

OPTIMA

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER

March 1982

Number 6

MATHEMATICAL PROGRAMMING ACTIVITIES IN THE USSR

Bernhard Korte, Bonn

In September/October 1981, at the invitation of the Academy of Sciences of the USSR, I visited some of their research institutes and other academic institutions in the Soviet Union. Since mathematical programming activities in the USSR are not too familiar to the scientific community in the West, it might be of interest to the readership of this newsletter to report here some of my personal impressions.

With the epidemic dissemination of the ellipsoid method in the West starting at a meeting at the Mathematisches Forschungsinstitut Oberwolfach in May 1979, many scholars in the fields of mathematical programming have become more aware of research results obtained in the Soviet Union. However, there has long been a substantial and important tradition of mathematical programming research in that country.

The reception and hospitality extended to me by official representatives of the Academy, as well as by colleagues at different institutes, was really outstanding and among the greatest impressions of this visit. I visited academic and research institutions in Moscow, Kiev, Novosibirsk (Akademgorodok), and Leningrad where I gave talks on my own research and survey lectures. At some places those lectures were translated from English into Russian by colleagues. During the whole visit I was accompanied by official interpreters of the Academy.

Original plans to visit places in Armenia, Grusinia, Acerbajshian and Belorussia had to be cancelled, since the necessary technical and bureaucratic organization was so time-consuming that it was not feasible during the relatively short time I could devote to this visit. The bureaucratic and scientific organization is very much centralized in Moscow. Thus, for example, every visit from abroad has to begin and end there. One of the main purposes of this visit was also to meet colleagues personally and

to invite them to participate in and to lecture at the XIth International Symposium on Mathematical Programming in August 1982 at the University of Bonn. I sincerely hope that all these invitations will be accepted and that all these leading scholars will eventually be able to lecture at the symposium.

In Moscow there are different institutions at which mathematical programming activities take place. The Central Economic-Mathematical Institute (CEMI) headed by Academician N.P. Federenko has about 1100 persons employed, among them 50 professors and 250 candidates (researchers with the second doctorate). Its main research topics are: forecasting models, general models for industrial complexes, management information systems and "mechanics of economic functions" (the Russian term for price systems). Mathematical programming topics are studied in the department of Professor E. Gol'stein which itself consists of three laboratories, one for mathematical programming under his own leadership, one for discrete optimization under Dr. A.A. Friedman, and one for probabilistic and stochastic methods. Professor Gol'stein and Dr. Tret'yakov have been working recently in the area of generalized Lagrangians; while the group on discrete optimization, in which Dr. Finkelstein, Dr. Frumkin, and Dr. Levner also work, deals mainly with complexity studies and algebraic problems in discrete optimization. During the time of my visit, CEMI moved into a new modern building, in which the computing facilities of the institute, an ES 1060 and ES 1022, are located. (In what follows, I will return to the subject of computer equipment in the USSR.)

The Computing Center of the Academy is under the directorship of Academician A.A. Dorodnicyn. Here the department of optimization is headed by Deputy Director Professor Y. Evtushenko. Formerly Deputy Director Professor N.N. Moiseev was in charge of this department. He is now responsible for applications. The

BONN SYMPOSIUM Registration Forms Mailed

A package of materials, including meeting and hotel registration forms, has been mailed to MPS members. Also included are forms for abstracts and social program information. Important deadline dates are:

Titles of contributed papers	April 1
Abstracts of contributed papers	June 1
Symposium registration	June 1
Social program registrations	June 1
Accommodations	June 1
Cancellations	August 1

optimization group at the Computing Center is quite strong and has become well-known as the place where Dr. L.G. Khachiyan works. This group works mainly on nonlinear optimization methods, generalized Lagrangians (Dr. Golikov), Newton-type methods for nonlinear equations (Dr. Burdanov), interactive NLP-software systems (Dr. V. Mazurick), combinatorial polyhedra, especially travelling salesman polytopes (Dr. V. Leontjev) and combinatorial optimization (Dr. S. Tarasov). Naturally, during my first meeting at this institute, I asked to meet with Dr. Khachiyan. One of the first comments about him by a senior scientist was simply: "He is an ordinary mathematician." This demonstrates to a certain extent that his work is perhaps not as much recognized and acknowledged there. Eventually arrangements were made for a meeting with him and we had an intensive discussion about the ellipsoid method and its extensions. He was very well aware of the follow-up papers on this method, especially its consequences for combinatorial optimization. He had a special greedy-type argument for the fact that a fully dimensional polytope is not necessary for the method, as well as for the equivalence proof of separation and optimization. (He prefers not to use the polar but rather the space of objective functions.) He is a young, impressive man whose appearance certainly reveals his Armenian descent. I was impressed by his very good knowledge of

Continued Overleaf

2 different areas of mathematics. It was very interesting to talk with him and, by the way, he spoke good English. Perhaps he is somewhat too nonconformist for his environment.

The optimization group at the Computing Center is very active in developing interactive software systems for nonlinear programming. With these packages, which contain all well-known optimization techniques, the user can choose from a terminal display an appropriate method or subroutine depending on the particular problem. Since I had the chance to study this in detail, I also learned about the computing facilities of the Center. It still has three BESM computers with a 220 K word memory. This model is by now almost 20 years old and about equivalent to the CDC 3200. It is run under a multi-partition operating system with 16 partitions and it includes interactive features. The more up-to-date computer models in the USSR are those of the series ES, which is a joint production of all COMECON countries. Its disks are produced in Bulgaria and are similar to the old IBM 2314 with a capacity of seven megabytes. The printers are usually manufactured in Poland, the video displays in Hungary, the tape equipment in the DDR and the central units, depending on the various models, in different countries but predominantly in the USSR. This ES family is very similar to the IBM 360/370 series, with a maximal power in the range of the 370/135. It was frankly admitted that the hardware technology of Soviet computers is below the current world standard, but this gives rise to more sophistication in implementations and software development.

As a curious historical reminiscence, it can be added here that V.I. Lenin was one of the first owners of a personal computer. In the Lenin museum at the Red Square in Moscow, I had a close look at this rare object, a Thomas Arithmometer built by Charles Xavier Thomas de Colmar around the middle of the last century.

At a seminar which I gave in Moscow, I had the chance to meet Dr. A.S. Nemirovskij. He is also relatively young and his work on oracle techniques to prove the polynomiality of certain algorithmic approaches is quite impressive. As is well-known, this framework led to the proof that the ellipsoid method is polynomial for linear programming. His book *Complexity of Optimization Problems and Efficiency of Their Methods*, coauthored by Professor D.B. Judin, contains more complexity and

oracle results than known from the English versions of their papers. Fortunately, an English translation of this book is in preparation. According to opinions of Soviet colleagues, L.G. Khachiyan and A.S. Nemirovskij are among the very best junior scientists in the area of mathematical programming in the Soviet Union, and this also coincides with the acknowledgement of their work in the Western world.

At the Institute of Control of the Academy in Moscow there is also a small group dealing with mathematical programming and particularly with nondifferentiable optimization. This work is mainly done by Dr. Boris Poljak and his colleagues. Finally, I should mention the All-Union Institute for System Studies in Moscow, which is not a direct institute of the Academy but somewhat related to it. Academician and Nobel-laureate L.G. Kantorovitch, who was formerly at Novosibirsk, is now head of a laboratory at this institute. Various activities in continuous as well as in discrete optimization are going on there and in related research seminars. The group in discrete optimization made a very strong impression on me. Their excellent research results, in particular on network flow problems, have been known and appreciated in the West for years. This group mainly consists of Drs. E.A. Dinic, P. Grishuhin, A.W. Karsonov, A.K. Kelmans, A. Lomonosov and P.A. Pevsner. They have issued several volumes of collected papers. Some of them are also known (and translated) in the West. Right now they are working on generalization of the two-commodity-flow problem to a multi-commodity one where, under certain assumptions for the source-sink pattern, a max-flow-min-cut result still holds, but of course not with integral flow values.

My visit to Novosibirsk was a striking experience. After a flight of 12 hours with an unexpected stopover at Omsk because of weather conditions, I was received at the airport by members of the Siberian Branch of the Mathematical Institute of the Academy. A further car ride of about one hour brought us to the "academic village" Akademgorodok which is 45 kilometers away. This little city was built about 20 years ago exclusively to host scientific institutes of the Academy. It now has 60,000 to 80,000 inhabitants and the infrastructure is, to a great extent, formed by its academic purpose. (I find it hard to decide whether academic life should be integrated in, or isolated from, other social structures — as is known a similar experi-

ment was started in France at Sophia-Antipolis. Although concentration and isolation of academic life has considerable advantages and although there are historical models in ancient monasteries, I personally prefer its implementation in normal social structures to prevent the establishment of subcultures. And I have to confess that my opinion was reinforced. But, of course, this is a very personal view.) Scientists and other personnel in Akademgorodok live in normal 4- or 6-story buildings, while academicians and leading senior scientists often have their own datscha, a little house with 5 to 6 rooms.

In its early stages mathematical programming was brought to Akademgorodok by Academician Kantorovitch from the Leningrad school. Some of his former students like G.S. Rubinstejn and A.A. Kaplan are now conducting it. Formally the mathematical programming group is part of the Mathematical Institute under Academician S.L. Sobolev. This institute consists of three departments: mathematics, cybernetics, and mathematical economics. "Convex Analysis and Theory of Extremal Problems" is a subdivision of the latter, headed by Professor Rubinstejn. This group is very strong in the theory and algorithms of convex optimization, particularly special duality and separation theorems (Prof. Rubinstejn), penalty methods (Dr. Kaplan) and contributions to vector optimization and decomposition (Dr. B.A. Bulavski). It was of particular interest to me to learn about some early work of Kantorovitch and Rubinstejn on the infinite dimensional transportation problem in which a certain Monge-property (greedy) was used.

Professor G.I. Marshuk who was formerly the director of the Computing Center in Novosibirsk, and who is well-known in the areas of optimization and control, entered a very promising political career. He is now Deputy Prime Minister of the USSR.

Kiev is normally reached by an overnight ride in a sleeping car from Moscow. There I mainly visited the Institute of Cybernetics of the Ukrainian Academy of Sciences. This institute became famous in the West since it is the place where Dr. N.Z. Shor works. He is in his late forties and has a very lively facial expression and a vivid appearance. His mathematical approach is more of an engineering type. Yet, his interest and knowledge in mathematics is remarkably broad and deep, which can be demonstrated by the fact that he is jointly writing a book

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about algebraic characterizations of the four-colour problem. We had ample time for several discussions (which had to be translated by a colleague) and he explained to me the origin of the ellipsoid method. It was first developed as a subgradient method for generalized (nonlinear) transportation problems, for which he then invented the dilatation of space approach which eventually leads to the ellipsoid method. He did some numerical implementations of this method and he also states that it does not compare with the simplex method for linear programming. On the other hand, he believes in his recent modification of the ellipsoid method which he calls the r-method (and which uses gradients of two violated hyperplanes). Although the theoretical convergence of this modification is the same as of the original ellipsoid method, he claims to observe an empirical complexity of $O(n^3)$ which again is comparable to that of the simplex method. About this I personally have some doubts.

The Institute of Cybernetics has about 6000 members, of which 2000 are employed in its scientific branch and 4000 in its engineering department, which besides special constructions for industrial use, is also engaged in designing electronic LSI chips. Academician V.M. Gluskov is the director of this institute; Academicians V.S. Michalevitch and A.A. Bakajew are deputy directors. Very recently all leaders of the institute, together with Dr. Shor received a state prize for the ellipsoid method and their work in mathematical programming. During my stay in Kiev, I was hosted by Professor Bakajew and his son. Their hospitality was outstanding and the visit was extremely pleasant.

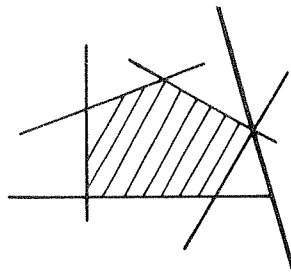
The research area of mathematical programming is located in the department of Professor Michalevitch in which Dr. Pscheschnitchny (subdifferential optimization), Dr. Ermoljev (stochastic programming) and Dr. Shor are heading subdivisions. Other researchers in this area are Dr. Gershovitch (subdifferential optimization and dilatation of space methods), Dr. Trubin (combinatorial optimization), Dr. Kuksa, Dr. Laptin, Dr. Tschurbenko and Professor Wolkovitch (cutting plane and branch and bound methods for linear and integer programming). This group in Kiev whose main research area - subdifferential optimization - made them famous, is certainly among the very strongest groups in mathematical programming in the USSR.

In Kiev, I also learned that the famous

van der Waerden conjecture was not proved for the first time by Egorichev from Krasnojarsk as it was believed in the western world for several months. Falikman from Kiev is credited with the first proof. He did not even use the Alexandrow inequality in his proof.

Leningrad, within easy reach of Moscow by a night-train, was, from a tourist's point of view, the most interesting place I visited. Its cultural and historical background is still evident today. The appearance of the city with its canals, the famous museums, and the very painstakingly restored czarist residences in their surroundings are impressive. Compared with the Hermitage, many museums all over the world seem to be provincial. As already mentioned, mathematical programming in its early stages was done at the University of Leningrad. It should be mentioned that some former students of L. Kantorovitch, such as Professor Romanovski, are still there. The Leningrad Branch of the Mathematical Institute of the Academy is doing studies in computational complexity, mainly carried out by Drs. Slisenko and Grigoriev. By a merging of different institutes of the Academy, the Institute of Socio-economical Studies was formed. Here a research group in game theory and optimization, headed by Professor Vorob'jev, includes Dr. A. Korbut who is working on discrete optimization.

This short report can only imperfectly characterize my very personal and limited experiences. And, of course, very many impressions - scientific as well as personal - are not related here. ●



OPTIMA

Newsletter of the Mathematical Programming Society

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Achim Bachem, Associate Editor

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FOURTH SYMPOSIUM ON MATHEMATICAL PROGRAMMING WITH DATA PERTURBATIONS

17-19 MAY 1982

A Fourth Symposium on Mathematical Programming with Data Perturbations will be held at The George Washington University's Marvin Center on 17-19 May 1982. 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.

Contributed papers in mathematical programming are solicited 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.

"Clinical" presentations are also invited that describe problems in sensitivity or stability analysis encountered in applications.

Abstracts of papers intended for presentation at the Symposium should be sent in triplicate to Professor Anthony V. Fiacco. Abstracts should provide a good technical summary of key results, avoid the use of mathematical symbols and references, not exceed 500 words, and include a title and the name and full mailing address of each author. The deadline for submission of abstracts is 1 March 1982.

Approximately 30 minutes will be allotted for presentation of each paper. A blackboard and overhead projector will be available.

A proceedings of selected papers is planned for publication as a special issue of the Marcel Dekker journal, *Numerical Functional Analysis and Optimization*, edited by M.Z. Nashed. If a sufficient number of other papers are presented that deal mainly with applications, these will be organized in a separate volume for another appropriate publication. The complete text of all proceedings contributions must be submitted before the conference convenes.

—Anthony V. Fiacco

CALENDAR

1982

- April 9-13: Meeting of the TIMS Special Interest Group on Multiple Criteria Decision Making, Mons. Contact: Pierr Hansen, Faculté des Sciences Économiques, Faculté Universitaire Cahtolique de Mons, Chaussée de Binche, 151, B-7000 Mons, Belgium.
- April 13-17: Workshop on Algebraic Structures in Operations Research, Bad Honnef, Federal Republic of Germany. Abstracts due March 1. Contact: Professor R.E. Burkard, Institut für Mathematik, Technische Universität, Kopernikusgasse 24, A-8010 Graz, Austria.
- April 26-29: SIAM Special Conference on Applied Linear Algebra, Raleigh, N.C., U.S.A. The Conference is devoted to five areas of applied linear algebra, one of which is "Operations Research and Optimization". Abstract deadline 30 November, 1981. Contact: Hugh B. Hair, Society for Industrial and Applied Mathematics, 1405 Architects Building, 117 South 17th Street, Philadelphia, PA 19103, U.S.A.; telephone 215-564-2929.
- May 13-14: "Optimization Days", Campus of the University of Montreal. Contact: Professor Jacques Ferland, Centre de recherche sur les transports, Université de Montréal, C.P. 6128, Succ. "A", Montréal, Québec, Canada H3C 3J7; telephone 514-343-7575. Deadline for abstract, January 31, 1982. Sponsored by IEEE, ACFAS, SIAM, SCMA, and the MPS.
- May 17-19: "Fourth 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, Deadline for abstracts, 1 March 1982. School of Engineering and Applied Science, The George Washington University, Washington, D.C. 20052, U.S.A.; telephone 202-676-7511.
- August 23-28: Eleventh International Symposium on Mathematical Programming in Bonn, Federal Republic of Germany. Contact: Institut für Ökonometrie und Operations Research Universität Bonn, Nassestraße 2, 5300 Bonn 1, Federal Republic of Germany; Telex 886657 unibo b, Telephone (02221) 739285. Official triennial meeting of the MPS. (Note: The International Congress of Mathematicians will be held August 11-19 in Warsaw, Poland.)
- October 25-27: Sparse Matrix Symposium 1982, Fairfield Glade, Tennessee, U.S.A. The Symposium will address the construction and analysis of algorithms and mathematical software for sparse matrix calculations and associated applications, one of which is 'Optimization'. Abstract deadline 1 July 1982. Contact: Robert C. Ward, Union Carbide Corporation, MSRDC, Computer Sciences, P. O. Box Y, Bldg. 9704-1, Oak Ridge, Tennessee 37380, U.S.A.; telephone 615-574-3131.
- October 20-21: Third Mathematical Programming Symposium Japan, Tokyo, Japan. Recent Advances in Mathematical Programming, Mathematical Programming Software, and Applications. Contact: Professor Masao Iri (Chairman, Organizing Committee), University of Tokyo, Bunkyo-ku, Tokyo, Japan 113, or Professor Kaoru Tone (Chairman, Program Committee), Graduate School for Policy Science, Saitama University, Urawa, Saitama 338, Japan.

1983

- 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.

5 CONFERENCE NOTES

INTERNATIONAL SYMPOSIUM

The Mathematical Programming Society is beginning its planning for the Twelfth International Symposium on Mathematical Programming, which it proposes be held about the last week in August, 1985, somewhere in the world other than Europe. It wishes hereby to invite all parties who might act as hosts to this event to make their interest known to the Society's Symposium Advisory Committee.

The Symposia have been the principal occasions on which large groups of the world's researchers on that subject have assembled. Since their beginning in 1949 they have steadily grown in size. About 250 papers were presented at the Eighth Symposium, August 27-31, 1973, at Stanford, California; 330 at the Ninth, August 23-27, 1976, in Budapest; and 450 at the Tenth, August 27-31, 1979, in Montreal. We can expect even more at the Eleventh Symposium in Bonn, Federal Republic of Germany, August 23-28, 1982.

The Society's practice with regard to the Symposia has been to give the host committee considerable autonomy in the whole affair. The Society has some guidelines for conducting the Symposium, traditions it wishes to maintain, and a large body of experience on which the host can draw. (The committee members are all organizers of previous Symposia: E.M.L. Beale, R.W. Cottle, J.-L. Goffin, A. Orden, and A. Prekopa.) The Symposium is expected, through its registration fee and institutional subsidies, to be self-supporting. The Society can lend 'seed money' to the Symposium or, to a limited extent, guarantee it against loss. The host may organize Proceedings of the Symposium as one or more Mathematical Programming Studies. (Proceedings were not compiled for all Symposia.)

There are no fixed criteria for the selection of a site. The more important considerations are: technical qualification and enthusiasm of the local staff; adequacy of the meeting facilities; availability of nearby lodging; reasonable travel and local costs -- in short, those factors that will lead to a productive conference that will appeal to a wide range of participants.

We hope that several suggestions for the Symposium site will have been made by Au-

gust, 1982 so that they can be discussed at the Society Council meetings to be held in Bonn. The Council hopes to make a final determination shortly thereafter. Interested parties should communicate with some member of the Committee as soon as possible on this matter as well as on the possibility of holding other meetings under the sponsorship of the Society in intermediate years.

Professor Jean-Louis Goffin, Chairman
MPS Symposium Advisory Committee
Faculty of Management
McGill University
1001 Sherbrooke Street West
Montreal, Quebec H3A 1G5
CANADA

New York

The 10th IFIP Conference on System Modeling and Optimization took place at the New York Sheraton Hotel in New York City, August 31 through September 4, 1981. The Conference was organized for the Technical Committee 7 of the International Federation for Information Processing by the host university, the Polytechnic Institute of New York, 333 Jay Street, Brooklyn, New York 11201.

The aim of the Conference was to bring together persons engaged in studies dealing with the modeling and the optimization of technological, managerial, socio-economic, and bio-medical systems. It was hoped that this broader scope would enable specialists from various fields to be exposed to the research objectives and methods used by others.

Among the 14 invited addresses were the following related to mathematical programming: S.W. Director (Carnegie-Mellon), *The Role of Optimization in VLSIC Design*; R.M. Karp (Berkeley), *The Inherent Complexity of Combinatorial Optimization Problems*; F. Clarke (British Columbia), *Non-Smooth Analysis and Optimization*.

There were 210 contributed papers given in 32 specialized sessions, including several devoted to topics in mathematical programming and its applications.

The Conference was somewhat unusual in that almost 60% of those attending came from abroad. In fact, thirty-one countries were represented among its participants.

-R.F. Drenick

KYOTO

The "Second Mathematical Programming Symposium Japan" was held in Kyoto, Japan, November 19 & 20, 1981, organized by a committee under the direction of Professor Masao Iri of Tokyo University and Professor Toshihide Ibaraki of Kyoto University. Most of the 140 attendees were from Japan; China, Canada, and the U.S.A. were also represented.

The fourteen papers presented were of high standard, both in theory and applications. Twelve were read in Japanese and two in English. They are given in full in the Proceedings (ten in Japanese, four in English), available from the Operations Research Society of Japan, Gakkai-Center Building, 2-4-16 Yayoi, Bunkyo-ku, Tokyo 113, Japan.

Philip Wolfe

The 3rd Mathematical Programming Symposium in Japan

Since 1980, the annual Symposia on Mathematical Programming have been promoting research in, and applications of, mathematical programming in Japan.

The 3rd Symposium will be held on October 20-21, 1982, at the Tokyo Norin Nenkin Kaikan in Tokyo. Professor G.B. Dantzig of Stanford University will attend and give a talk at the Symposium as the main guest speaker. Several tutorial lectures on recent advances in mathematical programming will be delivered, and invited papers on participants' original works will be presented in the following sessions:

- I. Recent Advances in Mathematical Programming: Session Chairman **H. Konno**,
- II. Mathematical Programming Software: Session Chairman **K. Ono**, and
- III. Applications: Session Chairman **R. Manabe**.

Participation from abroad is welcome. Those interested are requested to contact the Organizing Committee (Chairman: Professor Masao Iri, University of Tokyo, Bunkyo Ku, Tokyo, Japan 113) or the Program Committee (Chairman: Professor Kaoru Tone, Graduate School for Policy Science, Saitama University, Urawa, Saitama 338, Japan).

-Kaoru Tone

Technical Reports & Working Papers

UNIVERSITY OF MARYLAND
College of Business and Management
College Park, Maryland 20742

Gass, "Decision-Aiding Models - Validation, Assessment, and Related Issues," 81-022.

Golden and DeArmon, "Algorithms for the Capacitated Chinese Postman," 81-024.

Assad, "Nested Optimal Policies for Set Functions with Applications to Scheduling," 81-025.

Elsner, Johnson, Ross and Schönheim, "On A Generalized Matching Problem Arising in Estimating the Eigenvalue Variation of Two Matrices," 81-027.

Fromovitz and Loeb, "Modeling Selected Audit Report Decisions: A Game Theoretic Approach," 81-028.

Trader, "A Bayesian Technique for Selecting a Linear Forecasting Model," 81-031.

Golden, DeArmon and Baker, "Computational Experiments with Algorithms for a Class of Routing Problems," 81-033.

Bodin, Golden, Assad and Ball, "The State of The Art in the Routing and Scheduling of Vehicles and Crews," 81-035.

Assad, "Analysis of Rail Classification Policies," 81-037.

Golden, Assad, Burton, Grove, Hanley, Holm, Heintzleman and Myers, "A Preliminary Framework for Urban Model-Building," 81-038.

Ball, Assad, Bodin, Golden and Spielberg, "Garage Location for an Urban Mass Transit System," 81-039.

Golden and Stewart, "The Empirical Analysis of TSP Heuristics," 81-040.

Derigs, "Matching Code Theory Part I - Combinatorial Structures and the Cardinality Matching Problem," 81-041.

Derigs, "Efficiency and Time-Cost-Tradeoffs for Transportation Solutions," 81-042.

Derigs, "Another Composite Heuristic for Solving Euclidean Traveling Salesman Problems," 81-043.

STANFORD UNIVERSITY
Systems Optimization Laboratory
Department of Operations Research
Terman Engineering Center
Stanford, CA 94305

Gregory Dobson, "Exact and Approximation Algorithms for a Scheduling Problem," Sol 81-9.

Alan J. Hoffman and Jean-Louis Goffin, "On the Relationship Between the Hausdorff Distance and Metric Distances of Ellipsoids," Sol 81-10.

Frederick S. Hillier, "A Further Investigation of Efficient Heuristic Procedures for Integer Linear Programming with an Interior," Sol 81-11.

M.N. Thapa, "Optimization of Unconstrained Functions with Sparse Hessian Matrices," Sol 81-12.

Alfredo Noel Iusem, "Continuous Time Linear Programs with Economic Applications," Sol 81-13.

Alfredo Iusem and Benjamin Avi-Itzhak, "On Utility Functions with Affine Demand Curves," Sol 81-14.

Alfredo Iusem, "Energy Demand Elasticities," Sol 81-15.

J.-L. Goffin, "Variable Metric Relaxation Methods, Part I: A Conceptual Algorithm," Sol 81-16.

Nathn Buras, "A Study of Water Resource Constraints on Energy-Related Activities," Sol 81-17.

Bizhan Binesh, "Reinitialization of Macroeconomic and Energy Conversion Sectors of the Pilot Model," Sol 81-18.

UNIVERSITE DE MONTREAL
Centre de Recherche sur les Transports
Case Postale 6128, Succursale A
Montreal, Québec, H3C 3J7

Michael Florian and Marc Los, "A New Look at Static Spatial Price Equilibrium Models," CRT - 196.

Michael Florian, "The Convergence of Diagonalization Algorithms for Fixed Demand Asymmetric Network Equilibrium Problems," CRT - 198.

Patrice Marcotte, "An Analysis of Heuristics for the Continuous Network Design Problem," CRT - 200.

Christian Lardinois, "Statistical Inference with Large Combinatorial Problems: Estimation of the Exact Optimum and a Stopping Rule for the Heuristic Exploration," CRT - 201.

Sang Nguyen and Clermont Dupuis, "An Efficient Method for Computing Traffic Equilibria in Networks with Asymmetric Transportation Costs," CRT - 205A.

Clermont Dupuis, "Une Application de la Technique D'Approximation Lineaire Partielle en Programmation Convexe," CRT - 216.

Lourdes Zubieta, "Une Nouvelle Approche au Probleme de Maximisation du Flot Dans un Réseau A Plusieurs Commodites Avec Capacites Variables," CRT - 212.

Gilbert Laporte, Yves Nobert and Paul Pelletier, "Hamiltonian Location Problems," CRT - 224.

Sang Nguyen, "Modeles de Distribution Spatiale Tenant Compte des Itinéraires," CRT - 225.

Patrice Marcotte, "Network Optimization with Continuous Control Parameters," CRT - 226.

Teodor Crainic, Jacques -A. Ferland and Jean-Marc Rousseau, "A General Supply Model for Rail Freight Transportation," CRT - 228.

UNIVERSITY OF BONN
Department of Operations Research
Nassestr. 2
D-5300 Bonn 1, West Germany

B. Korte, "Matroid Properties and Matroid Oracles," WP-81200.
R. Schrader, "Approximations to Clustering and Subgraph Problems on Trees," WP-81202.

W.H. Cunningham, "Polyhedra for Composed Independence Systems," WP-81203.

W.H. Cunningham, "A Class of Linear Programs Convertible to Network Problems," WP-8104.

A. Frank, "Finding Feasible Vectors of Edmonds-Giles Polyhedra," WP-81205.

A. Frank, "Generalized Polymatroids," WP-81206.

W.H. Cunningham, "Testing Membership in Matroid Polyhedra," WP-81207.

U. Derigs, "A Shortest Augmenting Path Method for Solving Minimal Perfect Matching Problems," WP-81208.

A. Frank and E.Tardos, "Matroids from Crossing Families," WP-82210.

M. Grötschel and G.L. Nemhauser, "A Polynomial Algorithm for the Max-Cut Problem in Graphs Without Long Odd Cycles," WP-82211.

M. Grötschel and M.W. Padberg, "TSP Polyhedra," WP-82212.

W.H. Cunningham, "Decomposition of Submodular Functions," WP-82213.

(All titles of the working papers WP-7201 - WP-81200 will be available under WP-81201.)

7 TECHNICAL REPORTS & WORKING PAPERS. . . .

THE JOHNS HOPKINS UNIVERSITY
Department of Electrical Engineering
Baltimore, MD. 21218

- Vitit Kantabuta, "Traveling Salesman Cycles are not Always Subgraphs of Voronoi Duals," JHU - EE - 81 - 5.
Joseph O'Rourke and Kenneth J. Supowit, "Some NP-Hard Polygon Decomposition Problems," JHU - EE - 81 - 13.
Mikhail J. Atallah, "New Results on Minimal Graphs," JHU - EE - 81 - 14.

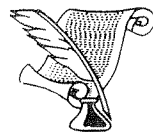
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- H.P. Williams, "A Characterisation of All Feasible Solutions to an Integer Programme," 1981.
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- R.E. Bixby, "Matroids and Operations Research."
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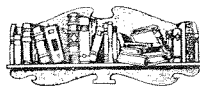


Volume 22 No. 3

- J.L. Goffin, "Convergence of a Cyclic Ellipsoid Algorithm for Systems of Linear Equalities."
R. Benveniste, "Evaluating Computational Efficiency: A Stochastic Approach."
A. Dax, "Partial Pivoting Strategies for Symmetric Gaussian Elimination."
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Volume 23 No. 1

- D. Goldfarb and M.J. Todd, "Modifications and Implementation of the Ellipsoid Algorithm for Linear Programming."
D.P. O'Leary, "A discrete Newton Algorithm for Minimizing a Function of Many Variables."
Michael J. Todd, "An Implementation of the Simplex Method for Linear Programming Problems with Variable Upper Bounds."
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Dietmar Saupe, "On Accelerating PL Continuation Algorithms by Predictor Corrector Methods."
M. Henig, "Existence and Characterization of Efficient Decisions with Respect to Cones."



BOOKS

- Network Models and Associated Applications*, edited by Darwin Klingman and John Mulvey. Reprinted from Mathematical Programming Studies, Vol. 15, 1981, 176 pp., \$25.00, North-Holland.
Dynamic Programming: Models and Applications, by Eric V. Denardo, 1982, 240 pp., \$26.95, Prentice-Hall.
Combinatorial Optimization: Algorithms and Complexity, by Christos H. Papadimitriou and Kenneth Steiglitz, 1981, 480 pp., \$23.95, Prentice-Hall.

Soon to Appear

- Evaluating Mathematical Programming Techniques*, edited by John H. Mulvey. Proceedings of an NBS Conference, Boulder, Colorado, January, 1981, \$20.00 (approx.), Springer-Verlag, Lecture Notes in Computer Science.

This public document was promulgated at a cost of \$426.15 or \$0.61 per copy to inform researchers in mathematical programming of recent research results.

Gallimaufry

Please complete and return the enclosed questionnaire which was prepared by the Executive Committee. . . Arthur M. Geoffrion (UCLA) became President of the Institute of Management Science on September 1, 1981. . . Michael Magazine (Waterloo) is spending seven months, January through July 1982, in INRIA outside of Paris. . . The *Proceedings of the International Symposium on Optimum Structural Design*, held in October, 1981, is available from the office of Special Professional Education, University of Arizona, Tucson. . . The Eighth Design Automation Conference to be held in September, 1982, invites papers on optimization techniques. Contact Prof. Glen E. Johnson (Vanderbilt University), Nashville, Tenn. . . Dr. Andrus Frank is spending the 1981-82 academic year at the University of Bonn. . . Julian Araoz Durand (Universidad Simon Bolivar, Caracas) is also visiting the University of Bonn for 1981-82. . . K. Ritter, formerly of the University of Stuttgart, has accepted a professorship at the Institute für Angewandte Mathematik, Technische Hochschule München. . . Jane K. Cullum (IBM) has been elected Vice President at large of SIAM through 1983. . . Erasmus University held a Symposium in January, 1982 in connection with the 25th Anniversary of the Econometric Institute at Rotterdam. M.J.D. Powell (Cambridge), David Gale (Berkeley) and Henri Theil (Florida) were among the invited speakers. . . Roger J.-B. Wets (Kentucky) is spending January through August 1982 at IASA. . . OPTIMA No. 5 incorrectly reported the amount of the Fulkerson awards (to be presented at the XI Symposium). The correct amount is \$750 (minimum).

Deadline for the next issue of OPTIMA is May 15, 1982.

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THE MATHEMATICAL PROGRAMMING SOCIETY

1982 Questionnaire

The Society can serve you best if it knows what you want. Please complete this questionnaire, fold so the address shows, tape it closed (no staples), and mail. Thank you!

1. Normally, the 1985 International Symposium on Mathematical Programming would be held in North America. There has been some discussion of holding it in Japan, but there is concern about the travel cost for many of our members. Would you plan to attend the Symposium if it were held in --

Japan: Probably yes Probably no
North America: Probably yes Probably no

2. The activities of our Society are expanding and we would like to invite interested members to become more active. Please check those areas in which you might like to participate; if any, put your name and return address on the reverse.

Publications Committee Membership Committee
 Committee on Algorithms
 Establish new activities(e.g., Video Tape Library)
 Editorial activities (e.g., edit problem column for Optima)
 Administrative (e.g., advice on accounting, secretariat, etc.)
 Other (please specify)

3. List subjects, if any, whose emphasis in the journal you would like changed.

Give more emphasis to:

Give less emphasis to:

4. If you have submitted an article to Mathematical Programming in the last two years, how did you find the response time?

Excellent Good Fair Poor

5. Do you think the Society should sponsor a new journal devoted exclusively to applications and systems? Yes No

Assuming reasonable cost, would you subscribe to it? Yes No

6. What features would you like to see added to Optima?

List here any services or activities that the Society is *not* providing that you would like to have, and any other comments.

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