K. G. Murty: Linear Complementarity, Linear and Nonlinear Programming (Sigma series in applied mathematics, 3), XLVIII+629 pages, Heldermann Verlag, Berlin, 1988.

This is an extended and up-to-dated book of "Linear and Combinatorial Programming" published in 1976.

"The book begins with a section titled 'notation' in which all the symbols and several terms are defined. It is strongly recommended that the reader peruse this section first at initial reading, and refer to it whenever there is a question about the meaning of some symbol or term.

Chapter 1 presents a clear geometric interpretation of the Linear Complementarity Problem (LCP) through the definition of the system of complementary cones as a generalization of the set of orthants in R^n. Applications to Linear Programming (LP), Quadratic Programming (QP), and nonzero sum game problems are discussed. There is a complete discussion of positive definiteness and positive semidefiniteness of square matrices, their relationship to convexity, together with efficient pivotal methods for checking whether these properties hold for a given matrix. Various applications of QP are discussed, as well as the recursive quadratic programming method for solving Nonlinear Programming (NLP) models.

Chapter 2 presents a complete discussion of the many variants of the complementary pivot method and proofs of its convergence on different classes of LCPs. Section 2.7. contains a very complete, lucid, but elementary treatment of the extensions of the complementary pivot method to simplicial methods for computing fixed points using triangulations of R^n, and various applications of these methods to solve a variety of general NLP models and nonlinear complementarity problems.

Chapter 3 covers most of the theoretical properties of the LCP. There is extensive treatment of the various separation properties in the class of complementary cones, and a complete discussion of principal pivot transforms of matrices. In this chapter we also discuss the various classes of matrices that arise in the study of the LCP. Chapter 4 provides a survey of various principal pivoting methods for solving the LCP. Algorithms for parametric LCP are presented in Chapter 5.

Chapter 6 contains results on the worst case computational complexity of the complementary and the principal pivoting methods for the LCP. Chapter 7 presents a special algorithm for the LCP associated with positive definite symmetric matrices, based on orthogonal projections, which turned out to be very efficient in computational tests. Chapter 8 presents the polynomially bounded ellipsoid method for solving LCPs associated with positive semidefinite matrices, or equivalently convex QPs.

Chapter 9 presents various iterative methods for LCPs. In Chapter 10 we present an extensive survey of various descent methods for unconstrained and linearly constrained minimization problems; these techniques provide alternative methods for solving quadrativ programming problems. In Chapter 11 we discuss some of the newer algorithms proposed for solving linear programming problems and their possible extensions to solve LCPs, and we discuss several unsolved research problems in linear complementarity.

To make the book self-contained, in the appendix we provide a complete treatment of theorems of alternatives for linear systems, properties of convex functions and convex sets, and various optimality conditions for nonlinear programming problems."

This is a high quality book. It may be recommended for a great number of people from researchers to graduate students.

J. Csirik

Chew Soo Hong, Zheng Quan: Integral Global Optimization — Theory, Implementation and Applications (Lecture Notes in Economics and Mathematical Systems, Vol 298), VII+179 pages. Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1988.

The book discusses a global optimization method studied and presented by the second author in numerous papers in Chinese only. Thus it is the first detailed publication of this algorithm in English. The book consists of five chapters: Preliminary, Integral Characterizations of Global Optimality, Theoretical Algorithms and Techniques, Monte Carlo Implementation, and Applications.

The method is based on the idea that for each level set the mean value of the objective function is not greater than the function value to which this level set belongs. At the same time, the mean value is always not less than the global minimum in the mentioned level set. With the mean value we can form a new, smaller level set, find the new mean value on this level set, and so on. This simple but fairly original idea results in a global optimization algorithm which can provide the set of global minimum points for all robust sets and all continuous objective functions. The word "integral" in the title of the book hints at the method with which one can determine the mean function value on a set.

The problem is, however, that each step of this algorithm (and what is more, separately the determination of the mean value and the level set) has the same computational complexity as that of the original global optimization problem. Because of this, one has to give up the guarantee for obtaining the set of global minimum points for all global optimization problems, and to produce a reasonable heuristic based on the theoretical algorithm mentioned before. This procedure to find an implementable algorithm that is reliable and effective enough is rather common. In all such cases the question is how to modify the theoretical algorithm to get an implementable version retaining the most of the desirable features of the original one.

In this case the above problem is solved in a rather rude way. The determination of a level set is padded in the algorithm with the selection of the set of points of a random sample that have function values not greater than the specified level, and with the calculation of an n-dimensional box containing this set of points, with a certain tolerance. The determination of the mean function value on a level set is substituted by the finding out of the mean function value on the random sample. These steps are easily implementable and of low complexity.

The reliability of this simplified algorithm depends heavily on the size of the random sample. From a practical point of view, the numerical testing of the reliability for all global optimization methods is more important than the theorems about the theoretical algorithms in the background.

The algorithm was tested with two of the standard global optimization test problems. Unfortunately two very simple problems were chosen: their global minima can be located by the majority of global optimization methods with high probability. It would have been interesting to see the performance of the new method on other test problems that have more hidden global minima. The test results are compared with those of Törn's method, and it is found that the method of Zheng is about five times more effective. This comparison is rather unfair, since the method of Törn is to find all local minima (not only the global one). In addition, the method of De Biase and Frontini (to be found in the same book dealing with the method of Törn) is more effective than that of Zheng, not to speak about later publications than the mentioned book published in 1978.

Some (not printer's or typing) errors make the reading difficult. In spite of the unsatisfactory and not convincing numerical testing, the book is worth reading for those interested in optimization.

Tibor Csendes

A. S. House: The recognition of speech by machine — A bibliography. Academic Press, Harcourt Brace Jovanovich, Publishers. London—San Diego—New York—Boston—Sydney—Tokyo—Toronto, 1988.

"The book is divided into three parts. Part 1 is a subject index that attempts to provide the names of authors who have written on a particular subject. Names listed here are sole or primary authors, making it possible for the user to search directly for citations in Part 2, the bibliography proper. An attempt has been made to provide enough detail and crossreference in the subject index to make the user's task manageable, but the well-known weaknesses of subject indexes are still obvious.

In Part 2 the citations are arranged alphabetically starting with the surnames of the sole or the primary authors. The alphabetical listing constitutes the working part of the bibliography.

Part 3 is an alphabetical list of authors; it will help is finding work for which an author is not the initially listed author, that is, neither a sole nor a primary author. Instructions for the use of the listing are included at the start of the section. It is hoped that the author index, along with the subject index, will provide adequate means of entry into the listing of citations in Part 2. It may be helpful to remember that the alphabetic ordering of names that have been transliterated from languages that do not use the roman alphabet can be surprising at time.

The titles include articles that appeared in periodicals, conference proceedings, institutional or laboratory reports that appear on a regular basis, as well as extended abstracts from proceedings, abstracts of oral presentations, etc., and books."

This bibliography include more than 4000 titles. It is surely very helpful for researchers of speech recognition.

J. Csirik

A. Kurzhanski, K. Neumann, D. Pallaschke (Editors): **Optimization, Parallel Processing and Applications** (Lecture Notes in Economics and Mathematical Systems, Vol. 304), VI+292 pages, Springer-Verlag, Berlin—Heidelber—New York—London—Paris—Tokyo, 1988.

This book contains selected papers that were presented at the Oberwolfach Conference on Operations Research, February 16—21, 1987 and the Workshop on Advanced Computation Techniques, Parallel Processing and Optimization, held at Karlsruhe, West Germany, February 22—25 1987.

On the basis of their subject, the papers form two groups: one discussing new optimization methods, and another studying the possible impact of recent computer advances (such as parallel computation, interval arithmetic and automatic differentation) on optimization. The contents of the book are the following: B. Bank, R. Mandel: Quantitative Stability of (Mixed-) Integer Linear Optimization Problems; O. Burdakov, C. Richter: Parallel Hybrid Optimization Methods; V. F. Demyanov: Continuous Generalized Gradients for Nonsmooth Functions; R. Horst: Outer Cut Methods in Global Optimization; P. S. Kenderov, N. K. Ribarska: Generic Uniqueness of the Solution of "Max Min" Problems; M. Schäl: Optimal Stopping and Leavable Gambling Models with Observation Costs; S. Schaible: Multi-Ratio Fractional Programming — A Survey; D. Conforti, L. Grandinetti: An Experience of Advanced Computation Techniques in the Solution of Nonlinearly Constrained Optimization Problems; L. C. W. Dixon: Automatic Differentiation and Parallel Processing in Optimisation; Y. Evtushenko: V. Mazourik, V. Ratkin: Multicriteria Optimization in the DISO System; R. De Leone, O. L. Mangasarian: Serial and Parallel Solution of Large Scale Linear Programs by Augmented Lagrangian Succesive Over-relaxation; K. Schittkowski: EMP: An Expert System for Mathematical Programming; R. G. Strongin, Y. D. Sergeev: Effective Algorithm for Global Optimization with Parallel Computations; M. Bartusch, R. H. Möhring, F. J. Radermacher: M-Machine Unit Time Scheduling: A Report on Ongoing Research; S. Perz, S. Rolewicz: On Inverse-Image of Non-Oriented Graphs; M. Kisielewicz: Existence of Optimal Trajectory of Mayer Problem for Neutral Functional Differential Inclusions; D. Przeworska-Rolewicz: Smooth Solutions of Linear Equations with Scalar Coefficients in a Right Invertible Operator; G. Feichtinger: Production-Pollution Cycles; B. Mazbic-Kulma, E. Komorowska, J. Stepien: Location Problem and its Applications in Distribution of Petrol.

The papers of Horst, Dixon, Evtushenko et al., Schittkowski and Strongin et al. are of great importance, and certainly worth reading. The book can be recommended for those willing to keep abreast with the new trends of optimization.

Tibor Csendes

ECOOP '88 European Conference on Object-Oriented Programming, Oslo, Norway, August 1988. Proceedings, Editors: S. Gjessing and K. Nygaard (Lecture Notes in Computer Science Vol. 322), VI+410 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1988.

"Object oriented seems to be becoming in the 1980s what structured programming was in the 1980s", (B. Randell and P. Lee), quoted in the motto of the conference.

The volume contains 22 papers from 13 countries, read at the second conference on object oriented programming. The papers included in the volume were selected by the program committee

from 103 contributions. The editors "believe that the papers contain a representative sample of the best works in object oriented programming today".

We can find papers on various topics including theoretical and practical aspects such as teaching object oriented programming, handling data bases, debugging, developing distributed systems, algebraic specification languages, etc.

Contents of the Volume:

What Object-Oriented Programming May Be—and What It Does Not Have to Be, O. Lehrmann Madsen, B. Moller-Pedersen; Teaching Object-Oriented Programming Is More Than Teaching Object-Oriented Programming Languages, J. Lindskov Knudsen, O. Lehrmann Madsen; The Mjolner Environment: Direct Interaction with Abstractions, G. Hedin, B. Magnusson; Inheritance as an Incremental Modification Mechanism or What Like Is and Isn't Like, P. Wegner, S. B. Zdonik; GSBL: An Algebraic Specification Language Based on Inheritance, S. Clerici, F. Orejas; Name Collision in Multiple Classification Hierarchies, J. Lindskov Knudsen; Reflexive Architecture: From ObjVLisp to CLOS, N. Graube; Nesting in an Object-Oriented Language is NOT for the Birds, P. A. Buhr, C. R. Zarnke; An Object-Oriented Exception Handling System for an Object-Oriented Language, C. Dony; On the Darker Side of C++, M. Sakkinen; Prototyping an Interactive Electronic Book System Using an Object-Oriented Approach, J. Pasquier-Boltuck, E. Grossman, G. Collaud; SCOOP, Structured Concurrent Object-Oriented Prolog, J. Vaucher, G. Lapalme, J. Malenfant; The Implementation of a Distributed Smalltalk, M. Schelvis, E. Bledoeg; Implementing Concurrency Control in Reliable Distributed Object-Oriented Systems, D. G. Parrington S. K. Shrivastava; An Implementation of an Operating System Kernel Using Concurrent Object-Oriented Language ABCL/c+, N. Doi, Y. Kodama, K. Hirose; Debugging Concurrent Systems Based on Object Groups, Y. Honda, A. Yonezawa; Fitting Round Objects Into Square Databases (invited paper), D. C. Tsichritzis, O. M. Nierstrasz; Database Concepts Discussed in an Object-Oriented Perspective, Y. Lindsjorn, D. Sjoberg; Object-Oriented Programming and Computerised Shared Material, P. Sorgaard; Asynchronous Data Retrieval from an Object-Oriented Database, J. P. Gilbert, L. Bic; An Overview of OOPS+, An Object-Oriented Database Programming Language, E. Laenens, D. Vermeir; PCLOS: A Flexible Implementation of CLOS Persistence, A. Paepcke; A Shared, Persistent Object Store, C. Low.

The Volume is recommanded all people interested in object oriented programming. The proceeding gives a good review on this topic.

János Toczki

J. Balcázar, J. Diaz, J. Gabarró: Structural Complexity I (EATCS Monographs on Theoretical Computer Science, Vol 11). IX+191 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1988.

"This book assumes as a prerequisite some knowledge of the basic models of computation, as taught in an undergraduate course on Automata Theory, Formal Language Theory, or Theory of Computation. Certainly, some mathematical maturity is required, and previous exposure to programming languages and programming techniques is desirable. Most of the material of Volume I can be successfully presented in a senior undergraduate course; Volume I and II should be suitable for a first graduate course. Some sections lead to a point in which very little additional work suffices to be able to start research projects. In order to ease this step, an effort has been made to point out the main references for each of the results presented in the text.

Thus, each chapter ends with a section entitled "Bibliographical Remarks", in which the relevant references for the chapter are briefly commented upon. These sections might also be of interest to those wanting an overview of the evaluation of the field. Additionally, each chapter (excluding the first two, which are intended to provide some necessary background) includes a section of exercises."

The contents of the book are the following:
— Introduction,
— Time and Space Bounded Computations,
— Central Complexity Classes,
— Time Bounded Turing Reducibilities,
— Nonuniform Complexity,
— Probabilistic Algorithms,

— Uniform Diagonalization,
— The Polinomial Time Hierarchy.

The book is clearly written. It can be recommended as a text for a graduate course and for people interested in Complexity Theory.

J. Csirik

P. Deransart, M. Jourdan and B. Lorho: Attribute Grammars, Definitions, Systems and Bibliography. (Lecture Notes in Computer Science. Vol. 323), IX+232 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1988.

Attribute Grammars have proved to be an efficient tool for the description of syntax-directed computations. This book gives a concize and comprehensive survey of attribute grammars and their applications. The book consists of three parts:

1. In the first part (Definitions and Main Results) the theoretical results achieved by attribute grammars are presented.

2. In the second part more than 40 systems are described. These descriptions contain the following parts:

— a list of the members of the project,
— the birthdate and deadline of the project,
— general features of the system,
— a scheme of the internal organization of the systems,
— optimizations implemented in the system,
— applications and performances of the systems,
— future projects,
— references.

3. In the third part a bibliography of about 600 titles pertaining to AG-s is included.

T. Gyimóthy

H. A. Eiselt, G. Pederzoli (Editors): **Advances in Optimization and Control** (Lecture Notes in Economics and Mathematical Systems, Vol. 302), VIII+371 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1988.

This book provides a collection of refereed papers presented at the Conference "Optimization Days 85" held at Montreal, Canada, April 30—May 2, 1986. It is first time that the proceedings of the Optimization Days is published in this way.

The papers cover a fairly wide variety of fields in optimization and control. The contents of the book are the following: J. Jones, Jr.: Matrix Differential Equations and Lyapunov Transformations; Quan Zheng: Theory and Methods for Global Optimization—an Integral Approach; E. A. Galperin: The Beta-Algorithm for Mathematical Programming; M. J. Todd: Polynomial Algorithms for Linear Programming; F. Chauny, R. Loulou, S. Sandones, F. Soumis: A Class of Asymptotically Optimal Strip-Packing Heuristics; M. Gendreau, J.-C. Picard, L. Zubieta: An Efficient Implicit Enumeration Algorithm for the Maximum Clique Problem; A. G. Ferreira: An Optimal $O(n)$-Algorithm to Fold Special PLA's; M. P. Helme: A Mixed Integer Programming Model for Planning an Integrated Services Network; G. Lapalme, J.-Y. Potvin, J.-M. Rousseau: A General Heuristic for Node Routing Problems; J. Desrosiers, Y. Dumas: The Sortest Path Problem for the Construction of Vehicle Routes with Pick-Up, Delivery and Time Constraints; G. Laporte, Y. Nobert: A Vehicle Flow Model for the Optimal Design of a Two-Echelon Distribution Problem; L. Jenkins: An Approximate Solution to a Capacitated Plant Location Problem Under Uncertain Demand; I. J. Curiel, G. Pederzoli, S. H. Tijs: Reward Allocations in Production Systems; M. Breton, P. L'Ecuyer: On the Existence of Sequential Equilibria in Markov Renewal Games; P. L'Ecuyer J. Malenfant: Computing Optimal Checkpoint Policies: A Dynamic Programming Approach; S. P. Sethi, C. Bes: Dynamic Stochastic Optimization Problems in the Framework of Forecast and Decision Horizons; J. B. Lasserre: Decision Horizon, Overtaking and 1-Optimality Criteria in Optimal Control; O. Hajek, K. A. Loparo: Bilinear Control: Geometric Properties of Reachable Sets; D. A. Carlson: Sufficient Conditions for Optimality and Supported Trajectories for Optimal

Control Problems Governed by Volterra Integral Equations; G. Bojadzeiv: Behavioural Strategy of Some Controlled Predator-Prey Systems; H. Y. Wan, Jr., S. Clemhout: A General Dynamic Model of Bargaining—The Perfect Information Case; C. Deissenberg: Long-Run Macroeconometric Stabilization Under Bounded Uncertainty; Z. Ritz, D. Sudharshan: An Evolutionary Analysis of Product-Preference Structure: Toward Managerial Control; J.-P. Amigues, G. Gaudet, M. Moreaux: Bertrand and Cournot Equilibrium Price Paths in a Nonrenewable Resource Differentiated Product Duopoly; B. Tolwinski: A Renegotiation—Proof Solution for a Price Setting Duopoly.

These papers provide a relatively quick access to some of the most important new ideas in optimization. For example, the paper of Zheng is one of the first publications in English about this new global optimization method. Todd's survey on polynomial algorithms for linear programming is excellent. Overall, the book gives a good selection of the latest research results in optimization, and it can be recommended for those interested in the state of the art in this field.

Tibor Csendes

H. Edelsbrunner: Algorithms in Combinatorial Geometry (EATCS Monographs on Theoretical Computer Science, Vol. 10) XV+423 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

From the preface of the book: "Computational geometry as an area of research in its own right emerged in the early seventies of this century. Right from the beginning, it was obvious that strong connections of various kinds exist to questions studied in the considerably older field of combinatorial geometry. For example, the combinatorial structure of a geometric problem usually decides which algorithmic method solves the problem most efficiently. Furthermore, the analysis of an algorithm often requires a great deal of combinatorial knowledge. As it turns out, however, the connection between the two research areas commonly referred to as computational geometry and combinatorial geometry is not as lop-sided as it appears. Indeed, the interest in computational issues in geometry gives a new and constructive direction to the combinatorial study of geometry. and combinatorial geometry is not as lop-sided as it appears. Indeed, the interest in computational issues in geometry gives a new and constructive direction to the combinatorial study of geometry.

It is the intention of this book to demonstrate that computational and combinatorial investigations in geometry are doomed to profit from each other. To reach this goal, I designed this book to consist of three parts, a combinatorial part, a computational part, and one that presents applications of the results of the first two parts. The choice of the topics covered in this book was guided by my attempt to describe the most fundamental algorithms in computational geometry that have an interesting combinatorial structure. In this early stage geometric transforms played an important role as they reveal connections between seemingly unrelated problems and thus help to structure the field. These transforms led me to beleive that arrangements of hyperplanes are at the very heart of computational geometry- and this is my belief now more than ever.

As mentioned above, this book consists of three parts: I. Combinatorial Geometry, II. Fundamental Geometric Algorithms, and III. Geometric and Algorithmic Applications. Each part consists of four to six chapters. The non-trivial connection pattern between the various chapters of the three parts can be somewhat untangled if we group the chapters according to four major computational problems. The construction of an arrangement of hyperplanes is tackled in Chapter 7 after Chapters 1, 2, and 5 provide preparatory investigations. Chapter 12 is a collection of applications of an algorithm that constructs an arrangement. The construction of the convex hull of a set of points which is discussed in Chapter 8 builds on combinatorial results presented in Chapter 6. Levels and other structures in an arrangement can be computed by methods described in Chapter 9 which bears a close relationship to the combinatorial studies undertaken in Chapter 3. Finally, space cutting algorithms are presented in Chapter 14 which is based on the combinatorial investigations of Chapter 4 and the computational results of Chapter 10. The above listing of relations between the various chapters is by no means exhaustive. For example, the connections between Chapter 13 and the other chapters of this book come in too many shapes to be described here. Finally, Chapter 15 reviews the techniques used in the other chapters of this book to provide some kind of paradigmatic approach to solving computational geometry problems."

The monograph contains a rich and deap material, which is well-arranged. It can be recommended as an excellent summary of algorithms in combinatorial geometry for a large number of people from students to researchers.

J. Csirik