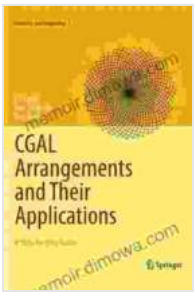
CGAL Arrangements and Their Applications: A Journey into Advanced Computational Geometry



CGAL Arrangements and Their Applications: A Step-by-Step Guide (Geometry and Computing Book 7) by Efi Fogel

★★★★★ 5 out of 5

Language	: English
File size	: 8261 KB
Screen Reader	: Supported
Print length	: 312 pages

Computational geometry is a branch of computer science that deals with the representation, analysis, and manipulation of geometric objects. It has applications in various fields, including graphics, robotics, manufacturing, and geographic information systems. One of the most fundamental concepts in computational geometry is the arrangement of lines, segments, and other geometric objects.

An arrangement is a decomposition of a plane into a set of polygons, each of which is the intersection of a set of objects. Arrangements can be used to represent a variety of geometric objects, such as polyhedra, Voronoi diagrams, and Delaunay triangulations. They can also be used to perform a variety of geometric operations, such as range searching and polygon triangulation.

The CGAL Library

CGAL is a C++ library that provides a comprehensive set of data structures and algorithms for computational geometry. It includes a wide range of classes for representing and manipulating geometric objects, such as points, lines, segments, and polygons. CGAL also includes a number of algorithms for performing geometric operations, such as computing intersections, computing convex hulls, and triangulating polygons.

The CGAL library is widely used in both academia and industry. It is used to develop a variety of applications, including graphics software, robotics software, and geographic information systems.

Arrangements in CGAL

CGAL provides a number of classes for representing and manipulating arrangements. The most important of these classes is the Arrangement_2 class. This class can be used to represent an arrangement of lines, segments, and rays in the plane.

The Arrangement_2 class provides a number of methods for performing geometric operations on arrangements. These methods include:

- Computing the intersection of two arrangements
- Computing the convex hull of an arrangement
- Triangulating an arrangement
- Performing range searching on an arrangement

Applications of CGAL Arrangements

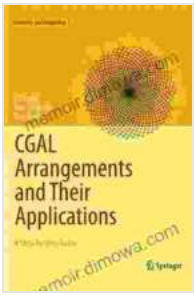
CGAL arrangements have a wide range of applications in both academia and industry. Some of the most common applications include:

- **Graphics**: Arrangements can be used to represent and manipulate a variety of geometric objects in graphics applications. For example, arrangements can be used to represent polyhedra, Voronoi diagrams, and Delaunay triangulations. These objects can then be used to create realistic and interactive 3D models.
- **Robotics**: Arrangements can be used to represent and manipulate the environment in robotics applications. For example, arrangements can be used to represent obstacles, such as walls and furniture. These obstacles can then be used to plan paths for robots to navigate.
- **Manufacturing**: Arrangements can be used to represent and manipulate the geometry of objects in manufacturing applications. For example, arrangements can be used to represent the geometry of a part that is being manufactured. This geometry can then be used to generate tool paths for CNC machines.
- **Geographic information systems**: Arrangements can be used to represent and manipulate the geometry of geographic features. For example, arrangements can be used to represent the boundaries of countries, states, and counties. These features can then be used to create maps and other visualizations.

CGAL arrangements are a powerful tool for representing and manipulating geometric objects. They have a wide range of applications in both academia and industry. As the field of computational geometry continues to grow, arrangements will likely continue to play an important role in many different applications.

References

- *Computational Geometry: Algorithms and Applications* by Mark de Berg, Marc van Kreveld, Mark Overmars, and Otfried Schwarzkopf
- *The CGAL User Manual*



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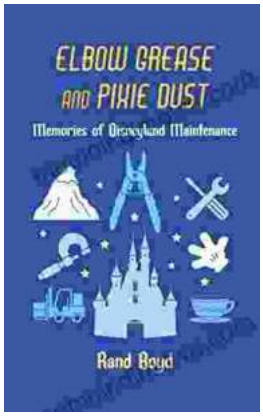

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