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COMPUTATIONAL GEOMETRY COLUMN 28

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ABSTRACT
The Web directory of Computational Geometry Software is described.

Keywords: software.

As the field of Computational Geometry matures, more resources are available to researchers and practioners. A previous column[2] introduced the Computational Geometry Bibliography, now containing over 7,000 entries. Here I describe the World Wide Web directory of Computational Geometry Software, maintained by Nina Amenta at the Minnesota Geometry Center. Its URL (Web address) is `http://www.geom.umn.edu/software/cglist/`. There is no substitute for looking at this site. I only will give a taste of what is accessible from it, as well as suggesting areas for future contributions.

Polygons

One can download code via ftp links to triangulate a simple polygon. In this case, and in several others, a choice of algorithms is available, including Seidel's randomized triangulation algorithm. Also available is code for trapezoidation of a polygon (expected linear-time), triangulating a polygon with holes, determining if a point is in a polygon (here linking to *Graphics Gems*[1] code), checking a polygon for convexity, computing the area of a polygon, computing the visibility graph of a polygon, generating a mesh with no small angles, and intersecting two polygons. One lacuna in the offerings here is robust computation of arbitrary Boolean operations on polygons.

2D Points

For a set of points in the two-dimensional Euclidean plane, one can obtain software for computing a minimum spanning tree, a travelling salesperson path either via heuristics or an optimal tour through an exact computation (these from *XYZ-Geobench*[3]), computing the Voronoi diagram and Delaunay triangulation of the points, the furthest-point Voronoi diagram, nearest neighbors, the centerpoint, and at least ten programs for computing the convex hull in 2D. Especially notable is Shewchuk's robust implementation of Ruppert's constrained Delaunay triangulation algorithm. Missing from the collection: the Voronoi diagram of segments and dynamic convex hull maintenance.

3D and Higher Dimensions

Again there are several alternatives for computing the Voronoi diagram, the Delaunay triangulation, and the convex hull in 3D. At least six programs compute arbitrary-dimensional convex hulls, including the Geometry Center's own `Qhull`. Several produce output compatible with the Center's sophisticated `Geomview` software. Randomized incremental algorithms for low-dimensional linear programming and finding the smallest enclosing ball are available. Other links reach Edelsbrunner's "alpha shape" code, code for reconstructing 3D models from parallel 2D slices, and a library for detecting collisions among moving convex polyhedra. Holes in the offerings include code for decomposing polyhedra, and for constructing arrangements.

Links to Other Sites

Not least of all, links are provided to other related Web sites, on mesh generation, on linear programming, and to several useful FAQ's. These latter are compendiums of answers to Usenet newsgroup "Frequently Asked Questions," including that for comp.graphics.algorithms, the closest match to computational geometry interests. As always on the Web, these FAQ's themselves link to many other useful documents and sites.

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[1] P. Heckbert, Ed. *Graphics Gems IV*. Academic Press, Boston, MA, 1994.

[2] J. O'Rourke. Computational Geometry Column 19. *Internat. J. Comput. Geom. Appl.* **3** (1993) 221–224. Also in *SIGACT News* **24**:2 (1993) 15–17.

[3] P. Schorn, Evolution of a software system: Interaction, Interfaces and Applications in the XYZ GeoBench, *J. Symbolic Comput.* **17** (1994) 311–320.

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