Planar Map and Arrangements in CGAL: Extensions and Improvements

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Abstract

Planar maps and arrangements are two types of *planar subdivisions*, namely subdivisions of the plane into vertices, edges and faces induced by a collection of curves. (We explain the difference between the types in our talk.) Planar maps and arrangements are ubiquitous in Computational Geometry and have a multitude of applications in various domains from GIS to mechanical assembly planning.

CGAL provides a family of data structures and algorithms to support the representation, manipulation and query of planar subdivisions. The package is in a constant process of evolvement, essential functionality is added, running times are improved, and new utilities are incorporated into the existing set.

In this presentation we focus on recent improvements and extensions. We start with a brief description of the basic functionality of our package. We then present the new generic planar sweep algorithm. Given a collection of curves, our planar sweep implementation can either produce the vertices of the induced arrangement, produce the collection of interior disjoint subcurves or it can build a planar map that represents the induced arrangement. The input curves are not confined to line segments but can be of any family of curves for which the user supplies a set of primitives via the so-called traits class. The traits classes delivered with the planar map and arrangement package model the set of requirements of the plane sweep algorithm. Hence, one can sweep sets of polylines, sets of line segments, as well as sets of circular arcs.

We continue the talk with presenting a new traits class for the simultaneous handling of line segments and circular arcs. It is possible to maintain arrangements of such curves, which frequently arise in applications such as robot motion planning. It is also possible to sweep a set of such curves to produce one of the desired results mentioned above. This traits class is a step in the way towards a traits class for conic arcs. The latter is currently in the last stages of development.

We go on to briefly discuss various interface enhancements to our package. For example, we added new faster curve-insertion functions and new query functions, that led to considerable speedups in constructing subdivisions as well as to a richer and more flexible functionality of our package.

We conclude with mentioning work in progress and possible future development[1].

[1] visit the home page of our group for more details (*http://www.cs.tau.ac.il/CGAL*).