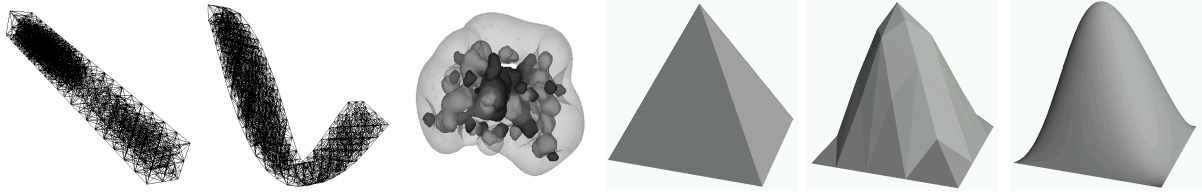


## Math 199A/299A (Supervised Reading), 1997 Fall Quarter

### Course Topic: Computational Geometry and Visualization using OpenGL and Inventor



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Texts: *Computational Geometry*, Preparata and Shamos.

*The Inventor Mentor*, by Wernecke.

*OpenGL Programming Guide*, by the ARB.

This section of Math 199A/299A is a supervised reading course in which the student will explore some problems in computational geometry and visualization. A key component of the work will involve learning how to use the latest SGI graphics hardware and software tools for visualizing surfaces and volumes. In particular, we will have unlimited access to a heavily configured SGI Octane, and we will try to develop and use some visualization tools employing Inventor and OpenGL. Some particularly interesting topics that could be explored in the course are:

- Provably good or optimal representations of simplex mesh topologies
- Representing manifolds with simplices and local coordinate systems
- Computing manifold curvature and other measures from simplex approximations
- Effective practical data structures for the above representations
- Algorithms for traversing the data structures in provably good ways
- Algorithms for generating provably good simplex meshes
- Algorithms for refining simplex meshes in provably good ways
- Efficient manipulation of scalar and vector fields defined over simplex meshes
- Effective visualization techniques for simplex meshes
- Effective visualization techniques for scalar/vector fields on simplex meshes
- Object-oriented software tools (in C or C++) for exploring all of the above

The prerequisites for this course are calculus, linear algebra, and some experience with C or C++. A previous course in computer graphics and background in differential geometry would also be useful, but neither is required. Programming experience with the X-toolkit and the Athena Widget set, and with the OpenGL API, would be helpful, but again not required. Experience with Inventor on SGI platforms could also be helpful.

This reading course could be continued into the Winter and Spring quarters, and perhaps beyond. Unfortunately, there is only enough computer graphics equipment to support a maximum of three students in this reading course.