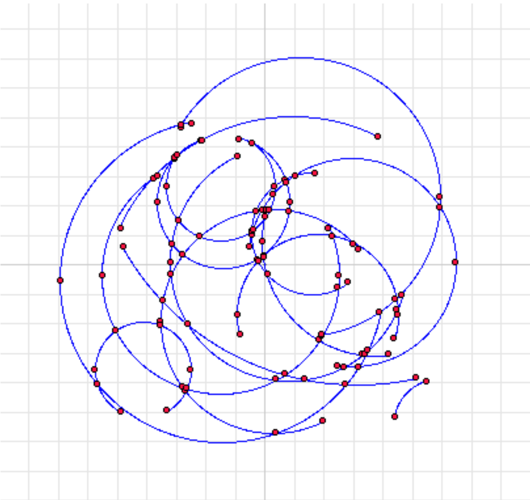
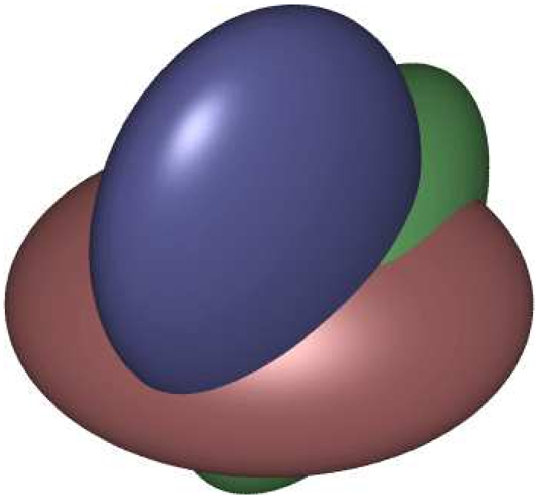
Effective Computational Geometry





The algorithms unit of the Max-Planck-Institute for Computer Science and Raimund Seidel's group in the Computer Science department has made important contributions to computational geometry over the past years. We invented algorithms, contributed decisively to the theoretical foundations of implementing geometric algorithms, and built systems (LEDA [LED], CGAL [CGA], SILVIA [SIL]) that make the algorithms and data structures of computational geometry available. A unique feature of our systems is their reliability. The systems are being used worldwide (for academic as well as commercial purposes). They are marketed by Algorithmic Solutions GmbH [AS].

Our current systems are mainly designed for linear objects (planar objects composed of points and line segments, three-dimensional objects that can be described by points, line segments, and triangles). Curved objects are approximated by linear objects. **Our goal for the next years is to handle curved objects directly.** We have won substantial inside and outside resources (MPG, DFG and EU) for the undertaking. The undertaking is a real challenge as it will force us to combine knowledge from many sources (computational geometry, combinatorial algorithms, numerical analysis, computer algebra, software engineering) and to make advances in all these areas. We are in a unique position to attack the challenge, we know the available theory and its shortcomings, we have the best systems to build on, and we have prototypical implementations for some of the tasks to be tackled. The figures on the top of the page show an arrangement of circular arcs and an arrangement of ellipsoids.

Stefan Funke, Nicola Geismann, Susan Hert, Lutz Kettner, Christian Lennerz, Kurt Mehlhorn, Edgar Ramos, Susanne Schmitt, Elmar Schömer, and Thomas Warken (see `http://www.mpi-sb.mpg.de/units/ag1/people.html`) are committed to the project. We refer to this group of persons as the ECG group in the sequel. The project has room for at least 20 students at all levels (programming projects, Diplomarbeit, or PhD thesis).

In order to prepare you for the project we will offer the following courses, seminars and FOPRAs in the next two semesters (winter term 01/02 and summer term 02).

Courses: In the winter term we will offer a course

Theory and Practice of Implementing Geometric Algorithms
Instructors: Lutz Kettner, Kurt Mehlhorn, Elmar Schömer

9 credit points (Kreditpunkte)

Topics of the course: common problems in the implementation of geometric algorithms, precision, degeneracy, exact computation paradigm, perturbation, floating point arithmetic, floating point filters, computation with algebraic numbers, solving polynomial systems, curves and curve arrangements, program checking, software structure of LEDA and CGAL, C++ techniques, boolean operations on curved polygons and curved polyhedra,

Seminars: In the winter *and* in the summer term we will offer seminars

Theoretical Foundations for the Implementation of Geometric Algorithms
Instructors: The ECG Group

The seminar for the winter term is tentatively scheduled for the week starting October 15th (this is the week before the winter term).

Preparatory Meeting (Vorbesprechung): June 13th, 13:15, Room 024, MPI, Pizza will be served at the meeting (since some of you will have to skip lunch in order to participate in the meeting). Please indicate your interest by sending email to Ingrid Finkler (infi@mpi-sb.mpg.de), even if you cannot attend. Please indicate in your message whether you are going to attend.

If you are interested in the seminar for the summer term 2002, you should also show up, so that we can discuss the timing of the seminar (during the break between winter and summer term, in the term, after the term).

Fopra: In the winter and in the summer semester we offer FOPRAs

Geometry Software
Instructors: The ECG Group

Preparatory Meeting (Vorbesprechung): June 13th, 13:15, Room 024, MPI. Pizza will be served at the meeting (since some of you will have to skip lunch in order to participate in the meeting). Please indicate your interest by sending email to Ingrid Finkler (infi@mpi-sb.mpg.de).

Diplomarbeiten: There is plenty of opportunity to write either a theoretical or a practical thesis. Contact either Elmar Schömer or Kurt Mehlhorn.

Students can enter the project in many different ways, through one of the seminars, through the course, or through the software projects. We recommend to participate in the seminar or the course before entering the software project. If you want to get involved deeply, we recommend that you take the course and participate in one of the seminars (either one is fine) and in one of the FOPRAs.

The project is also offering positions for student assistants (payment is at the rate of 12.50 Euro per hour). Contact either Elmar Schömer or Kurt Mehlhorn.

References

[AS] Algorithmic solutions. `http://www.Algorithmic-Solutions.com/`.

[CGA] CGAL (Computational Geometry Algorithms Library). `www.cgal.org`.

[LED] LEDA (Library of Efficient Data Types and Algorithms). `www.mpi-sb.mpg.de/LEDA/leda.html`.

[SIL] Simulation library for virtual reality. `http://www.mpi-sb.mpg.de/~schoemer/silvia/silvia.html`.