OPTIMA

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER

No 37 July 1992

Hoffman & Wolfe *Receive Von Neumann Prize*

THE 1992 VON NEUMANN THEORY PRIZE for fundamental contributions to the theory of operations research and management science was awarded by the Operations Research Society of America and The Institute of Management Sciences to **Alan J. Hoffman and Philip Wolfe** at the joint meeting of the societies in Orlando, Florida, April 29, 1992. The following citation is from the ORSA office press release.

"Alan Hoffman and Phil Wolfe have had distinguished careers in mathematical programming. Their common bond is having worked together for more than 25 years in the Mathematical Sciences Department of the IBM Thomas J. Watson Research Center. They have been intellectual leaders of the mathematical programming group at IBM. This was one of the first industrial groups in the field and it has continued to produce work of the highest quality in theory, algorithms and software.

"Throughout his career, Alan Hoffman has worked on linear programming and combinatorial optimization. He has brought to bear a deep knowledge of algebra and combinatorics and much mathematical insight to the solution of a multitude of problems in this area.

"In 1951, Hoffman was the co-author of one of the first computational studies establishing the efficiency of the simplex method for solving linear programming problems. By the mid 1950s PAGE ELEVEN ▶

NUMBER 37

CONFERENCE Notes

Oberwolfach Conference

APPLIED AND COMPUTATIONAL CONVEXITY

January 26 — February 1, 1992

The conference which was organized by P. Gritzmann (Trier), V. Klee (Seattle) and P. Kleinschmidt (Passau), was attended by 39 participants, who gave a total of 37 lectures.

The conference reflected the interesting developments in the area of Applied and Computational Convexity which give this young field of mathematics its clear profile. The roots of this field lie jointly in geometry, in mathematical programming and in computer science. Typically, the problems are algorithmic in nature, the underlying structures are geometric with special emphasis on convexity, and the questions are usually motivated by practical applications in mathematical programming, computer science, and other less obviously mathematical areas of science.

According to the concept of this conference, the participants belonged to four different fields; classical convexity theory, mathematical programming, computational geometry and computer science.

The talks dealt with various topics of the wide spectrum of subjects covered by Applied and Computational Convexity. A couple of lectures were devoted to convex polytopes and polyhedral combinatorics, where polyhedral approaches are utilized for solving large-scale combinatorial optimization problems.

Linear programming was the subject of another group of lectures. Average case analysis of LP-algorithms, new randomized approaches to linear programming, and questions concerning its parallel complexity were studied.

Geometric aspects of nonlinear optimization were scrutinized in some other talks while yet other lectures dealt with lattice point problems, partly from the point of view of integer programming. Another complex covered at the conference dealt with concepts of classical convexity like mixed volumes of convex bodies and their relations to problems in computer algebra or mathematical programming.

Some other talks were devoted to questions in geometric probing that are related to various problems in numerical analysis or computer tomography. In this context the algorithmic theory of convex bodies played an important role. Various concrete practical applications were studied, including a problem of chromosome classification. Also presented were some algorithmic approaches for the construction of certain tilings that are relevant for the study of quasicrystals.

In addition, various open problems were stated which led to vivid discussions.

The conference showed that even though the participants belonged to different fields that have quite different tool-boxes, approaches and ideas for solving their problems, there is a deep and close connection which is centered around the basic concept of convexity. We are certain that the further study of these concepts will lead to a fruitful further development of the field of Applied and Computational Convexity.

In the following we list the speakers and the titles of their talks.

Imre Bárány: *On the number of convex lattice polygons.* Joint work with **J. Pach** and **A. Vershik.**

Louis J. Billera: *Fiber polytopes and transportation polytopes.* Joint work partly with **B. Sturmfels** and **A. Sarangarajan.**

Jürgen Bokowski: *Spatial polyhedra without diagonals.* Joint work with **Amos Altshuler** and **Peter Schuchert.**

Vladimir G. Boltyanski: *The Helly dimension of convex bodies.*

Karl Heinz Borgwardt: *Improvements in the average-case analysis of the simplex-method based on geometrical properties of randomly generated polyhedra.*

Ludwig Danzer: *Strategies for the generation of PENROSE-tilings with defects, which (hopefully) will not lead into dead ends.*

Klaus Donner: *Best L^2-approximation with order convex and cone star-shaped sets in MR-tomographic images.*

Martin Dyer: *Random walks and unimodular linear programs.* Joint work with **A. Frieze.**

Günter Ewald: *Projections of polytopes onto k-spaces.*

Miroslav Fiedler: *An application of simplex geometry to graphs and resistive electrical circuits.*

Richard J. Gardner: *Determination of convex polytopes by X-rays.* Joint work with **Peter Gritzmann.**

Peter Gritzmann: *Polytope containment and determination by linear probes.* Joint work with **Victor Klee** and **John Westwater.**

Martin Henk: *Approximating the volume of convex bodies.* Joint work with **U. Betke.**

Reiner Horst: *Global optimization and the geometric complementarity problem.*

Alexander Hufnagel: *On the complexity of computing the volume of a zonotope.* Joint work with **Martin Dyer** and **Peter Gritzmann.**

Gil Kalai: *The diameter of graphs of convex polyhedra and a randomized simplex algorithm.*

Victor Klee: *Three unsolved problems concerning cubes.*

Peter Kleinschmidt: *Methods of automated chromosome classification.* Joint work with **Ilse Mittereiter, Christian Rank.**

Jeffrey C. Lagarias: *The spectral radius of a set of matrices and matrix norms.* Joint work with **Yang Wang.**

D. G. Larman: *A Ramsey theorem for convex sets in the plane.*

Jim Lawrence: *Transversals and the Euler characteristic.*

Carl Lee: *Generalized stress and rigidity.*

Horst Martini: *The generalized Fermat-Torricelli problem.*

Nimrod Megiddo: *Parallel complexity of linear programming.*

Günter Meisinger: *On the face and flag numbers of convex polytopes.*

Shmuel Onn: *Permutation polytopes.*

Panos Pardalos: *Minimization of separable convex functions subject to equality and box constraints.* Joint work with **N. Kovoov.**

Richard Pollack: *Arrangements, spreads and topological projective planes.* Joint work with **J. E. Goodman, R. Wenger,** and **T. Zamfirescu.**

Bill Pulleyblank: *On splittable sets.* Joint work with **F.B. Shephard** and **B.A. Reed.**

Alexander Schrijver: *The stable set and odd path polytopes.* Joint work with **P.D. Seymour.**

Ron Shamir: *Unimodal separable minimization subject to partial order constraints.* Joint work with **Endre Boros.**

György Sonnevend: *Analytic centers for semiinfinite sets of convex inequalities.*

Josef Stoer: *On the complexity of continuation methods following an infeasible path.*

Bernd Sturmfels: *Product formulas for sparse resultants.* Joint work with **Paul Pedersen.**

Emo Welzl: *A randomized LP-algorithm with a subexponential number of arithmetic operations.* Joint work with **Jirka Matousek** and **Micha Sharir.**

J.M. Wills: *A lattice point problem.*

Günter M. Ziegler: *Subspace arrangements and their homotopy types.* Joint work with **Rade T. Zivaljevic.**

P. GRITZMANN, V. KLEE, P. KLEINSCHMIDT

OPTIMIZATION IN PLANNING AND OPERATION OF ELECTRIC POWER SYSTEMS

October 15-16, 1992,

Hotel Seepark, Seestrasse 47

CH-3602 Thun, Switzerland

This tutorial is organized by SVOR/ASRO (Swiss Association of Operations Research), in collaboration with ETG/PES (Power Engineering Society) member of the SEV (Swiss Institute of Electrical Engineers).

OBJECTIVES

Permanently increasing requirements in power supply necessitate efficient control of electric power systems. An emerging subject of importance is optimization which is the challenging principal theme of the announced tutorial.

Modelling Aspects of Unit Commitment and Optimal Power Flow will provide insight to electric energy systems engineering and to its associated problem statement. Due to the nature of the underlying optimization problems recent developments in advanced and well-established **Mathematical Programming Methodologies** will be presented, illustrating in which way dynamic, separable, continuous and stochastic features might be exploited. In completing the various methodologies a number of presentations will state **experiences with optimization packages** currently used for unit commitment and optimal power flow calculations.

One of the interesting objectives of this tutorial is the fruitful communication – to be expected – between operations research experts, analysts of the application's side and users in the power industry.

TOPICS:

Unit Commitment; (Hydro-) Thermal Optimization; Optimal Power Flow; Optimization Packages for Unit Commitment and Optimal Power Flow; Dynamic Programming; Interior Point Methodology; Lagrangian Optimization Methodology; Stochastic Programming.

CONFERENCE Notes

THIRD CONFERENCE ON INTEGER PROGRAMMING AND COMBINATORIAL OPTIMIZATION

IASI–CNR

Erice, Italy

April 29 – May 1, 1993

This meeting will highlight recent developments in the theory of integer programming and combinatorial optimization.

Topics will include:

POLYHEDRAL COMBINATORICS, INTEGER PROGRAMMING, GEOMETRY OF NUMBERS, COMPUTATIONAL COMPLEXITY, GRAPH THEORETIC ALGORITHMS, NETWORK FLOWS, MATROIDS AND SUBMODULAR FUNCTIONS, 0-1 MATRICES, APPROXIMATION ALGORITHMS, SCHEDULING THEORY AND ALGORITHMS, ALGORITHMS FOR SOLVING COUNTING PROBLEMS.

Accommodations

Accommodation for the participants and the facilities for the Conference will be provided by the "Ettore Majorana" Centre for Scientific Culture. The Centre is located in Erice, a small medieval village on top of a mountain (750 meters above sea level) on the western edge of Sicily.

For further information including registration details, please contact:

Giovanni Rinaldi
Consiglio Nazionale delle Ricerche
Istiituto di analisi dei sistemi ed Informatica
Viale Manzoni 30, ROMA, Italy.
E-mail: rinaldi@ iasi.rm.cnr.it Fax: (39)6-770031.

Instructions for Contributors

Persons wishing to submit a paper should send eight copies of an extended abstract before September 30, 1992 to:

Professor L.A. Wolsey
CORE
Université Catholique de Louvain
Voie du Roman Pays 34
1348 Louvain-la-Neuve, Belgium.

The extended abstract should be from five to ten pages in length (typed, double-spaced), i.e., about 2,000 words, and not a complete paper. It must provide sufficient details concerning the results and their significance to enable the program committee to make its selection.

September 30, 1992 *Deadline for submission of extended abstracts of papers.*
December 31, 1992 *Notification of acceptance of papers.*
February 28, 1993 *Deadline for submission of full text of accepted papers.*
April 29–May 1st, 1993 *The Conference.*

INVITED SPEAKERS:

Dr. H. Braun (BASF, Germany), **Prof. G.B. Dantzig & Dr. G. Infanger** (Stanford University, USA), **Dr. K. Kato** (ECC, USA), **Dipl. Ing. K. Linke & Dipl. Ing. H.H. Sanders** (VEW, Dortmund, Germany), **Prof. K. Neumann** (University of Karlsruhe, Germany), **Dr. A. Papalexopoulos** (PG&E, USA), **Prof. R.T. Rockafellar** (University of Washington, Seattle, USA), **Dr. E. Steinbauer, Dipl. Ing. A Schadler** (STEWEAG, Austria), **Prof. J.-P. Vial** (University of Geneva, Switzerland), **Dr. R. Bacher** (ETH Zurich, Switzerland), **Prof. H. Glavitsch** (ETH Zurich, Switzerland).

Organizing Committee:

Dr. Karl Frauendorfer (University of Zurich, SVOR/ASRO), **Prof. Dr. Hans Glavitsch** (ETH Zurich, ETG/PES), **Dr. Rainer Bacher** (ETH Zurich, ETG/PES).

For registration and further information please contact:

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Technical Reports & Working Papers

RUTCOR RESEARCH REPORTS

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

Irvin J. Lustig, Roy E. Marsten and David F. Shanno, *"The Interaction of Algorithms and Architectures for Interior Point Methods,"* RRR 36-91.

Ronald M. Harstad and Michael H. Rothkopf, *"Optimal Use of Governmental Monopoly Power,"* RRR 37-91.

Ilan Adler and Ron Shamir, *"Greedily Solvable Transportation Networks and Edge-Guided Vertex Elimination,"* RRR 39-91.

Endre Boros, Peter L. Hammer and Ron Shamir, *"Balancing Problems in Acyclic Networks,"* RRR 40-91.

Endre Boros, Peter L. Hammer, Toshihide Ibaraki and Kazuhiko Kawakami, *"Identifying 2- Monotonic Positive Boolean Functions in Polynomial Time,"* RRR 41-91.

Fred S. Roberts, *"On the Indicator Function of the Plurality Function,"* RRR 43-91.

Fred S. Roberts and Yonghua Xu, *"On the Optimal Strongly Connected Orientations of City Street Graphs IV: Four East-West Avenues or North-South Streets,"* RRR 44-91.

Guoli Ding, A.Schrijver and P.D. Seymour, *"Disjoint Paths in a Planar Graph - A General Theorem,"* RRR 45-91.

Guoli Ding, A. Schrijver and P.D. Seymour, *"Disjoint Cycles in Directed Graphs on the Torus and the Klein Bottle,"* RRR 46-91.

Christodoulos A. Floudas, Pierre Hansen and Brigitte Jaumard, *"Reformulation of Two Bond Portfolio Optimization Models,"* RRR 47-91.

Fred S. Roberts, *"Limitations on Conclusions Using Scales of Measurement,"* RRR 48-91.

N.V.R. Mahadev, Fred S. Roberts and Prakash Santhanakrishnan, *"3-Choosable Complete Bipartite Graphs,"* RRR 49-91.

Pierre Hansen and Keh-Wei Lih, *"Heuristic Reliability Optimization by Tabu Search,"* RRR 50-91.

Frank K. Hwang, Uriel G. Rothblum and Larry Shepp, *"Monotone Optimal Multi-Partitions Using Schur Convexity With Respect To Partial Order,"* RRR 51-91.

Frank K. Hwang and Uriel G. Rothblum, *"Majorization and Schur Convexity with Respect to Partial Orders,"* RRR 52-91.

Uriel G. Rothblum, *"Using A Characterization of Feasibility of Transportation Problems to Establish the Pairwise Connectedness of R^n with Respect to Partial Orders,"* RRR 53-91.

Joel E. Cohen and Uriel G. Rothblum, *"Nonnegative Ranks, Decompositions and Factorizations of Nonnegative Matrices,"* RRR 54-91.

Tamra J. Carpenter and David F. Shanno, *"An Interior Point Method for Quadratic Programs Based on Conjugate Projected Gradients,"* RRR 55-91.

Benjamin Avi-Itzhak and Shlomo Halfin, *"Servers in Tandem with Communication and Manufacturing Blocking,"* RRR 56-91.

Rainer E. Burkard, Karin Dlaska and Bettina Klinz, *"The Quickest Flow Problem,"* RRR 57-91.

Pierre Hansen and Maolin Zheng, *"Upper Bounds for the Clar Number of a Benzenoid Hydrocarbon,"* RRR 58-91.

Maolin Zheng, *"On Clar Graph,"* RRR 59-91.

Shaoji Xu and Jianzhong Zhang, *"An Inverse Problem of the Weighted Shortest Path Problem,"* RRR 60-91.

Yves Crama and Frits C.R. Spieksma, *"Scheduling Jobs of Equal Length: Complexity and Facets,"* RRR 61-91.

Pey-Chun Chen, Pierre Hansen, Brigitte Jaumard and Hoang Tuy, *"Weber's Problem with Attraction and Repulsion,"* RRR 62-91.

Denise Sakai, *"No-Hole K-Tuple (R+1)-Distant Colorings,"* RRR 63-91.

Yves Crama, Pierre Hansen and Brigitte Jaumard, *"Complexity of Product Positioning and Ball Intersection Problems,"* RRR 64-91.

Denise Sakai, *"Minimizing the Number of Holes in 2-Distant Colorings,"* RRR 65-91.

Denise Sakai, *"Two Results About Niche Graphs,"* RRR 66-91.

Denise Sakai, *"Labelling Chordal Graphs with a Condition at Distance Two,"* RRR 67-91.

J. Long and A.C. Williams, *"On the Number of Local Maxima in 0-1 Quadratic Programs,"* RRR 68-91.

Peter L. Hammer and Alain Hertz, *"On A Transformation which Preserves the Stability Number,"* RRR 69-91.

András Prékopa, *"Inequalities on Expectations Based on the Knowledge of Multivariate Moments,"* RRR 70-91.

BOOK REVIEWS

Dynamic Optimization, The Calculus of Variations and Optimal Control in Economics and Management,

Second Edition
by M.I. Kamien and N.I. Schwarz
North-Holland, Amsterdam, 1991
ISBN 0-444-01609-0

The flier which accompanies this book states that: "The first edition of this volume has served as the classic text in economics, mathematical methods in economics and dynamic optimization, management science, mathematics and engineering. Now, with this second edition, a new generation of readers will benefit from the book's clear exposition and many worked examples." This not so modest recommendation raises high expectations. After having studied the book, the current reviewer comes to the conclusion that the book lives up to these expectations. Let us have a closer look.

For those who are familiar with the first edition, the second edition contains new developments. The most noticeable addition is a section on differential games. Other additions deal with comparative dynamics, integral state equations and jumps in the state variable. The book consists of two parts; calculus of variations and optimal control. The first part, on the calculus of variations, is split up into 18 sections. The second part, on optimal control, is split up into 23 sections. The average length of each section is about seven pages (the maximum length is 15 pages which occurs only once). Most sections deal with standard, separate, topics which are easily accessible. Thus a clear exposition has been obtained. Most of the sections contain worked out examples. The sections contain exercises and conclude with some information on further reading. Apart from these two parts there are two extensive appendices, one on calculus and nonlinear programming and one on differential equations. Without being exhaustive, let me mention the contents of some sections. In the part on the calculus of variations we have the Euler equation, second order conditions, the Legendre condition, transversality condition, free end value, finite and infinite horizon, sensitivity, corners and the Weierstrass-Erdmann corner conditions, inequality constraints, graphical aids. The part on optimal control deals amongst others with the distinction between 'state' and 'control', necessary conditions, sufficiency conditions, discounting, the current-value Hamiltonian, infinite horizon, bounded controls, bang-bang control, singular solutions, Pontryagin maximum principle, state variable inequalities, delays in the differential equation, dynamic programming, stochastic optimal control, differential games (two person, Nash), open-loop and feedback strategies.

In both parts only continuous time formulations are considered. Most sections deal with scalar problems (the 'state' x is one-dimensional). According to the preface, the style is such that the "focus is on providing the student with the tricks of the trade on an informative intuitive level." Indeed, I think that this book is an excellent first introduction to the field of dynamic optimization. Though most of the examples have an economic flavor, the emphasis is on the solution technique(s) and therefore this book is not only interest-arousing for economists and management scientists, but also for (applied) mathematicians and engineers.

Indeed, I think that this book is an excellent first introduction to the field of dynamic optimization.

The prerequisites are rather modest; calculus, some basic knowledge of nonlinear programming and of the theory of differential equations. The text is suitable for undergraduates in the mathematical sciences and for beginning graduates of the economic and managerial sciences. Some mild criticism is that the novice might not realize that the examples have been carefully designed such as to make analytical insight possible. For more complicated problems one definitely needs numerical techniques which are not treated.

Another point that puzzles me somewhat is that the dynamic programming approach is somewhat hidden in the part on optimal control. One could easily devote a separate third part to dynamic programming which would have emphasized the difference between open-loop and feedback solutions. In the current set up this difference hardly shows up which is a pity (the difference in these solutions becomes visible only in the section on differential games). Notwithstanding this criticism, the novice will "benefit from the book's clear exposition and many worked examples."

G.J. OLSDER

Handbook of Theoretical Computer Science

Volume B
Edited by J. van Leeuwen
North-Holland, Amsterdam, 1990
ISBN 0-444-88074-7

The ***Handbook of Theoretical Computer Science*** is designed to provide a wide audience of professionals and students in computer science and related disciplines with an overview of the major results and developments in the theoretical exploration of modern developments in computer and software systems. The current version of the Handbook is presented in 2 volumes: Vol. A: ***Algorithms and Complexity***; Vol. B: ***Formal Models and Semantics***.

This reflects the division between algorithm-oriented and description-oriented research that can be witnessed in theoretical computer science. The volumes can be used independently, and together they give a unique impression of the core areas of research in theoretical computer science as it is practiced today. In my opinion, the handbook is a basic and very important book.

Volume B, called ***Formal Models and Semantics***, is divided into 19 chapters:

Finite Automata (Perrin), Context-Free Languages (J. Berstel and L. Boasson), Formal Languages and Power Series (A. Salomaa), Automata on Infinite Objects (W. Thomas), Graph Rewriting: An Algebraic and Logic Approach (B. Courcelle), Rewrite Systems (N. Dershowitz and J.-P. Jouannaud), Functional Programming and Lambda Calculus (H.P. Barendregt), Type Systems for Programming Languages (J.C. Mitchell), Recursive Applicative Program Schemes (B. Courcelle), Logic Programming (K.R. Apt), Denotational Semantics (P.D. Mosses), Semantic Domains (C.A. Gunter and D.S. Scott), Algebraic Specifications (M. Wirsing), Logics of Programs (D. Kozen and J. Tiuryn), Methods and Logics for Proving Programs (P. Cousot), Temporal and Modal Logic (E.A. Emerson), Elements of Relational Database Theory (P.C. Kanellaiks), Distributed Computing: Models and Methods (L. Lamport and N. Lynch), Operational and Algebraic Semantics of Concurrent Processes (R. Milner).

M. LOEBL

Stability, Duality and Decomposition in General Mathematical Programming

by O.E. Flippo,
CWI Tract 76, Centre for Mathematics and Computer Science
Amsterdam, 1991
ISBN 90-6196-398-2

This book presents a new general framework for primal and dual decomposition methods. Books about decomposition are scarce, and most literature on decomposition is based on practical applications. This book, however, is outspokenly theoretical in its approach. The author states that the approach is one of abstraction and the analysis is more conceptual than algorithmic in nature. No applications or computational results are presented or discussed. Therefore, the book is mainly addressed to readers interested in theoretical aspects of decomposition.

The main goal of the book is to give new generalizations of the traditional decomposition methods of Benders and Dantzig and Wolfe. It consists of three parts, each self-contained with an introduction, a summary and a reference list. The topics of the three parts are stability, general duality theory and general decomposition methods. General duality theory is an essential prerequisite for the general decomposition methods, and stability is an essential condition for the general decomposition methods to converge, so the first two parts are mainly prerequisites to the third part, where the new decomposition methods are presented and analyzed.

In the first part, right-hand-side perturbations are considered, and stability is defined as continuity of the value-function (the perturbation function). A number of results are given containing sufficient conditions for stability, and the necessity of these conditions is also discussed.

The second part presents general duality theory. It is shown to contain Lagrangean duality, augmented Lagrangean duality and integer linear programming duality as special cases. Special consideration is given to the question about one-to-one correspondence between primal constraints and dual variables, which is shown to hold in the case of additively separable dual solutions, and, if the dual functions are finite, in the case of stability, or in the case of a bounded integer program.

The third part presents two new, very general decomposition procedures, variable decomposition and constraint decomposition, which are shown to be dual to each other.

The key idea in ***variable*** decomposition is a new and seemingly simple reformulation, when constructing the subprogram. Usually some "difficult" variables x are fixed to some $\bar{x}$, which means that these variables are eliminated from the problem. Here the constraints $x = \bar{x}$ are introduced explicitly and x kept as variables. The standard derivation of the master problem is then carried through, keeping this special problem formulation. This generalization eliminates the need for any additional assumptions about separability or the Property P introduced by Geoffrion, something which is needed in former extensions of Benders decomposition (due to what the author calls the "inappropriate" formulation of the problem by directly fixing x to $\bar{x}$).

The rather simple trick of using the constraints $x = \bar{x}$ explicitly has the effect of expanding the dual space. If the subproblem is actually going to be solved that way, i.e., without eliminating the fixed variables, the subproblem will become larger that the original problem. From this point of view it is unfortunate that the practical efficiency of this decomposition method is not discussed at all.

The algorithm is given as a framework, without specifying many details. Decomposition procedures by the following authors are shown to fit into the framework: Benders (partially linear programs), Balas, Lazimy (both mixed-integer quadratic programs with a convex structure), Geoffrion (partially convex programs), Wolsey (no explicit constraints), Burkard, Hamacher and Tind (separable algebraic optimization) and the outer approximation approach of Duran and Grossman.

The method is shown to have finite convergence if the primal or dual solutions generated belong to finite sets. Examples are bounded integer sets (primally finite) or linear programs (dually finite). Conditions for asymptotic convergence are also given, and results for ε-optimal solutions are given, which allows for inaccurate solutions of the sub- and master programs.

By applying this approach to a mixed-integer nonlinear program with underlying convex structure, a separation into a mixed integer linear program and a convex nonlinear program is obtained, i.e., the integer requirements are separated from the nonlinearities.

The ***constraint*** decomposition procedure presented uses general dual functions, instead of affine functions with ordinary Lagrange multipliers, and generalizes the methods of Dantzig and Wolfe (LP), Dantzig (convex programs) and Burkard, Hamacher and Tind. The subprogram is a "generalized" Lagrangean relaxation. Convergence results similar to those for variable decomposition are given.

Finally, generalizations of the two primal-dual decomposition methods – cross decomposition and Kornai-Liptak decomposition – are presented, using both variable and constraint decomposition.

A book about decomposition is always welcome. This book is well written with a certain elegance of style. It is in fact Flippo's Ph.D.-dissertation, and this is obvious by the repeated discussions about which results are new contributions and which are not. This might also explain the somewhat argumentative style in which the author promotes his ideas.

In conclusion, this book describes an interesting generalization of primal and dual decomposition methods. It might not quite qualify as ***the*** generalization which subsumes all others, but is an interesting contribution and can be recommended to everyone interested in theoretical aspects of decomposition methods.

KAJ HOLMBERG

This book describes an interesting generalization of primal and dual decomposition methods. It might not quite qualify as ***the*** generalization, . . . but is an interesting contribution and can be recommended to everyone interested in theoretical aspects of decomposition methods.

OPTIMA Journals

Vol. 55, No. 1

Michael J. Todd, *"On Anstreicher's Combined Phase I-Phase II Projective Algorithm for Linear Programming."*

J.F. Pekny and D.L. Miller, *"A Parallel Branch and Bound Algorithm for Solving Large Asymmetric Traveling Salesman Problems."*

Michele Conforti and M.R. Rao, *"Properties of Balanced and Perfect Matrices."*

G. Di Pillo, F. Facchinei and L. Grippo, *"An RQP Algorithm Using a Differentiable Exact Penalty Function For Inequality Constrained Problems."*

J.H. Dula, *"An Upper Bound on the Expectation of Simplical Functions of Multivariate Random Variables."*

U. Passy and E.Z. Prisman, *"A Duality Approach to Minimax Results for Quasi-Saddle Functions in Finite Dimensions."*

A.G. Robinson, N. Jiang and C.S. Lerme, *"On the Continuous Quadratic Knapsack Problem."*

Yin Zhang, *"Computing a Celis-Dennis-Tapia Trust-Region Step for Equality Constrained Optimization."*

Vol. 55, No. 2

Michele Conforti and M.R. Rao, *"Structural Properties and Decomposition of Linear Balanced Matrices."*

Martin Dyer and Alan Frieze, *"Probabilistic Analysis of the Generalised Assignment Problems."*

Ephraim Korach and Michal Penn, *"Tight Integral Duality Gap in the Chinese Postman Problem."*

Alan J. King and R.Tyrrell Rockafellar, *"Sensitivity Analysis for Nonsmooth Generalized Equations."*

Rachelle S. Klein, Hanan Luss and Donald R. Smith, *"A Lexicographic Minimax Algorithm for Multiperiod Resource Allocation."*

Asim Roy and Jyrki Wallenius, *"Nonlinear Multiple Objective Optimization: An Algorithm and Some Theory."*

Vol. 55, No. 3

Pierre Hansen, Brigitte Jaumard and Shi-Hui Lu, *"Global Optimization of Univariate Lipschitz Functions: I. Survey and Properties."*

Pierre Hansen, Brigitte Jaumard and Shi-Hui Lu, *"Global Optimization of Univariate Lipschitz Functions: II. New algorithms and Computational Comparison."*

Dimitri P. Bertsekas and Jonathan Eckstein, *"On the Douglas-Rachford Splitting Method and the Proximal Point Algorithm for Maximal Monotone Operators."*

Graham R. Wood, *"The Bisection Method in Higher Dimensions."*

M. Gröetschel and Zaw Win, *"A Cutting Plane Algorithm for the Windy Postman Problem."*

Dorit S. Hochbaum, Ron Shamir and J. George Shanthikumar, *"A Polynomial Algorithm for an Integer Quadratic Nonseparable Transportation Problem."*

Vol. 56, No. 1

S. Frank Chang and D. Thomas McCormick, *"A Hierarchial Algorithm for Making Sparse Matrices Sparser."*

Shinji Mizuno, *"A New Polynomial Time Method for a Linear Complementarity Problem."*

Douglas J. White, *"A Linear Programming Approach To Solving Bilinear Programmes."*

Hiroshi Konno and Takahito Kuno, *"Linear Multiplicative Programming."*

Jerzy Kyparisis and Chi-Ming IP, *"Solution Behavior for Parametric Implicit Complementarity Problems."*

Chi-Ming Ip and Jerzy Kyparisis, *"Local Convergence of Quasi-Newton Methods for B-Differentiable Equations."*

Silvia Vogel, *"On Stability in Multiobjective Programming–a Stochastic Aproach."*

Hoffman & Wolfe Receive Von Neumann Prize FROM PAGE ONE

his interest in applying linear programming to the solution of combinatorial optimization problems had clearly emerged, and in 1956 his paper with J. Kruskal on unimodular matrices appeared. He has been a very active contributor to the derivation of combinatorial min-max results using linear programming duality and total unimodularity.

"Alan Hoffman has written papers with at least seven other von Neumann prize winners, so it is very likely that he represents the node of highest degree in the graph of von Neumann collaborators. His long standing tenure in the field is documented by having had papers in the first volume of SIAM Journal (1953), Management Science (1954) and Naval Research Logistics Quarterly (1954). Remarkably, he has sustained a high level of research activity for more than forty years. He has done substantial work in linear programming, network flows, unimodularity, blocking and antiblocking polyhedra, balanced matrices, greedy algorithms, eigenvalue estimation and other areas of mathematics.

"Philip Wolfe has published more than 60 papers on the subject of mathematical programming. The pioneering work on using lexicography to resolve cycling in the simplex method for linear programming, done with co-workers G. Dantzig and A. Orden, was published in 1955. In 1956, M. Frank and Wolfe published the seminal paper that gives a linearly convergent algorithm for quadratic programming. His 1959 paper 'The simplex method for quadratic programming' exemplifies the idea of using the simplex method as a building block for solving nonlinear problems. The restricted pivot selection scheme of this paper has had a strong influence on algorithmic developments in quadratic programming and linear complementarity.

"Phil Wolfe is also a co-author of what may be the first paper in large-scale optimization, namely his paper with Dantzig on the decomposition principle of linear programs. This idea has had an enormous impact on theory and computation and is still an active area of research today.

"Phil Wolfe also contributed to numerical analysis, computational complexity, game theory and software systems. In addition to being well-known for his fundamental contributions to the simplex method, decomposition and quadratic programming, he also developed the most robust optimization algorithm ever written, but was too modest to take credit for it. See Anonymous, 'A new algorithm for optimization,' Mathematical Programming 3, 1972."

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The second **meeting of the Nordic Section of MPS** will be August 14-16, 1992. Contact **Jens Clausen**, email: clausen@diku.dk. ¶The first **Soviet-Italian Conference on Methods and Applications of Mathematical Programming** will be held Sept. 7-11, 1992, Cetraro, Cosenza, Italy. Contact is **Dr. Francesco Lampariello**, email: itasov@irmiasi.bitnet or fax: 39 6 770031. ¶A course on **Interior Point Methods in Optimization** is being organized by INRIA for October 7-9, 1992, in Rocquencourt, France. The main speakers are C.C. Gonzaga and J.Ph. Vial. Contact **Frederic Bonnans**, email: bonnans@femat.inria.fr. ¶The **16th IFIP Conference on System Modeling and Optimization** will be July 5-9, 1993, Compiègne, France. Contact **the Secretariat**, email: symposia@inria.fr or fax: (33) (1) 39 63 56 38. ¶A **Sixth Workshop on Computer-Aided Scheduling of Public Transport** will be held in Lisbon, Portugal, 6-9 July, 1993. Contact **the Secretariat**, email: paixao@ul.pt or fax: (01) 397 83 08. ¶**Deadline** for the next OPTIMA is **October 1, 1992.**

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