## Lecture Notes in Computer Science

1763

Edited by G. Goos, J. Hartmanis and J. van Leeuwen

## Springer

Berlin
Heidelberg
New York
Barcelona
Hong Kong
London
Milan
Paris
Singapore
Tokyo

Jin Akiyama Mikio Kano Masatsugu Urabe (Eds.)

# Discrete and Computational Geometry

Japanese Conference, JCDCG'98 Tokyo, Japan, December 9-12, 1998 Revised Papers



#### Series Editors

Gerhard Goos, Karlsruhe University, Germany Juris Hartmanis, Cornell University, NY, USA Jan van Leeuwen, Utrecht University, The Netherlands

#### Volume Editors

Jin Akiyama

Research Institute of Educational Development, Tokai University 2-28-4, Tomigaya, Shibuya-ku, Tokyo, 151-0063, Japan

E-mail: fwjb5117@infoweb.ne.jp

Mikio Kano

Department of Computer and Information Sciences Faculty of Engineering, Ibaraki University Hitachi, 316-8511, Japan

E-mail: kano@cis.ibaraki.ac.jp

Masatsugu Urabe

Department of Mathematics, Tokai University 3-20-1, Orido, Shimizu-Shi, Shizuoka, 424-8610, Japan

E-mail: qzg00130@scc.u-tokai.ac.jp

#### Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Discrete and computational geometry: Japanese Conference; revised papers / JCDCG '98, Tokyo, Japan, December 9 - 12, 1998. Jin Akiyama ... (ed.). - Berlin; Heidelberg; New York; Barcelona; Hong Kong; London; Milan; Paris; Singapore; Tokyo: Springer, 2000 (Lecture notes in computer science; Vol. 1763) ISBN 3-540-67181-1

CR Subject Classification (1991): I.3.5, F.2, G.1-2

ISSN 0302-9743

ISBN 3-540-67181-1 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag is a company in the specialist publishing group BertelsmannSpringer © Springer-Verlag Berlin Heidelberg 2000 Printed in Germany

Typesetting: Camera-ready by author

Printed on acid-free paper SPIN: 10719677 06/3142 5 4 3 2 1 0

#### **Preface**

This volume consists of those papers presented at the Japan Conference on Discrete and Computational Geometry '98. The conference was held 9-12 December 1998 at Tokai University in Tokyo. Close to a hundred participants from 10 countries participated.

Interest in Computational Geometry surfaced among engineers in Japan about twenty years ago, while interest in Discrete Geometry arose as a natural extension of the research of a group of graph theorists more recently. One of the goals of the conference was to bring together these two groups and to put them in contact with experts in these fields from abroad.

This is the second conference in the series. The plan is to hold one every year and to publish the papers of the conferences every two years.

The organizers thank the sponsors of the conference, namely, The Institute of Educational Development of Tokai University, Grant-in-Aid of the Ministry of Education of Japan (A.Saito;(A)10304008), Mitsubishi Research Institute, Sanada Institute of System Development, Japan Process, and Upward. They also thank especially T. Asano, D. Avis, V. Chvátal, H. Imai, J. Pach, D. Rappaport, M. Ruiz, J. O'Rourke, K. Sugihara, T. Tokuyama, and J. Urrutia for their interest and support.

January 2000

Jin Akiyama Mikio Kano Masatsugu Urabe

#### Committee Listings

J. Akiyama (Tokai University)

K. Hosono (Tokai University)

M. Kano (Ibaraki University)

T. Kodate (Tokai University)
T. Sakai (Tokai University)

X. Tan (Tokai University)

M. Urabe (Tokai University)



### **Table of Contents**

Rivera-Campo,

Radical Perfect Partitions of Convex Sets in the Plane J. Akiyama, A. Kaneko, M. Kano, G. Nakamura, E. S. Tokunaga, and J. Urrutia
Dudeney Dissection of Polygons

E. Kranakis, D. Krizanc, and J. Urrutia

Papers

S. Tokunaga, and J. Urrutia
Dudeney Dissection of Polygons
Effective Use of Geometric Properties for Clustering
Living with <i>lrs</i>
On the Existence of a Point Subset with 4 or 5 Interior Points
Planar Drawing Algorithms of Survivable Telecommunication Networks 65 A. E. Barouni, A. Jaoua, and N. Zaguia
Polygon Cutting: Revisited
Algorithms for Packing Two Circles in a Convex Polygon
Folding and Cutting Paper
An Interpolant Based on Line Segment Voronoi Diagrams
2-Dimension Ham Sandwich Theorem for Partitioning into Three Convex Pieces
NP-Completeness of Stage Illumination Problems
On the Maximum Degree of Bipartite Embeddings of Trees in the Plane 166 $\it A.\ Kaneko$
Efficient Regular Polygon Dissections

#### VIII Table of Contents

On Soddy's Hexlet and a Linked 4-Pair
Approximation Algorithms for Maximum Independent Set Problems and Fractional Coloring Problems on Unit Disk Graphs
Visibility of Disks on the Lattice Points
Convex Hull Problem with Imprecise Input
One-Dimensional Tilings with Congruent Copies of a 3-Point Set
Polygonal Approximations for Curved Problems:  An Application to Arrangements
Grouping and Querying: A Paradigm to Get Output-Sensitive Algorithms . 250 $F.\ Nielsen$
Folding and Unfolding in Computational Geometry
Crossing Numbers. 267  J. Pach
A Note on the Existence of Plane Spanning Trees of Geometric Graphs 274 E. Rivera-Campo
Embeddings of Equilateral Polygons in Unit Lattices
Order-k Voronoi Diagrams, k-sections, and k-sets
"Impossible Objects" Are Not Necessarily Impossible  – Mathematical Study on Optical Illusion –
An Efficient Solution to the Corridor Search Problem
Author Index