Annual Report 1999

Work Group

Theoretical Computer Science

(Prof. Dr. Helmut Alt – Prof. Dr. Günter Rote)

January 2000

Institut für Informatik
Fachbereich Mathematik und Informatik
Freie Universität Berlin
Takustraße 9
D–14195 Berlin, Germany

1. **Members of the Group**

(a) Professors

Alt, Helmut, Dr.
Rote, Günter, Dr. (since April 1st)

(b) Guest professors

Lassak, Marek, Dr. (since June 1st)

(c) Assistants, scientific personnel, scholarship holders

Braß, Peter, Dr. habil. (Heisenberg scholarship holder)
Felsner, Stefan, Priv.-Doz., Dr. (Freie Universität Berlin)
Heinrich-Litan, Laura (graduate program *Computational Discrete Mathematics*, since April 1st)
Hoffmann, Frank, Dr. (Freie Universität Berlin)
Kaffanke, Astrid (Freie Universität Berlin, since August 1st)
Knauer, Christian (Freie Universität Berlin)
Kriegel, Klaus, Priv.-Doz., Dr. (DFG - german science foundation)
Meißner, Lutz (Freie Universität Berlin)
Morawe, Nicole (Freie Universität Berlin)
Schönherr, Sven (Esprit project GALIA)
Thiele, Torsten, Dr. (graduate program *Computational Discrete Mathematics*, until September 30th)
Wenk, Carola (DFG)
Wolff, Alexander (DFG, until May 31st)

(d) Secretary

Heinrich, Hannah (Freie Universität Berlin)

(e) Coordinator of the graduate program

Felsner, Bettina (DFG)

(f) Student assistants

Arweiler, Irina (DFG, since November 1st)
Rochusch, Dorothea (DFG, until March 31st)
Schultz, Christof (DFG, April 1st through October 31st)

2. Guests and Lectures

HEINRICH MÜLLER
Universität Dortmund (January 29th)
Praktische Probleme bei der Rückführung und Einpassung von Flächen (Practical Problems with Surface Reconstruction and Surface Matching)

EMO WELZL
ETH Zürich (February 15th)
On the j-Facets of Finite Point Sets

MARTIN GRÖTSCHEL
Konrad-Zuse-Zentrum für Informationstechnik Berlin (March 29th - ADiMMO-Workshop 1999)
On-line Optimierung in Theorie und Praxis (On-line Optimization in Theory and Practice)

THOMAS ERLEBACH
Technische Universität München (March 29th - ADiMMO-Workshop 1999)
Optimierungsprobleme bei der Wellenlängenzuteilung in optischen Kommunikationsnetzwerken (Optimization problems with the Wave-Length Assignment in Optical Communtication Networks)

CARSTEN DAMM
Universität Trier (March 29th - ADiMMO-Workshop 1999)
Überdeckungs- und Rangprobleme für 0/1 Matrizen (Covering and Range Problems for 0/1 Matrices)

JÜRGEN RICHTER-GEBERT
ETH Zürich (March 29th - ADiMMO-Workshop 1999)
Dynamische Geometrie (Dynamic Geometry)

THORSTEN THEOBALD
Technische Universität München (March 29th - ADiMMO-Workshop 1999)
Partielle Sichtbarkeit für diskrete Objekte (Partial Visibility for Discrete Objects)

VOLKER KAIBEL
Technische Universität Berlin (March 29th - ADiMMO-Workshop 1999)
Einfache 0/1-Polytope (Simple 0/1 Polytopes)

OLIVER BASTERT
Technische Universität München (March 29th - ADiMMO-Workshop 1999)
Kanonische Berechnung von Basen kohärenter Algebren (Computation ofBases of Coherent Algebras)

PETRA MUTZEL
Max-Planck-Institut für Informatik, Saarbrücken (March 30th - ADiMMO-Workshop 1999)
Optimierungsprobleme beim automatisierten Zeichnen von Graphen (Optimization Problems with the Automated Drawing of Graphs)

Arno Wagner
Universität Trier (March 30th - ADiMMO-Workshop 1999)
OHO-OBDD Heuristics Online

Christian Stangier
Universität Trier (March 30th - ADiMMO-Workshop 1999)
Accelerating OBDD Variable Ordering

Angelika Steger
Technische Universität München (March 30th - ADiMMO-Workshop 1999)
Entwurf und Analyse von Strategien zur dynamischen Lastverteilung (Design and Analysis of Strategies for Dynamic Load Balancing)

Deryk Osthus
Humboldt Universität zu Berlin (March 30th - ADiMMO-Workshop 1999)
Zufällige maximale Graphen (Random Maximum Graphs)

Ferran Hurtado
Univ. Politécnica de Catalunya, Barcelona (May 3rd through 12th)
Elementary Transformation of Geometric Structures

Otfried Cheong
Hong Kong University of Science and Technology (June 18th through 26th)

Therese Biedl
University of Waterloo (May 19th)
Graphenzeichnen (Graph Drawing)

Peter Clote
Technische Universität München (June 21st)
Protein Folding, the Levinthal Paradox, and Rapidly Mixing Markov Chains

Hans-Christian Hege
Konrad-Zuse-Zentrum für Informationstechnik (July 9th)
Wissenschaftliche Visualisierung: Ziele, Methoden und Ergebnisse (Scienctific Visualisation: Goals, Methods, and Results)

Tomás Lukovski
Universität Paderborn (July 15th)
Fehlertolerante geometrische Spanner-Graphen und Anwendungen (Fault-tolerant Geometric Spanner Graphs and Applications)

Alon Efrat
University of Stanford, California (September 9th through 19th)
Geometry Helps in Bottleneck Matching and Related Problems

David Wood
Monarch University Melbourne, Australia (September 21st)

Piotr Indyk
University of Stanford, California (September 9th through 17th)
Deterministic and Las Vegas Algorithms for Approximate Nearest Neighbor

Martin Loebl
Karls-Universität Prag (October 25th)
A Graph Theory of Crystal Structures

Ulrich Kortenkamp
ETH Zürich (November 1st)
Foundations of Dynamic Geometry

Gyula Károly
Eötvös University, Budapest (December 5th through 19th)
Geometric Representations of Graphs

Erik Demaine
University of Waterloo, Canada (December 6th)
Folding and Cutting Paper

Hee Kap Ahn
University of Hong Kong (November 1st through 30th)

3. **Projects supported by external grants**

- Graduate program Computational Discrete Mathematics
  financially supported by the german science foundation (DFG)

Participating scientist:	Helmut Alt (speaker)
Coordination:	Bettina Felsner
Scholarship holders:	Torsten Thiele, Dr. (until September 30th)
	Laura Heinrich-Litan (since April 1st)
Duration of the project:	October 1991 through September 2000

This is a joint graduate program of scientists of Freie Universität, Humboldt-Universität, Technische Universität, and Konrad-Zuse-Zentrum.

Taking into consideration the algorithmic point of view, discrete mathematics has developed from classical fields like combinatorics or graph-theory into a field which unifies aspects of fundamental as well as of applied science in a unique way. Examples are: coding theory and data security, algorithmic number theory and computational algebra, computational geometry and robotics, network planning, design of algorithms – within all these topics, computational discrete mathematics delivers foundations and leads to the applications. The main goal of the graduate program is to work out contributions to important actual questions within the fundamental principles and applications of science by concentrating research and education.

- Project GALIA (GEOMETRIC ALGORITHMS FOR INDUSTRIAL APPLICATIONS) financially supported by the European Community within the ESPRIT IV-Program

Participants:	Helmut Alt (project leader)
	Sven Schönherr
Duration of the project:	November 15th 1998 through May 15th 2000

GALIA ist the continuation project of the project CGAL - CONSTRUCTING A GEOMETRIC ALGORITHMS LIBRARY.

It is a joint project of seven work groups in Utrecht, Zürich, Berlin, Sophia Antipolis/France, Saarbrücken, Linz and Tel Aviv. The main subject of the project is the implementation of the most important algorithms of computational geometry and the corresponding theoretical research.

We aim to create a software package for users of geometric algorithms. This is why the project includes the implementation of applications from fields like Geographical Information Systems (GIS), visualization and simulation, CAD/CAM and pattern-analysis and -reconstruction. The project is planned to be realized in cooperation with several industrial companies of the participating countries.

Our work group joins the implementation of the "Kernel" (elementary geometric objects and algorithms), of optimization algorithms and matching of patterns and shapes.

- Project POINT PATTERN MATCHING FOR THE ANALYSIS OF GEL IMAGES financially supported by the german science foundation (DFG)

Participants:	Helmut Alt (project leader)
	Klaus Kriegel, Frank Hoffmann, Carola Wenk,
	Christof Schultz, Irina Arweiler
Duration of the project:	January 1st 1997 through December 31st 2000

This project is a joint project of the Institute of Computer Science of Freie Universität and Deutsches Herzzentrum (german heart center) Berlin. The main topics of research are 2-dimensional gel images, that are produced by high-resolution gelelectophoresis-techniques. The gelelectrophoresis has been established to be a central molecular-biological method for the analysis of the protein/DNA-compound of tissue samples. Each "spot" in a gel image that has been produced by gelelectrophoresis represents one protein appearing in the sample. The analysis of the pictures helps to discover molecular and genetic reasons of heart diseases.

Until now, the interpretation of gel images is mainly based on the exact (and time consuming) examination by experienced specialists. The main goal of the project is to design and implement algorithms for the effective, computer supported gel analysis. Central to our investigations are two steps of this procedure, the gel-matching (assignment of corresponding spots from different pictures) as well as the setup and the administration of a 2-D gel protein database.

The matching represents a very important and time consuming prerequisite for the quantitative and qualitative data analysis of protein images. Within the matching, geometric distortions, that appear when producing protein samples, are to be equilibrated. The corresponding algorithmic problem is a variation of 2-dimensional pattern recognition, where the main difficulty is produced by geometric distortion. The project aims to develop new algorithms for gel-matching, based on already known procedures for point pattern matching from computational geometry. Because of the fundamental nature of the task of approximative point pattern matching, every single progress within the work on this problem will also have great importance for various other applications.

- Project Efficient Algorithms for Map Labeling
  financially supported by the German science foundation (DFG)

Participants:	Frank Wagner (project leader)
	Alexander Wolff
Duration of the project:	June 1st 1996 through May 31st 1999

The contents of the project are the development, the theoretical analysis, the implementation and the experimental application of algorithms for some map labeling problems. The objective is to label a given quantity of objects (points, lines, regions) such that

a) no two labels intersect,
b) the legibility is granted by a sufficient label (font) size,
c) the labeled object can easily be identified.

Based on an algorithm for solving a restricted version of this problem which has already proved to be successful in practical applications, dynamic labeling problems that occur in Geographical Information Systems (GIS) shall be solved together with the users.

- Project Algorithms for Shape Matching and Approximation
  financially supported by the German science foundation (DFG)

Participants:	Helmut Alt (project leader)
	Christian Knauer, Lutz Meißner,
	Dorothea Rochusch, Carola Wenk
Duration of the project:	April 1st 1998 through March 31st 2000

The aim of this project is the development and partial implementation of algorithms for similarity determination and approximation of geometric objects. To achieve this, methods of computational geometry are to be applied in order to recognize and approximate patterns and shapes. Earlier works of the work group concerning this topic shall be generalized to higher dimensions and to more general transformations for the matching of shapes, e.g. arbitrary affine mappings. In particular, data structures that allow to determine the most similar one out of a fixed set of shapes shall be developed. The practicability of the complex data structures and methods that most of the algorithms contain, as well as the application of approximation-approaches like for example reference-point-methods, shall also be examined.

- Project GEOMETRIC SHAPE MATCHING AND CHINESE CHARACTER RECOGNITION financially supported by the German Academic Exchange Service (DAAD)

Participants:	Helmut Alt (project leader)
	Christian Knauer
Duration of the project:	March 5th 1999 through December 31st 1999

This is a joint project between the Hong Kong University of Science and Technology and the Institute of Computer Science of the Freie Universität.

It is concerned with the recognition of Chinese characters and similar pattern matching problems. The same character can appear in a variety of shapes that differ geometrically. What remains invariant, however, is the "combinatorial" structure of the pattern: a number of strokes that intersect or touch each other in a prescribed way. A stroke may move relative to another stroke, but it will not suddenly appear on the other side of that stroke; this motivates the idea to consider patterns as drawings of planar graphs. Two graph drawings can be considered similar, if both the underlying graph and the geometry of the planar embedding are similar.

The goal of this project is to lay the foundations for subsequent research by theoretically and experimentally developing a suitable measure of similarity, combining ideas from graph theory with the purely geometric definition of pattern matching used in computational geometry so far.

4. **Publications and Lectures**

(a) Publications in Journals (with a selection procedure)

O. AICHHOLZER, F. AURENHAMMER, G. ROTE, Y.-F. XU. *Constant-level greedy triangulations approximate the MWT well.* Journal of Combinatorial Optimization, 2:361–369, 1999.

H. ALT, U. FUCHS, K. KRIEGEL. *On the number of simple cycles in planar graphs.* Combinatorics, Probability and Computing, 8(5):397–405, 1999.

P. BRASS. *Equilateral Simplices in Normed Spaces.* Beiträge zur Algebra und Geometrie, 40:303–307, 1999. appeared also as preprint Freie Universität Berlin, Fachbereich Mathematik und Informatik Serie B 97-12.

P. BRASS. *Isoperimetric Inequalities for Densities of Lattice-Periodic Sets.* Monatshefte für Mathematik, 127:177–181, 1999. appeared also as preprint Freie Universität Berlin, Fachbereich Mathematik und Informatik Serie B 97-05.

P. BRASS. *On strongly normal tesselations.* Pattern Recognition Letters, 20:957–960, 1999. appeared also as preprint Freie Universität Berlin, Fachbereich Mathematik und Informatik Serie B 99-06.

S. FELSNER, G. AGNARSSON, W.T. TROTTER. *The Maximum Number of Edges in a Graph of Bounded Dimension, with Applications to Ring Theory.* Discrete Mathematics, 201:5–19, 1999.

S. FELSNER, P.C. FISHBURN, W.T. TROTTER. *Finite 3-Dimensional Partial Orders which are not Sphere Orders.* Discrete Mathematics, 201:101–132, 1999.

S. FELSNER, J. GUSTEDT, M. MORVAN. *Interval Reductions and Extensions of Orders: Bijections to Chains in Lattices.* Order, 15:221–246, 1999.

S. FELSNER, K. KRIEGEL. *Triangles in Euclidean Arrangements.* Discrete & Computational Geometry, 22:429–438, 1999.

S. FELSNER, K. REUTER. *The Linear-Extension-Diameter of a Poset.* SIAM Journal on Discrete Mathematics, 12:360–373, 1999.

S. FELSNER, L. WERNISCH. *Maximum k-Chains in Planar Point Sets: Combinatorial Structure and Algorithms.* SIAM Journal on Computing, 28:192–209, 1999.

M. GAVALEC, G. ROTE. *Reachability of fuzzy matrix period.* Tatra Mountains Mathematical Publications, 16:61–79, 1999.

F. HOFFMANN, K. KRIEGEL, C. WENK. *An applied point pattern matching problem: comparing 2D patterns of protein spots.* Discrete Applied Mathematics, 93:75–88, 1999.

M. LASSAK. *Parallelotopes of Maximum Volume in a Simplex.* Discrete and Computational Geometry, 21:449–462, 1999.

K.-P. PLEISSNER, F. HOFFMANN, K. KRIEGEL, C. WENK, S. WEGNER, A. SAHLSTRÖHM, H. OSWALD, H. ALT, E. FLECK. *New algorithmic approaches to protein spot detection and pattern matching in two-dimensional electrophoresis gel databases.* Electrophoresis, 20:755–765, 1999.

(b) Publications in Conference Proceedings (with a selection procedure)

J. R. GRIGGS, G. ROTE. *On the distribution of sums of vectors in general position.* J. N. Ronald L. Graham, Jan Kratochvíl, F. S. Roberts, editors, Contemporary Trends in Discrete Mathematics, pages 139–142. DIMACS series in discrete mathematics and theoretical computer science, American Mathematical Society, 1999.

F. HOFFMANN, K. KRIEGEL, I. SEEFELDT, C. SCHULTZ, C. WENK, V. REGITZ-ZAGROSEK, H. OSWALD, E. FLECK. *An Alternative Approach to Automatically Deal with Uncertain Information within 2D Gels.* Proceedings Electrophoresis Forum 99, page 54, Munich.

C. WENK. *Applying an Edit Distance to the Matching of Tree Ring Sequences in Dendrochronology.* M. Crochemore, M. Paterson, editors, Combinatorial Pattern Matching (CPM99), volume 1645 of LNCS, pages 223–242, 1999.

A. Wolff, L. Knipping, M. van Kreveld, T. Strijk, P. K. Agarwal. *A Simple and Efficient Algorithm for High-Quality Line Labeling.* Proc. GIS Research UK 7th Annual Conference (GISRUK'99), pages 146–150, Southampton, 14–16 April 1999.

(c) Other Publications

H. Alt, L. Guibas. *Discrete Geometric Shapes: Matching, Interpolation, and Approximation.* J.-R. Sack, J. Urrutia, editors, Handbook of Computational Geometry, pages 121 – 153. Elsevier Science Publishers B.V. North-Holland, Amsterdam, 1999.

Alexander Wolff. *Label Placement in Theory and Practice.* Ph.D. thesis, Freie Universität Berlin, 1999.

(d) Technical Reports

B 99-01 Carola Wenk. *Applying an Edit Distance to the Matching of Tree Ring Sequences in Dendrochronology.*

B 99-04 Stefan Felsner, Günter M. Ziegler. *Zonotopes Associated with Higher Bruhat Orders.*

B 99-05 Stefan Felsner, Vijay Raghavan, Jeremy Spinrad. *Recognition Algorithms for Orders of Small Width and Graphs of Small Dilworth Number.*

B 99-06 Peter Brass. *On Strongly Normal Tesselations.*

B 99-07 Peter Brass. *On the Number of Maximum-Area Triangles in a Planar Point Set.*

B 99-08 Alexander Wolff, Tycho Strijk. *Labeling Points with Circles.*

B 99-10 Peter Brass, Carola Wenk. *On the Number of Cylinders Touching a Ball.*

B 99-18 Peter Brass, Christian Knauer. *Testing the Congruence of d-Dimensional Point Sets.*

B 98-19 Stefan Felsner, R. Kant, C.P. Rangan, D. Wagner. *The Complexity of Partial Order Properties.*

B 99-20 Stefan Felsner. *The Skeleton of a Reduced Word and a Correspondence of Edelman and Greene.*

B 99-21 Frank Hoffmann, Klaus Kriegel, Sven Schönherr, Carola Wenk. *A Simple and Robust Geometric Algorithm for Landmark Registration in Computer Assisted Neurosurgery.*

B 99-22 Marek Lassak. *Approximation of Convex Bodies by Rhombi and by other Axially Symmetric Bodies.*

(e) Talks

Helmut Alt

- *Exact L_∞ Nearest Neighbor Search in High Dimensions*, Seminar "Computational Geometry", IBFI Schloss Dagstuhl, March 10th.
- *Exact L_∞ Nearest Neighbor Search in High Dimensions*, Workshop CG '99, Antibes, France, March 16th.
- *Packing Convex Polygons into Rectangular Boxes*, Seminar, Computer Science Department, Hong Kong University of Science and Technology, October 7th.

Peter Brass

- *Probleme und Anwendungen von Kreis- und Kugelpackungen (Problems and Applications of Circle- and Sphere-Packings)*, Colloquium at the University of Greifswald, January 13th.
- *Problems and Results on Sphere Packings*, Colloquium at the University of Pretoria, February 15th.
- *Structural Results for Discrete Extremal Problems*, Colloquium at the University of Pretoria, February 17th.
- *On Equilateral Sets in Normed Spaces*, 8th International Conference on Geometry, Haifa, Israel, March 7th through 14th.
- *Diskrete Geometrie in Normierten Räumen (Discrete Geometry in Normed Spaces)*, invited talk, Tag der Geometrie 1999, Hannover, May 14th.
- *Dreiecksflächenprobleme in der kombinatorischen Geometrie (Triangle Area Problems in Combinatorial Geometry)*, DMV-Jahrestagung 1999, Mainz, September 5th through 11th.
- *Turán-type Theorems for Convex Geometric Graphs*, Colloquium on Combinatorics, Braunschweig, November 12th and 13th.

Stefan Felsner

- *On the Graphs of Arrangements*, 23rd Berliner Algorithmen-Tag, January 8th.
- *Arrangments, Graphs, and Orders (six lectures)*, Banach Center Symposium on Ordered Sets, Warsaw, July 26th through 28th.
- *On the Complexity of Poset Properties*, Workshop on Graphs, Posets, and Algorithms, Rutgers University, U.S.A., August 3rd.
- *Recognition Algorithms for Orders of Small Width and Graphs of Small Dilworth Number*, Ordal 1999, Montpellier, France, August 25th.
- *Ketten in partiellen Ordnungen (Chains in Partial Orders)*, Forschungsinstitut für Diskrete Mathematik, Bonn, September 21st.
- *Hamiltonicity and Coloring of Arrangement Graphs*, Colloquium on Combinatorics, Braunschweig, November 13th.

Frank Hoffmann

- *On the Polygon Exploration Problem*, Dagstuhl-Seminar "Competitive Algorithms", June 20th through 25th.

Christian Knauer

- *Matching Shapes with Respect to the Symmetric Difference*, Euro-CG-1999 (INRIA), March 17th.

- *Matching Shapes with Respect to the Symmetric Difference*, Theorietag 1999, Humboldt Universität zu Berlin, March 23rd.
- *Was Computer niemals können werden - Fundamentale Phänomene der Berechenbarkeitstheorie (What Computers will never be able to achieve – Fundamental Phenomena of Computability Theory)*, Tag der Mathematik, Freie Universität Berlin, May 29th.
- *Fast Point Pattern Matching*, Hong Kong University of Science and Technology, September 30th.

Klaus Kriegel

- *Über die Anwendung von NP-schweren Problemen in der Kryptographie (On the Application of NP-Hard Problems in Cryptography)*, habilitation talk, Freie Universität Berlin, February 3rd.
- *A Geometric Approach to Protein Identification in 2D Electrophoretic Gel Images*, 15th European Workshop on Computational Geometry, Antibes, France, March 15th.
- *Stand und Perspektiven der Entwicklung der Matchingsoftware CAROL (Status and Perspectives of the Development of the Matching Software CAROL)*, project presentation at Deutsches Herzzentrum Berlin, September 3rd.
- *An Alternative Approach to Automatically Deal with Uncertain Information within 2D Gels*, Electrophoresis Forum 1999, October 27th.

Marek Lassak

- *Combinatorial and Geometric Problems on Approximation of a Set by a Triangle*, invited talk, Colloquium on Combinatorics, Braunschweig, November 12th and 13th.
- *Covering a Convex Body by Negative Homothetic Copies*, Jahrestagung der Deutschen Mathematiker-Vereinigung, Mainz, September 5th through 11th.
- *Covering a Convex Body by Positive and Negative Homothetical Copies*, Fakultät für Mathematik, Technische Universität Chemnitz, November 22nd.
- *How to Compare Shapes of Convex Bodies*, Institut für Geometrie, Technische Universität Dresden, November 23rd.

Günter Rote

- *Optimal Triangulations*, Oberwolfach, January 11th through 16th.
- *Matchings Between Triangulations of a Planar Set of Points*, Workshop on Discrete Geometry and the Kepler Problem, Institute for Advanced Study, Princeton, January 17th through 22nd.
- *Realizations of Polytopes with Integer Coordinates*, Oberwolfach, February 1st through 5th.
- *Beleuchtungsprobleme (Illumination Problems)*, 23rd Berliner Algorithmen-Tag, Humboldt Universität zu Berlin, July 16th.
- *Berechnung der Determinante und Pfaff'schen ohne Division (Calculation of the Determinant and Pfaffian without Division)*, 10. Österreichisches Mathematikertreffen, September 20th through 24th.

- *Optimal Logistics for Expeditions – The Jeep Problem with Complete Refilling*, Humboldt Universität zu Berlin, November 18th.
- *Polytopes with Small Integral Coordinates*, 4th Geometry Festival, Budapest, November 29th through December 2nd.

Carola Wenk

- *Applying an Edit Distance to the Matching of Tree Ring Sequences in Dendrochronology*, 10th Annual Symposium on Combinatorial Pattern Matching (CPM 99), Warwick, GB, July 22nd through 24th.
- *Geometrische Mustererkennung in 2D Elektrophoresegelen (Geometric pattern matching in 2D electrophoresis gels)*, 27th Tieftemperatur-Thermodynamik-Kolloquium (TTTK) in Tirol, Austria, February 20th through 27th.

Alexander Wolff

- *A Combinatorial Framework for Label Placement*, invited talk, 3rd Workshop of the Applied Algorithms' Group, Utrecht University, March 31st.
- *A Combinatorial Framework for Label Placement*, ETH Zürich, April 27th.
- *An Algorithm for High-Quality Line Labeling* (Best Paper of a Young Researcher), Geographical Information Systems Research, United Kingdom (GISRUK'99), Southampton, April 14th through 16th.
- *Parametrized Complexity – A New Approach for Hard Problems*, Defense of Ph.D. thesis, Freie Universität Berlin, May 28th.

(f) Posters

Klaus Kriegel

- poster presentation: *The Use of Geometric Algorithms for Spot Detection and Gel Matching in 2DE Gel Analysis*, Electrophoresis Forum 1999, (together with: Ingo Seefeldt, Helmut Oswald, Eckart Fleck, Deutsches Herzzentrum Berlin).

5. **Courses, Seminars, Exercises and Laboratories (WS 98/99 und SS 99)**

H. Alt, *Einführung in die Theoretische Informatik (Introduction to theoretical computer science)*, course and exercises, (winter semester 98/99).

H. Alt, and other lecturers of the graduate program, *Lectures of the graduate program* Computational Discrete Mathematics, course, (winter semester 98/99).

P. Brass, *Mathematik des Wählens (Mathematics of elections)*, course, (winter semester 98/99).

F. Hoffmann, C. Knauer, *Entwurf und Analyse von Algorithmen (Design and analysis of algorithms)*, course and exercises, (winter semester 98/99).

S. Felsner, N. Morawe, *Algorithmische Geometrie (Computational geometry)*, course and exercises, (winter semester 98/99).

H. Alt, F. Hoffmann, *Seminar über Algorithmen (Seminar on algorithms)*, seminar, (winter semester 98/99).

S. Felsner, *Geometrische Graphentheorie (Geometric graph theory)*, seminar, (winter semester 98/99).

H. Alt, S. Felsner, P. Brass, *Seminar for M.S. and Ph.D. students in theoretical computer science*, seminar, (winter semester 98/99).

R. Rojas, F. Wagner, B. Frötschl, A. Wolff, *Algorithmen für die Linguistik (Algorithms for linguistics)*, seminar, (winter semester 98/99).

H. Alt, L. Meissner, *Praktikum zur Computergraphik (Laboratory on computer graphics)*, laboratory, (winter semester 98/99).

H. Alt, and other lecturers of the graduate program, *Colloquium of the graduate program* Computational Discrete Mathematics, colloquium, (winter semester 98/99).

F. Hoffmann, *On-line Algorithmen und ihre Analyse (On-line algorithms and their analysis)*, course and exercises, (summer semester 99).

P. Brass, *Diskrete Geometrie (Discrete geometry)*, course, (summer semester 99).

H. Alt, and other lecturers of the graduate program, *Lectures of the graduate program* Computational Discrete Mathematics, course, (summer semester 99).

H. Alt, T. Thiele, L. Meissner, *Randomisierte Algorithmen (Randomized algorithms)*, course and exercises, (summer semester 99).

G. Rote, N. Morawe, *Lineare und diskrete Optimierung (Linear and discrete optimization)*, course and exercises, (summer semester 99).

K. Kriegel, *Kryptographie und Komplexitätstheorie (Cryptography and complexity theory)*, seminar, (summer semester 99).

H. Alt, C. Knauer, *Algorithmen zur Computer-Arithmetik (Algorithms for computer arithmetics)*, seminar, (summer semester 99).

H. Alt, G. Rote, *Datenstrukturen (Data structures)*, seminar, (summer semester 99).

H. Alt, G. Rote, S. Felsner, P. Brass, *Seminar for M.S. and Ph.D. students in theoretical computer science*, seminar, (summer semester 99).

S. Felsner, N. Morawe, *Algorithmische Geometrie (Computational geometry)*, seminar, (summer semester 99).

S. Felsner, C. Knauer, *Kombinatorik und Maple-Programmierung (Combinatorics and Maple- programming)*, laboratory, (summer semester 99).

H. Alt, and other lecturers of the graduate program, *Colloquium of the graduate program* Computational Discrete Mathematics, colloquium, (summer semester 99).

6. **Organisation of scientific events**

ADiMMO 1999, March 29th and 30th.
Organisation: H. Alt, B. Felsner, H. Heinrich.

GALIA Developers Meeting, December 7th through 9th.
Organisation: H. Alt, S. Schönherr, H. Heinrich.

7. **Habilitations**

   KLAUS KRIEGEL, February 3rd:
   Über die Anwendung von NP-schweren Problemen in der Kryptographie (On the Application of NP-Hard Problems in Cryptography)
   Supervisor: Helmut Alt.

8. **Doctoral Graduations**

   ALEXANDER WOLFF, February 10th:
   Label Placement in Theory and Praxis,
   Disputation (May 28th) on: *Parametrisierte Komplexität – eine neue Herangehensweise für schwere Probleme (Parametrized Complexity – A New Approach for Hard Problems)*
   Supervisor: Frank Wagner.

9. **Diplomas**

   CLEMENS HENDLER, June 7th.
   Graphenklassen mit durch Funktionen in der Cliquezahl beschränkter Färbungszahl (Graph Classes with a Chromatic Number bounded by some Function in the Clique Number).
   Supervisor: Stefan Felsner.

   CARSTEN IHLEMANN, August, 8th.
   Komplementärpaare linearer Erweiterung von Ordnungen (Complex Pairs of Linear Extensions of Orders).
   Supervisor: Stefan Felsner.

   ASTRID KAFFANKE, July 23rd.
   Geometrische Suchprobleme bei gegebener Anfrageverteilung (Geometric Search Problems with Predefined Query Distribution).
   Supervisor: Stefan Felsner.

   SVEN SIEBERT, April 6th.
   Algebraische Flächen zweiter Ordnung (Algebraic Surfaces of Second Order).
   Supervisor: Helmut Alt.

   HELMUT WEIL, September 6th.
   Signotope – Zur Kombinatorik von Pseudogeradenarrangements (Signotopes – On the Combinatorics of Pseudo-line Arrangements).
   Supervisor: Stefan Felsner.

10. **Miscellaneous**

    HELMUT ALT
    - Speaker of the graduate program *Computational Discrete Mathematics*.
    - Deputy speaker of the special interest group 0.1.1 *Algorithms and Data Structures* of the german association for computer science (GI).
    - Member of the editorial board of *ORDER*.

– Referee for the research focus program (SPP) *Efficient Algorithms for Discrete Problems and their Applications* of the german science foundation (DFG).
– Chairman of the habilitation committee of Peter Braß and Gerd Wagner.
– Chairman of the habilitation committee of Klaus Kriegel.
– Member of the habilitation committee of Jens Lang.

PETER BRASS
– Reelection into the speakers' circle of the *DMV-special interest group geometry*; operation of their web-sites and electronic newsletter.
– Research stay at the University of Pretoria (two weeks in February).
– Contribution of several reports to *Zentralblatt für Mathematik und ihre Grenzgebiete.*
– Referee for *Geometriae Dedicata.*
– Referee for *Discrete Mathematics.*
– Referee for *STACS 2000.*

STEFAN FELSNER
– Referee for *SIAM Journal of Discrete Mathematics.*
– Referee for *AMS-NSA*.
– Referee for *Cocoon 99.*
– Referee for *J. of the Egyptian Mathematical Society.*
– Referee for *Discrete & Computational Geometry.*
– Referee for *Discrete Applied Mathematics.*
– Referee for *Algorithmica.*
– Referee for *STACS 2000.*
– Article for *Encyclopedia of Mathematics "Interval Dimension".*
– Lecture *Zufall und Algorithmen (Coincidence and Algorihtms)* at the pupil's seminar, Freie Universität Berlin, February 13th and 14th.
– Organisation of the *Tag der Mathematik*, Freie Universität Berlin, May 29th.
– Coordination of the pupil's contest at the *Tag der Mathematik*, Freie Universität Berlin, May 29th.
– Referee report on: *π, der Film (π, the movie)* for *DMV-Mitteilungen 2/99.*
– Lecture *Diskrete Mathematik (Discrete mathematics)* at the pupil's seminar, Freie Universität Berlin, October 11th through 16th.
– Member of the habilitation committee of Klaus Kriegel.
– Member of the Ph.D. committee of Matthias Horn.
– Member of the program committee of *Ordal 99.*
– Member of the program committee of *SIAM Conference on Discrete Mathematics 2000.*
– Second referee for the dipoma thesis of Mrs. Ugan.

LAURA HEINRICH-LITAN
– Referee for *STACS 2000.*
– Helping Hand at the *Berliner Tag der Mathematik*, Freie Universität Berlin, May 29th.

FRANK HOFFMANN
– Lecture *Mathematische Methoden der Informatik II (Mathematical methods of computer science, II)* in the summer semester 1999, Berufsakademie Berlin.

– Referee for *STACS 2000*.
– Referee for *SoCG 1999*.

Christian Knauer
– Research stay at the Hong Kong University of Science and Technology, September 16th through October 14th.
– Referee for *STACS 2000*.

Astrid Kaffanke
– Referee for *STACS 2000*.
– Referee for *Discrete Mathematics*.

Klaus Kriegel
– Referee for *Journal of Graph Algorithms and Applications*.
– Referee for *SoCG 1999*.
– Referee for *STACS 1999*.

Marek Lassak
– 11 reports for *Zentralblatt für Mathematik und ihre Grenzgebiete*.
– 6 reports for *Mathematical Reviews*.
– Referee report for *Mathematika*.
– Referee for *Beiträge zur Algebra und Geometrie*.

Nicole Morawe
– Referee for *STACS 2000*.
– Helping Hand at the *Berliner Tag der Mathematik*, Freie Universität Berlin, May 29th.

Günter Rote
– Referee for *Computing*.
– Referee for *Discrete Applied Mathematics*.
– Referee for *Discrete Mathematics*.
– Referee for *Discrete and Computational Geometry*.
– Referee for *Geometriae Dedicata*.
– Referee for the conference *Integer Programming and Combinatorial Optimization (IPCO)* in Graz, Austria, June.
– Referee for *Symposium on Theoretical Aspects of Computer Science (STACS 2000)*, Lille.
– Book review for *Optima*.
– Member of the Ph.D. committee of Matthias Horn.
– Member and executive chairman of the selection committee for the position of a member and/or leader of the department's technical staff.

Sven Schönherr
– Design and implementation of an efficient, exact, and generic quadratic programming solver for geometric optimization.
– Design, realisation, and maintenance of the workgroup's WWW-pages.
– Helping Hand at the *Berliner Tag der Mathematik*, Freie Universität Berlin, May 29th.

Carola Wenk
- Referee for *STACS 2000*.
- Helping Hand at the *Berliner Tag der Mathematik*, Freie Universität Berlin, May 29th.

Appendix:

Talks in the *Noon Seminar* 12.00 a.m.

January 1st: Carola Wenk
On the Union of Moving Polygonal Pseudodiscs

January 7th: Helmut Alt
Berechenbarkeit und Komplexität von Kachelungen (Computability and Complexity of Tilings)

January 12th: Torsten Thiele
Neues über Kreuzungszahlen (News on Crossing Numbers)

January 14th: Zsuzsanna Liptak
Zur algebraischen Charakterisierung regulärer Termsprachen (Towards the Algebraic Characterization of Regular Term Languages)

January 19th: Christian Knauer
Computing a Line Arrangement in Linear Space

January 21st: Alexander Wolff
Viewing Map Labeling as a Constraint Satisfaction Problem – A New Approach to Overconstraint System

January 26th: Lutz Meissner
Shape Indexing through Curvature Scale Space

January 28th: Peter Brass
Über stark normale Parkettierungen (On Strongly Normal Tesselations)

February 2nd: Stefan Felsner
Klassisches Zählen und Zellen in Arrangements (Combinatorial Enumeration and Regions in Arrangements)

February 4th: Frank Hoffmann
Kürzeste Wege in Graphen und Matrixmultiplikation (Shortest Paths and Matrix Multiplication)

February 5th: Frank Wagner
Projekt "Integrierte Netzoptimierung" – Neues von der *Deutschen Bahn* (Project "Integrated Network Optimization" – News from the *Deutsche Bahn*)

February 9th: Artur Andrzejak
Segmentierungsprobleme - Optimierungsprobleme aus der Wirtschaft (Segmentation Problems - Industrial Optimization Problems)

February 11th: Christoph Stamm
Automatisierte Platzierung von Antennen im Gelände (Automated Placement of Antennas in Terrains)

February 16th: Udo Warschewski
Funktionelle Bildgebung vom menschlichen Gehirn - ein praktisches Matchingproblem (Functional Visualization of the Human Brain - A Practical Matching Problem)

February 18th: KLAUS KRIEGEL
Über das Finden von Hamilton-Kreisen in dichten Graphen (Finding Hamilton Cycles in Dense Graphs)

February 23rd: SVEN SCHÖNHERR
Exact Geometric Predicates using Cascades Computation

February 25th: HELMUT ALT
Rekonstruktion von ebenen Kurven (Reconstruction of plane curves)

March 2nd: CHRISTIAN KNAUER
A Lower Bound for Knapsacks

March 4th: ALEXANDER WOLFF
Edge Irreducibility and Label Number Maximization

March 9th: CAROLA WENK
Hausdorffabstände von Punkten, Strecken und Dreiecken, II (On the Hausdorff Distance between Points, Line Segments, and Triangles)

March 11th: TORSTEN THIELE
Approximative Inklusion-Exklusion (Approximate Inclusion-Exclusion)

March 25th: HELMUT WEIL
Diplomprüfung: Signotope (Defense of the Diploma Thesis: Signotopes)

April 13th: STEFAN FELSNER
Fraktionale Graph-Isomorphie (Fractional Graph Isomorphism)

April 15th: KLAUS KRIEGEL
Komplexität im average case (Complexity Average Case)

April 16th: OLIVER THIMM
Die Komplexitätsklasse BPP, I (The Complexity Class BPP, I)

April 20th: PETER BRASS
Über die Anzahl flächenmaximaler Dreiecke (On the Number of Maximum-area Triangles)

April 22nd: SVEN SCHÖNHERR
"Brain Matching" - Eine Anwendung aus der Medizin ("Brain Matching" - An Application from the Field of Medicine)

April 27th: FRANK HOFFMANN
Compact Orthogonal Drawings

April 29th: CHRISTIAN KNAUER
Die universelle Verteilung (oder 'worst case = average case')(The Universal Distribution (or 'worst case=average case'))

May 4th: GÜNTER ROTE
Referenzpunkte und geometrische Spannungen (Reference Points and Geometric Tensions)

May 6th: NICOLE MORAWE
Graphen auf konvexen Punktmengen (Graphs on Convex Point Sets)

May 11th: CAROLA WENK

Terrain Matching under Translations

May 18th: Therese Biedl
Große unabhängige Mengen in planaren Graphen in linearer Zeit (Large Independent Sets in Planar Graphs in Linear Time)

May 20th: Torsten Thiele
Große unabhängige Mengen in logarithmischer bzw. konstanter Zeit (Large Independent Sets in Logarithmic or Constant Time)
May 25th: Torsten Thiele
Große unabhängige Mengen in logarithmischer bzw. konstanter Zeit, Teil II (Great Independent Sets in Logarithmic or Constant Time, Part II)

May 27th: Klaus Kriegel
FKG-Ungleichung (und ihre Verwandtschaft)(The FKG Inequality (and its Relatives))

June 1st: Stefan Felsner
Neues über Dreiecke (News about Triangles)

June 3rd: Helmut Alt
How to Pack Polygons into Rectangular Boxes

June 8th: Peter Brass
Über die Anzahl flächenminimaler Dreiecke (On the Number of Minimum-area Triangles)

June 10th: Prof. Chaudari (Gast von Frau Fehr)
Karmarkar's Algorithm for Linear Programming

June 15th: Christian Knauer
Geometric Predicates & Roundoff Errors

June 17th: Laura Heinrich-Litan
External-Memory Computational Geometry – Part One

June 22nd: Lutz Meissner
The Hardness of Speeding-up Knapsack

June 24th: Christian Haase
Tiling Groups and Algorithms for Tiling

June 29th: Carola Wenk
Constructing Casts for Polyhedra

July 1st: Artur Andrzejak
On counting of (i, j)-Partitions of Cyclic Polytopes

July 6th: Günter Rote
Beleuchtungsprobleme (Illumination Problems)

July 8th: Sven Schönherr
A Simplex-type Algorithm for Quadratic Problems

July 13th: Frank Hoffmann
k Servers on a Tree

July 15th: Klaus Kriegel
Randomized Point Pattern Matching

July 20th: Stefan Felsner
The 1/3 - 2/3 property of Semi-Orders

July 22nd: Marek Lassak
A Few Problems about Approximation of a Convex Body by a Triangle

July 23rd: Darko Dimitrov
Registration of Range Images

July 27th: Peter Brass
On the Directions of Segments Contained in a Surface

July 29th: Torsten Thiele
Vectors in General Position

August 3rd: Helmut Alt
How to Pack Polygons into Rectangular Boxes - II

August 24th: Christian Knauer
A Non-Linear Bound for Monotone Circuit Size

August 26th: Nicole Morawe
Permutations with and without 132-Subsequences

August 31st: Zsuzsanna Liptak
How to Communicate with your Friends if E-Mailing is Unreliable

September 2nd: Carola Wenk
On the Area Bisectors of a Polygon

September 7th: Laura Heinrich-Litan
Lower Bounds for High Dimensional Nearest Neighbor Search

September 9th: Günter Rote
Gewichtsvektoren von Halbgeradenarrangements (Weight Vectors of Arrangements of Rays)

September 14th: Piotr Indyk
Convolutions and Geometric Pattern Matching

September 16th: Stefan Felsner
On Chains in Orders (45 Min)

September 21st: David Wood, Melbourne
Algorithms for Orthogonal Graph Drawing

September 23rd: Frank Hoffmann
Predicting from Expert Advice

September 28th: Klaus Kriegel
On the Advantage of Knowing the Weather Forecasts: An Online Game

September 30th: Marek Lassak
Covering a Convex Body by Negative Homothetic Copies

October 5th: Lutz Meissner
On a Theory of Computing Symposia

October 7th: Günter Rote

Small Sets of Aperiodic Wang Tiles

October 14th: PETER BRASS
Almost Linear Turan Numbers for Convex Geometric Graphs

October 19th: ASTRID KAFFANKE
Degrees and Cycles in Graphs

October 21st: HELMUT ALT
Chinese Character Recognition

October 26th: CHRISTIAN KNAUER
Overlap Maximization for Convex Polygons

October 28th: SVEN SCHÖNHERR
Expression Templates in C++

November 2nd: LAURA HEINRICH-LITAN
On Using Communication Complexity to provide Lower Bounds

November 4th: CAROLA WENK
An Efficient Algorithm for Terrain Simplification

November 9th: STEFAN FELSNER
Infeasability of Systems of Halfspaces

November 11th: GÜNTER ROTE
Are Prefixcodes Optimal?

November 16th: FRANK HOFFMANN
PAC-Learning and VC-Dimension

November 18th: KLAUS KRIEGEL
Depth in Arrangement of Lines

November 23rd: MARK PAULY
Robust Monte Carlo Methods for Photorealistic Rendering of Volumetric Effects

November 25th: HEE KAP AHN
Separating a Polyhedron with Trembling Hands

November 30th: PETER BRASS
Approximation of Convex Polygons by Sub-Polygons

December 2nd: CHRISTOF SCHULTZ
Spotdetection in 2-dimensional Gel Electrophoresis Images

December 7th: HELMUT ALT
Quadratic Binary Search

December 9th: GYULA KÁROLY
Incidence Theorems in the Plane, With Applications in Number Theory

December 14th: ASTRID KAFFANKE
Fire-Protection and Well Skating – Triangulations May Help

December 16th: MAREK LASSAK
Approximation of Convex Bodies by Axially Symmetric Bodies

December 21st: GÜNTER ROTE

Straightening and Opening Polygonal Chains, Part I

December 23rd: BERND GÄRTNER
A Sampling Lemma with Applications