complementarity Conditions to an Equation," WP-81-127.

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- M. Groetschel and M.W. Padberg, "Polyhedral Aspects of the Travelling Salesman, Problem II; Computation," WP 82214-OR.
- M. Groetschel, M. Juenger, and G. Reinelt, "On the Acyclic Subgraph Polytope," WP 82215-OR.
- A. Frank, "Disjoint Paths in a Rectilinear Grid," WP 82216-OR.
- M. Groetschel, M. Juenger, and G. Reinelt, "Facets of the Linear Ordering Polytope," WP 82217-OR.
- J. Arazo, J. Edmonds, and V. Griffin, "Lifting the Facets of Polyhedra," WP 82218-OR.
- M. Groetschel, M. Juenger, and G. Reinelt, "A Cutting Plane Algorithm for the Linear Ordering Problem," WP 82219-OR.
- J. Arazo, "Packing Problems in Semi-Group Programming," WP 82220-OR.
- U. Derigs, and R. Schrader, "Some Greedy Ideas for the Cardinality Matching Problem," WP 82221-OR.
- U. Derigs, "Shortest Augmenting Paths and Sensitivity Analysis for Optimal Matchings," WP 82222-OR.
- M.D. Plummer and W.R. Pulleyblank, "Equi-Matchable Graphs," WP 82223-OR.
- W.H. Cunningham and A. Frank, "A Primal-Dual Algorithm for Submodular Flows," WP 82224-OR.
- G. Morton, K. Ringwald, and R. von Randow, "A Simple Algorithm for a Class of Quadratic Smoothing Problems," WP 82225-OR.
- M.O. Ball and U. Derigs, "An Analysis of Alternate Strategies for Implementing Matching Algorithms," WP 82226-OR.
- A. Bachem, "Convexity and Optimization in Discrete Structures," WP 82227-OR.
- M. Groetschel, M. Juenger and G. Reinelt, "Optimal Triangulation of Large Real-World Input-Output Matrices," WP 82228-OR.
- J. Arazo and E.L. Johnson, "Polyhedra of Multivalued Additive System Problems," WP 82229-OR.

- B. Korte and L. Lovasz, "Greedoids - a Structural Framework for the Greedy Algorithm," WP 82230-OR.
- J. Arazo and E.L. Johnson, "Mappings and Liftings for Group and Semi-Group Problems," WP 82233-OR.
- U. Derigs, "Optimale Zuordnungen und Matchings: Anwendungen, Grundlagen und Verfahren," WP 82232-OR.
- J. Arazo and J. Edmonds, "A Case of Non-Convergent Pivoting in Assignment Problems," WP 82233-OR.
- S. Fujishige, "Theory of Submodular Programs: A Fenchel-Type Min-Max Theorem and Subgradients of Submodular Functions," WP 82234-OR.
- U. Faigle, G. Richter, and M. Stern, "Geometric Exchange Properties in Lattices of Finite Length," WP 82235-OR.
- S. Fujishige, "Structures of Polyhedra Determined by Submodular Functions of Crossing Families," WP 82236-OR.
- M. Juenger and G. Reinelt, "Techniques and Machines in the History of Computing," WP 82237-OR.
- J. Arazo, W.H. Cunningham, J. Edmonds and J. Green-Krotky, "Reduction to 1-Matching Polyhedra," WP 82238-OR.
- F. Barahona, "The Max-Cut Problem on Graphs not Contractible to  $K(5)$ ," WP 82239-OR.
- J. Arazo, "Subadditive Characterization of Ordered Semi-Group Problems," WP 82240-OR.
- S. Fujishige, "Characterization of Subdifferentials of Submodular Functions and its Relation to Lovasz's Extension of Submodular Functions," WP 82241-OR.
- B. Korte and L. Lovasz, "Structural Properties of Greedoids," WP 82242-OR.
- A.A.F. Oliveira and C.C. Gonzaga, "Convergence Bounds for the 'Capacity' Max-Flow Algorithm," WP 82243-OR.
- B. Korte and L. Lovasz, "A Note on Selectors and Greedoids," WP 82244-OR.
- U. Derigs and B. Korte, "Discrete and Combinatorial Optimization: General Introduction," WP 82245-OR.
- U. Derigs and B. Korte, "Independence Systems and Combinatorial Optimization," WP 82246-OR.
- U. Derigs and B. Korte, "Polyhedral Combinatorics and Cutting Plane Methods," WP 82247-OR.
- U. Derigs and B. Korte, "The Branch and Bound Approach to Combinatorial Optimization Problems," WP 82248-OR.
- U. Derigs and B. Korte, "Approximative Methods for Combinatorial Optimization Problems," WP 82249-OR.
- R.E. Bixby, W.H. Cunningham and D.M. Topkis, "The Partial Order of a Polymatroid Extreme Point," WP 82250-OR.
- M. Juenger, W.R. Pulleyblank and G. Reinelt, "On Partitioning the Edges of Graphs into Connected Subgraphs," WP 82251-OR.
- A. Frank and E. Tardos, "An Algorithm for the Unbounded Matroid Intersection Polyhedron," WP 82252-OR.
- G. Gastou and E.L. Johnson, "Binary Group and Chinese Postman Polyhedra," WP 82253-OR.
- A. Frank, "Submodular Flows," WP 82254-OR.

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- Paul T. Boggs and Jon W. Tolle, "Merit Function for Nonlinear Programming Problems," 81-2.
- Paul T. Boggs and Jon W. Tolle, "An Implementation of a Quasi-Newton Method for Constrained Optimization," 81-3.

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- R. Euler, "Perfect Independence Systems," 81-19.
- U. Zimmerman, "Minimization of Combined Objective on Integral Submodular Flows," 82/02.
- U. Zimmerman, "Augmenting Circuit Methods for Submodular Flow Problems," 82/03.
- R. Euler, "Odd Cycles and a Class of Facets of Independence System Polyhedra," 82/06.

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A. J. de Zeeuw, "Hierarchical Decentralized Optimal Control in Econometric Policy Models," RM 107.

A. Kapteyn and T. J. Wansbeek, "Identification in Factor Analysis," RM 108.

G. van der Laan and A. J. J. Talman, "Simplicial Algorithms for Finding Stationary Points, a Unifying Approach," RM 109.

B. B. van der Genugten, "The Asymptotic Behaviour of the Estimated Generalized Least Squares Method in the Linear Regression Model," RM 111.

H. H. Tigelaar, "The Informative Sample Size for Dynamic Multiple Equation Systems with Moving Average Errors," RM 113.

A. J. de Zeeuw, "Policy Solutions for Mini-Interplay, a Linked Model for Two Common Market Countries," RM 116.

F. J. M. van Doorne and P. H. M. Ruys, "Die Struktur einer Sprechhandlung in Habermas' Forschungsprogramm: Formale Analyse mit den Mitteln des tripolaren Modells," RM 117.

G. van der Laan and A. J. J. Talman, "Simplicial Approximation of Solutions to the Non-Linear Complementarity Problem," RM 118.

P. G. H. Mulder and A. L. Hempenius, "Evaluating Life Time in a Competing Risks Model for a Chronic Disease," RM 121.

G. van der Laan and A. J. J. Talman, "From Fixed Point to Equilibrium," RM 122.

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F. Al-Khayyal, "Jointly Constrained Bilinear Programming and Related Problems," ISyE.

J. J. Bartholdi, III, "On the Difficulty of Finding Nice Submatrices," ISyE, 82-08 PRDC.

C. E. Blair and R. G. Jeroslow, "Computational Complexity of Some Problems in Parametric Discrete Programming," COM.

J. J. Bartholdi, III, and L. K. Platzman, "An  $O(\log N)$  Planar Travelling Salesman Heuristic Based on Spacefilling Curves," ISyE, 82-07, PRDC.

F. Cullen, J. J. Jarvis, and H. D. Ratliff, "IRG - Interactive Route Generator: A Narrative Description," ISyE, 82-15, PRDC.

R. G. Jeroslow and D. F. Karney, "Cluster Sets of Vector Series," COM, MS-82-6.

D. F. Karney, "A Duality Theorem for Semi-Infinite Convex Programs and Their Finite Subprograms," COM, MS-82-4.

D. F. Karney, "The Number of Constraints in a Semi-Infinite Program is Always Countable," COM, MS-82-5.

D. F. Karney and T. D. Morley, "Limiting Lagrangians - a Primal Approach," COM and Math, MS-82-3.

L. F. McGinnis, "Computer Aided Layout Programs: A Contemporary Appraisal," ISyE, 82-11, PRDC.

L. F. McGinnis and Rao, "Optimal Lot Sizing in Acyclic Multiperiod Production Systems," ISyE, 82-10, PRDC.

L. F. McGinnis, R. J. Graves and Joneja, "Multicriterion Layout Evaluation: The Value Measurement Problem," ISyE, 82-12, PRDC.

L. F. McGinnis, and Runyan, "A Computer Package for the Composite Criterion Model," ISyE, 82-13, PRDC.

B. Montrieux, H. D. Ratliff and M. Goetschalckx, "Matching Based Interactive Facility Layout," ISyE, 82-02, PRDC.

M. Pinedo, "Applications of Duality and Stochastic Dominance in Reliability Theory," ISyE, 8201, PRDC.

M. Pinedo, "On Flow Time and Due Dates in Stochastic Open Shops," ISyE, 82-05, PRDC.

M. Pinedo, "Stochastic Shop Models with Jobs that Have Dependent Processing Times at the Various Machines," ISyE, 82-09, PRDC.

H. D. Ratliff and T. Tran, "Optimum Four Module Pallet Packing," ISyE, 82-03, PRDC.

J. Spingarn, "Partial Inverse of a Monotone Operator," Math.  
C. A. Tovey, "Low Order Polynomial Bounds on the Expected Number of Iterations of Local Improvement Algorithms," ISyE, RR No. J82-6.

C. A. Tovey, "Hill Climbing with Multiple Local Optima," ISyE, RR No. J82-7.

C. A. Tovey, "Sensitivity of  $P \parallel C_{max}$  with Respect to the Number of Processors," ISyE, RR No. J82-8.

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Curtis Eaves and James A. Yorke, "Equivalence of Surface Density and Average Directional Density," SOL 82-1.

B. Avi-Itzhak, T. J. Connolly, G. B. Dantzig, P. H. McAllister and W. D. Winkler, "A Dynamic Equilibrium Model for Energy-Economic Planning," SOL 82-2.

B. Avi-Itzhak, T. J. Connolly, G. B. Dantzig, P. H. McAllister and W. D. Winkler, "Mathematical Appendix: A Dynamic Equilibrium Model for Energy-Economic Planning," SOL 82-3.

Klaus Schittkowsky, "On the Convergence of a Sequential Quadratic Programming Method with an Augmented Lagrangian Line Search Function," SOL 82-4.

B. Curtis Eaves, "Permutation Congruent Transformations of the Freudenthal Triangulation with Minimal Surface Density," SOL 82-5.

Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright, "Procedures for Optimization Problems with a Mixture of Bounds and General Linear Constraints," SOL 82-6.

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Richard W. Cottle and Steven G. Duvall, "A Lagrangean Relaxation Algorithm for the Constrained Matrix Problem," SOL 82-10.

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Frederick S. Hillier, "Heuristics: A Gambler's Roll," SOL 82-12.

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## Integer Programming and Related Areas A Classified Bibliography 1978-1981

edited by Rabe von Randow  
Lecture Notes in Economics and Mathematical Systems, Vol. 197  
Springer Verlag  
Berlin, Heidelberg, New York, 1982

For the third time the Bonn Institute of Operations Research has undertaken the respectable effort to compile and publish its classified bibliography of integer programming and related areas. After the first volume covering the period until 1975 and the second for the period 1976-1978 (Volumes 128 and 160 in the Lecture Notes in Economics and Mathematical Systems), this one continues this important work for the period 1978-1981.

The third volume, edited by Rabe von Randow, maintains the traditional form of a comprehensive survey of all accessible publications scattered over many journals, proceedings volumes, monographs and working papers.

Part 1 contains the alphabetical bibliography which lists all publications alphabetically by the first author and chronologically for each author, and includes the full bibliographical data plus a reference code which reflects the author's name and the year of publication. The purpose of the code is to enable the user to identify publications referenced in Part 2 and Part 3. In Part 2 the publications have been classified according to 51 subjects: within each subject the ordering is again alphabetical by the first author. Those 51 subjects cover the topics Theory and Methods of General Integer Programming, Combinatorial and Graph Theoretical Optimization Problems Related to Integer Programming, Applications of Integer Programming. The purpose of Part 3 is to enable the user to locate publications for which only a coauthor's name is known. It consists of an alphabetical catalogue of all the authors appearing in Part 1 and lists for each author the reference codes of all his publications.

This bibliography is so well known and generally appreciated by scientists working in the field of integer programming or in related areas that we can confine ourselves to merely announcing the long expected third volume.

—M. Jünger, Cologne

## Optimization Over Time, Vol. 1

by Peter Whittle  
John Wiley, New York, 1982

This book provides a systematic and unified treatment of control problems where emphasis is placed on discrete-time, finite-horizon problems. Both deterministic and stochastic models, respective models with complete and incomplete information, are dealt with. It is demonstrated that the dynamic programming methods provide an intuitive and far-reaching tool which applies to a wide range of important problems. Starting from a well-chosen classification of the problems, the author elaborates the essential principles and basic structures of the theory and carefully reveals the inter-relationships and analogies between different areas (continuous time - discrete time, minimax - stochastic approach, deterministic - stochastic approach). The material is presented at such a level that the reader can appreciate its basic characteristics and distinctions. At the same time, the author succeeds in evading technicalities which would only conceal the intrinsic nature of the problems. In particular, the book is not concerned with questions of technical measurability where - in the author's judgement - the natural view of these matters has yet to be found. The organization of the book enables the author to treat many of the classical, as well as many modern, challenging examples in an adequate manner.

In general the book deals with the discrete time case, passing to the continuous time case only when it is more natural or more convenient for the respective problem. The theory profits from the discrete-time formulation by the direct and explicit way of obtaining recursive relations. However, the maximum principle is also extensively discussed in continuous time where it, and its relation to the dynamic programming principle, are more natural.

The infinite horizon models are treated only in a heuristic manner postponing the proofs to the projected second volume. The book contains interesting new material mainly in the areas of multi-armed bandit and generalized linear/quadratic/Gaussian models.

The text is divided into three parts, Part I: deterministic problems (including dynamic models), Part II: stochastic formulation (including Markov decision processes), Part III: linear/quadratic/Gaussian models (including recursive filtering procedures and risk-sensitive control). These parts contain the major areas of discrete-time control theory as well as many important examples such as: consumption-investment problems, production scheduling, the warehousing problem, eikonal problems, the bush problem, rocket thrust program optimization, control of temperature peaking, secretary problems, replacement models, gambling (optimality of bold play), control of queues, inventory and storage problems, index policies for sequential scheduling (multi-armed bandits). The book addresses itself to people in operational research and optimization theory, control engineers, economists and statisticians, and, since exercises are included, it could also be used as a text for some advanced courses.

—M. Schäl, Universität Bonn

## The Theory of Subgradients and its Applications to Problems of Optimization, Convex and Nonconvex Functions

by R.T. Rockafellar  
Heldermann, Berlin, 1981

In broad classes of optimization problems, which range from models in economics and operations research over approximation problems to variational principles that correspond to partial differential equations, it is often necessary to treat functions that are not differentiable in any traditional two sided sense. Therefore, since the early 1960's, much effort has gone into the development of a generalized kind of differentiation for extended-real-valued functions on real vector spaces that can serve in the analysis of optimization.

This beautiful book, written in Rockafellar's typically lucid style, gives a very clear, easily understandable and comprehensive treatment of the development up to the end of the 1970's. It is the original English version of ten lectures, given by the author at the University of Montreal in 1978 (A French translation by G. Tilquin was published by Les Presses de l'Université de Montreal in 1979).

The treatment is restricted to functions defined on  $R^n$ , so as not to distract attention from the main ideas by technical complications. It contains important unifying and clarifying aspects that cannot be found in previous literature and highly benefits from the author's broad and deep knowledge of the field. The presentation of the results is essentially self-contained.

A brief outline of the organization of the book is as follows:

In the introductory chapter the most important cases of nondifferentiability in optimization are described: Chebychev approximation, reduction of the number of constraints, exact penalties, marginal functions in various contexts, etc.

In Chapter 2, on tangent cones and normal vectors, fundamental properties of, and relations between, contingent cones (the classical tangent cones), tangent cones in the sense of Clarke, hypertangent cones and normal cones are established.

In Chapter 3, on subderivatives and subgradients, the author extends his earlier results in convex optimization to the nonconvex case by introducing and investigating concepts like lower semidifferentiability, lower semigradients, upper subderivatives.

Chapters 4-6 contain most important results in nonsmooth optimization: Lipschitzian cases, subdifferential calculus, optimality conditions, duality and marginal functions.

Chapter 7 concludes the book by applying results of the previous chapters to monotone operators.

The book is highly recommended for anyone interested in modern analysis and optimization theory.

—Reiner Horst

This book is the second part of a two-volume work which considers practical optimization problems and is addressed to both under- and postgraduate readers. In contrast to part one, constrained optimization is regarded. The intention of the author throughout this book is to emphasize numerically practicable and reliable methods. In every chapter the basic structure of the problem is exhibited first and is then amplified and qualified with rigour.

After introduction in chapter 7 (joining chapter 6 of volume 1) chapter 8 deals with linear programming problems where, besides the simplex method, other techniques such as duality, decomposition, parametric programming and the active set method are considered. After presenting the theory of constrained optimization (Lagrange-multipliers, first and second order conditions, convexity, duality), in chapter 10 the specific case of quadratic programming is regarded with stress upon Lagrangian, active set and complementary pivoting methods. Subsequently, general optimization problems with linear equality and inequality constraints are examined and strategies to prevent the special phenomenon of zigzagging are given attention.

Chapter 12 deals with nonlinear programming. Approaches by penalty and barrier functions, SOLVER, elimination, feasible direction and further methods are shown. The treatment of other optimization problems such as integer and geometric programming in a less, and non-differentiable optimization in a more, detailed way completes this book. The latter topic points at the current research of the author and besides optimality conditions and exact penalty functions, it also contains the study of algorithms (line search-, bundle-, cutting plane-, QL-method).

Connectivity in Multifactor Designs  
by Lothar Butz  
Heldermann, Berlin, 1982

The algebraic core of one of the basic problems in the theory of linear statistical models - namely the identifiability problem - is to characterize the consistency of a matrix equation  $XB = A$ . Characterizations in terms of concepts of linear algebra (rank conditions, g-inverses, etc.) are in practical applications often not very useful because of the large size of the "design"-matrix B. Now for many models, in particular in ANOVA-settings, the design-matrix is an incidence matrix having a certain block structure. In those cases combinatorial characterizations seem to be possible. In fact, in 1947 R. C. Bose remarked that in models with one treatment and one additive block factor the consistency of  $XB = A$  is equivalent to the connectedness of a certain associated bipartite graph.

The monograph by Butz extends this characterization in all generality to settings with n additive block factors. It turns out - for a very special case this has first been seen by Wynn (1977) - that in the general case, directed graphs whose arcs are integer labelled have to be associated and that, in addition to connectedness, conditions on the number of cycles are relevant. To check the last condition, an algorithm by reduction is presented which seems to be interesting by itself.

The book is clearly written; proofs and methods are supplemented by well-chosen examples. Some background in graph theory is necessary to understand the proofs.

Although aimed at a rather limited number of readers, the monograph is an interesting contribution demonstrating the interplay of combinatorial design, graph theory and "discrete" linear algebra.

—O. Krafft, Aachen

## JOURNALS & STUDIES

### Volume 25 No. 2

- M. Kojima and S. Mizuno, "Computation of all Solutions to a System of Polynomial Equations".  
M. N. Thapa, "Optimization of Unconstrained Functions with Sparse Hessian Matrices—Quasi-Newton Methods".  
C. McDiarmid, "Integral Decomposition in Polyhedra".  
J. R. Brown, "The Flow Circulation Sharing Problem".  
R. Hassin, "The Minimum Cost Flow Problem: A Unifying Approach to Dual Algorithms and a New Tree-Search Algorithm".  
J. Ponstein, "Comments on the General Duality Survey by J. Tind and L. A. Wolsey".

### Volume 25 No. 3

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S. P. Han and O. L. Mangasarian, "A Dual Differentiable Exact Penalty Function".  
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Y. Yamamoto, "A New Variable Dimension Algorithm for the Fixed Point Problem".  
J. Jahn, "Duality in Vector Optimization".  
G. van der Laan and A. J. J. Talman, "Note on the Path-Following Approach of Equilibrium Programming".  
M. J. Best and R. J. Caron, "A Method to Increase the Computational Efficiency of Certain Quadratic Programming Algorithms".  
E. Kohlberg, "Consistency of Finite Systems of Convex Inequalities".

### \*Volume 26, No. 1

- M. J. Todd, "Large-Scale Linear Programming: Geometry, Working Bases and Factorizations".  
R. R. Meyer, "Computational Aspects of Two-Segment Separable Programming".  
S. Dafermos, "An Iterative Scheme for Variational Inequalities".  
R. K. Martin and D. J. Sweeney, "An Ideal Algorithm for Integer Programs with Special Ordered Sets of Variables".  
P. J. Carstensen, "Complexity of Some Problems in Parametric and

\*Volume 26 contents subject to change by publisher.

### Integer Programming".

- M. E. Posner, "The Continuous Collapsing Knapsack Problem".  
S. J. Grotzinger, "On Characterizing L-Supports, Natural and Chebyshev Approximates".  
G. Huberman, "Error Bounds for the Aggregated Convex Programming Problem".  
S. Halfin, "The Sphere Method and the Robustness of the Ellipsoid Algorithm".

### \*Volume 26 No. 2

- G. Strang, "Maximal Flow Through a Domain".  
K. Tone, "Revisions of Constraint Approximations in the Successive QP Method for Nonlinear Programming".  
S. T. McCormick, "Optimal Approximation of Sparse Hessians and its Equivalence to a Graph Coloring Problem".  
W. B. van Dam, J. B. G. Frenk, and J. Telgen, "Randomly Generated Polytopes for Testing Mathematical Programming Algorithms".  
W. H. Cunningham and J. G. Kliniewicz, "On Cycling in the Network Simplex Method".  
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P. Loridan and J. Morgan, "Penalty Functions in ε-Programming and ε-Minimax Problems".  
S. Komlosi, "Some Properties of Nondifferentiable Pseudoconvex Functions".  
P. Zipkin and K. Raimer, "An Improved Disaggregation Method for Transportation Problems".

### \*Volume 26 No. 3

- R. T. Rockafellar, "Marginal Values and Second-Order Necessary Conditions for Optimality".  
G. Cornuejols, D. Naddef and W. R. Pulleyblank, "Halin Graphs and the Travelling Salesman Problem".  
B.-h. Ahn, "Iterative Methods for Linear Complementarity Problems with Upper Bounds on Primary Variables".  
J. R. Birge and A. Gana, "Computational Complexity of Van der Heyden's Variable Dimension Algorithm and Dantzig-Cottle's Principal Pivoting Method for Solving LCP's".  
R. E. Steuer and E.-U. Choo, "Interactive Weighted Tchebycheff Procedure for Multiple Objective Programming".  
T. Ibaraki, "Parametric Approaches to Fractional Programs".

**Martin Beale** (Scicon) conveys the news that **M.J.D. Powell** (Cambridge) was elected a Fellow of the Royal Society on 17 March, 1983. The citation reads: "Distinguished for his many contributions to numerical analysis, especially for the construction of powerful algorithms for nonlinear optimization and the theoretical evaluation of their convergence properties."

Visitors at the Institute of Operations Research, University of Bonn during 1982-83 include **L. Bakajew** (Kiev), **F. Barahona** (University of Chile), **W.H. Cunningham** (Carleton), **S. Fujishige** (Sakura, Japan), **R.G. Jeroslow** (Georgia Tech), and **M.M. Syslo** (Washington State)....An announcement from CORE (Louvain), received too late for the last OPTIMA, stated the availability of 1983-84 post-doctoral and faculty fellowships. The application deadline was February 15, 1983. The contact at CORE is **Paul Champsaur**....**E.A. Nurminski** (IIASA) announces the volume *Progress in Nondifferentiable Optimization*, available from the IIASA publications department for \$14....There will be an IFIP conference October 24-26, 1983 in Lyon, France on "Optimization in Computer-Aided Design," Contact Prof. **John S. Gero**, Dept. of Architectural Science, University of Sydney, Sydney N.S.W. 2006, Australia.

Deadline for the next OPTIMA is July 15, 1983.

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# C A L E N D A R

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Calendar of mathematical programming meetings  
as of 1 April 1983

Maintained by the Mathematical Programming Society (MPS)

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 33-221, 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. For further information address the Treasurer of the Society, Dr. A. C. Williams, Mobil Corporation, 150 East 42d Street, New York, NY 10017, U.S.A.; Telephone 212-883-7678.

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.

April 5-10: 15th Conference 'Mathematical Optimization', Sellin/Rügen, German Democratic Republic.  
Contact: Dr. R. Hansel, Sektion Mathematik, Humboldt-Universität zu Berlin, 1086 Berlin, German Democratic Republic; telephone 203 2239.

May 13-14: 'Optimization Days', Campus de la Université de Montréal, Canada. Contact: Professor Michael Polis, École Polytechnique de Montréal, C.P. 6079, Succ. 'A', Montréal, Québec, Canada H3C 3A7; telephone 514-344-4884, Telex 05-24146 BIBPOLYTEC. Sponsored by ACFAS, CAMS, IEEE, and the MPS.

May 16-18: 'Fifth Symposium on Mathematical Programming with Data Perturbations', The George Washington University, Washington, D.C., U.S.A. Contact: Professor Anthony V. Fiacco, Department of Operations Research, School of Engineering and Applied Science, The George Washington University, Washington, D.C. 20052, U.S.A.; telephone 202-676-7511. Deadline for abstracts, 1 March 1983.

June 20-21: IFAC Workshop on Applications of Nonlinear Programming to Optimization and Control, San Francisco, California, U.S.A. Abstract deadline February 1, 1983. Contact: Herbert E. Rauch, Lockheed 52-56/205, Palo Alto Research Laboratory, 3251 Hanover Street, Palo Alto, CA 94304, U.S.A.; Telephone 415-493-4411, Extension 45677.

June 27-29: SIAM Symposium on the Applications of Discrete Mathematics, Cambridge, Massachusetts, U.S.A. Contact: Hugh B. Hair, SIAM Services Manager, 1405 Architects Building, 117 South 17 Street, Philadelphia, Pennsylvania 19103, U.S.A.; Telephone 215-564-2929.

July 4-15: Summer School on Combinatorial Optimisation, Dublin. Contact: Secretariat, Summer School on Combinatorial Optimisation, National Institute for Higher Education, Glasnevin, Dublin 9, Ireland.

July 11-15: 3d IFAC/IFORS Symposium 'Large Scale Systems: Theory and Applications', Warsaw. Deadline for abstracts, 15 February 1982. Contact: Dr. Z. Nahorski, 3d IFAC/IFORS LSSTA, Systems Research Institute, Polish Academy of Sciences, ul. Newelska 6, 01-447 Warszawa, Poland; Telex 812397 ibs pl, Telephones 364103, 368150.

July 25-29: 11th IFIP Conference on System Modelling and Optimization, Copenhagen, Denmark. Deadline for abstracts, 31 December 1982. Contact: Professor P. Thoft-Christensen, Institute of Building Technology and Structural Engineering, Aalborg University Center, P.O. Box 159, DK-9100 Aalborg, Denmark.