



Course number:
14MSI40520AS
14MSI40521AS
Computational Geometry
Study Level: Master / Graduate

Prof. Dr. Georg Umlauf
Language of instruction: English
ECTS Credits: 5

Objectives:

For applications in computer-aided design (CAD), geographic information systems (GIS), or computer graphics various geometric properties and relations of the 3d objects in the data set (e.g. points, lines, triangles, etc.) need to be computed. These relations are for example what are two points that are closest to each other or which objects collide or intersect each other. Since the number of points or objects in the data set might be huge, the relevant algorithms need to be tuned with respect to runtime and memory consumption.

In this module techniques, algorithms, and data structures to solve geometric problems for computer graphics, CAD, GIS and robotics for industrial and technical applications are presented. In the accompanying lab-assignments examples and case studies for these techniques will be implemented by the students.

Contents:

CG-Lecture

- Convex hulls in 2d and 3d
- Line intersections
- Space partition data structures, point locations, range queries
- Polygon triangulation
- Voronoi and Delaunay techniques
- Geometry of linear programming
- 2d motion planning

CG-Lab

Programming assignments: Application examples and case studies, e.g. convex hulls, polygon triangulation, Voronoi diagrams, space partitions, etc.

Assessment:

Assessment of this course will be based on a final oral examination and the solutions of the lab-assignments.