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Applications

Network Design: Connectivity and Facilities Location

Panos M. Pardalos, *University of Florida, Gainesville,* and **Dingzhu Du**, *University of Minnesota, Minneapolis,* Editors

Connectivity and facilities location are two important topics in network design, with applications in data communication, transportation, production planning, and VLSI designs. There are two issues concerning these topics: design and optimization. They involve combinatorial design and combinatorial optimization. This volume features talks presented at an interdisciplinary research workshop held at DIMACS in April 1997. The workshop was attended by leading theorists, algorithmists, and practitioners working on network design problems.

Finding the solution of design problems and the optimal or approximate solution of the related optimization problem are challenging tasks because no polynomial time algorithms are known. Such problems include some variations of Steiner tree problems (such as multiple-connected Steiner network, independent flow problem, and subset-interconnection designs), topology network design, nonlinear assignment problems (such as quadratic assignment problems), problems in facilities location and allocation, and network problems appearing in VLSI design.

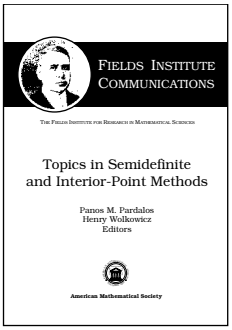
The focus of this book is on combinatorial, algorithmic, and applicational aspects of these problems. The volume would be suitable as a textbook for advanced courses in computer science, mathematics, engineering, and operations research.

This text will also be of interest to those working in discrete mathematics and combinatorics.

Contents: S. Arora, Nearly linear time approximation schemes for Euclidean TSP and other geometric problems; **R. Battiti** and **A. Bertossi**, Differential greedy for the 0–1 equicut problem; **M. Brazil**, **D. A. Thomas**, and **J. F. Weng**, Gradient-constrained minimal Steiner trees; **S.-W. Cheng**, The Steiner tree problem for terminals on the boundary of a rectilinear polygon; **D. Cieslik**, Using Hadwiger numbers in network design; **C. Duin**, Reducing the graphical Steiner problem with a sensitivity test; **A. Eisenblätter**, A frequency assignment problem in cellular phone networks; **T. Erlebach**, **K. Jansen**, **C. Kaklamanis**, and **P. Persiano**, An optimal greedy algorithm for wavelength allocation in directed tree networks; **K. Holmqvist**, **A. Migdalas**, and **P. M. Pardalos**, A GRASP algorithm for the single source uncapacitated minimum concave-cost network flow problem; **K. Jansen**, Approximation results for the optimum cost chromatic partition problem; **M. Karpinski** and **A. Zelikovsky**, Approximating dense cases of covering problems; **S. Guha** and **S. Khuller**, Connected facility location problems; **N. Deo** and **N. Kumar**, Constrained spanning tree problems: Approximate methods and parallel computation; **W.-J. Li** and **J. M. Smith**, Star, grid, ring topologies in facility location & network design; **S. O. Krumke**, **M. V. Marathe**, **H. Noltemeier**, **R. Ravi**, and **S. S. Ravi**, Network improvement problems; **M. V. Marathe**, **R. Ravi**, and **R. Sundaram**, Improved results on service-constrained network design problems; **R. A. Murphey**, **P. M. Pardalos**, and **L. Pitsoulis**, A greedy randomized adaptive search procedure for the multitarget multisensor tracking problem; **W. B. Powell** and **Z.-L. Chen**, A generalized threshold algorithm for the shortest path problem with time windows; **J. D. P. Rolim** and **L. Trevisan**, A case study of de-randomization methods for combinatorial approximation algorithms; **S. Voß** and **K. Gutenschwager**, A chunking based genetic algorithm for the Steiner tree problem in graphs; **D. M. Warme**, A new exact algorithm for rectilinear Steiner trees; **P.-J. Wan** and **A. Pavan**, A scalable TWDM lightwave network based on generalized de Bruijn digraph; **J. F. Weng**, A new model of generalized Steiner trees and 3-coordinate systems; **R. Wessäly**, A model for network design; **C. S. Adjiman**, **C. A. Schweiger**, and **C. A. Floudas**, Nonlinear and mixed-integer optimization in chemical process network systems; **M. Brazil**, **J. H. Rubinstein**, **D. A. Thomas**, **J. F. Weng**, and **N. C. Wormald**, Shortest networks on spheres.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 40

March 1998, 461 pages, Hardcover, ISBN 0-8218-0834-6, LC 97-45788, 1991 *Mathematics Subject Classification*: 03B05, 90A05, 68T15, 68Q42, 90C27, 90C30, 90B40, 68T01, 68Q15; 68Q22, 68Q25, 68P10, **Individual member $47**, List $79, Institutional member $63, Order code DIMACS/40N



Topics in Semidefinite and Interior-Point Methods

Panos M. Pardalos, *University of Florida, Gainesville,* and **Henry Wolkowicz**, *University of Waterloo, ON, Canada*, Editors

This volume contains refereed papers presented at the workshop on "Semidefinite Programming and Interior-Point Approaches for Combinatorial Optimization Problems" held at The Fields Institute in May 1996. Semidefinite programming (SDP) is a generalization of linear programming (LP) in that the nonnegativity constraints on the variables is replaced by a positive semidefinite constraint on matrix variables. Many of the elegant theoretical properties and powerful solution techniques follow through from LP to SDP. In particular, the primal-dual interior-point methods, which are currently so successful for LP, can be used to efficiently solve SDP problems.

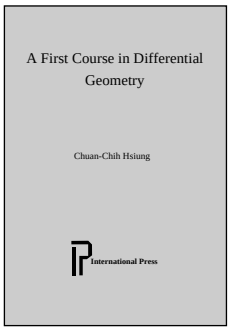
In addition to the interesting theoretical and algorithmic questions, SDP has found many important applications in combinatorial optimization, control theory and other areas of mathematical programming. SDP is currently a very hot area of research. The papers in this volume cover a wide spectrum of recent developments in SDP. The volume would be suitable as a textbook for advanced courses in optimization.

Contents: *Theory:* **A, Shapiro**, Optimality conditions and sensitivity analysis of cone-constrained and semi-definite programs; **L. Porkolab** and **L. Khachiyan**, Testing the feasibility of semidefinite programs; **M. V. Ramana**, Polyhedra, spectrahedra, and semidefinite programming; **L. Faybusovich**, Infinite-dimensional semidefinite programming: Regularized determinants and self-concordant barriers; *Applications:* **M. Laurent**, A tour d'horizon on positive semidefinite and Euclidean distance matrix completion problems; **S. E. Karisch** and **F. Rendl**, Semidefinite programming and graph equipartition; **C. R. Johnson**, **B. K. Kroschel**, and **M. Lundquist**, The totally nonnegative completion problem; **J. Gu**, The multi-SAT algorithm; **M. R. Emamy-K.**, How efficiently can we maximize threshold pseudo-Boolean functions?; **G. Xue**, **D.-Z. Du**, and **F. K. Hwang**, Faster algorithm for shortest network under given topology; **A. Mockus**, **J. Mockus**, and **L. Mockus**, Bayesian heuristic aproach (BHA) and applications to discrete optimization; **B. Mirkin**, Approximation clustering: A mine of semidefinite programming problems; *Algorithms:* **K. M. Anstreicher** and **M. Fampa**, A long-step path following algorithm for semidefinite programming problems; **C. Helmberg** and **R. Weismantel**, Cutting plane algorithms for semidefinite relaxations; **E. de Klerk**, **C. Roos**, and **T. Terlaky**, Infeasible-start semidefinite programming algorithms via self-dual embeddings; **S. Lucidi** and **L. Palagi**, Solution of the trust region problem via a smooth unconstrained reformulation.

Fields Institute Communications, Volume 18

February 1998, 250 pages, Hardcover, ISBN 0-8218-0825-7, LC 97-43573, 1991 *Mathematics Subject Classification*: 68Q10, 90C06, 90C27, 68Q25, 90C05, 90C25, 90C30, 90C10, **Individual member $41**, List $69, Institutional member $55, Order code FIC/18N

Geometry and Topology



A First Course in Differential Geometry

Chuan C. Hsiung, *Lehigh University, Bethlehem, PA*

This book is designed to introduce differential geometry to beginning graduate students and advanced undergraduates. The text covers the traditional topics: curves and surfaces in a three-dimensional Euclidean space. Unlike most classical books on the subject, however, the author pays more attention to the relationships between local and global properties rather than to local properties only.

Most global theorems for curves and surfaces in the book can be extended to either higher-dimensional spaces or more general curves and surfaces or both. Geometric interpretations are given along with analytic expressions. This enables students to make use of geometric intuition—a precious tool for studying geometry and related problems.

International Press publications are distributed worldwide, except in Japan, by the American Mathematical Society.

Contents: Euclidean spaces; Curves; Local theory of surfaces; Global theory of surfaces; Appendix 1. Proof of existence theorem 1.5.1, chapter 2; Appendix 2. Proof of the first part of theorem 7.3, chapter 3; Bibliography; Answers and hints to exercises; Index.

International Press

November 1997, 343 pages, Hardcover, ISBN 1-57146-046-2, LC 97-073201, 1991 *Mathematics Subject Classification*: 53-01, **All AMS members $36**, List $45, Order code INPR/24N