Constrained delaunay tetrahedralization

Pranav Kant Gaur

January 21, 2014

Abstract

This document describes work of the author to develop and integrate module for ***Constrained Delaunay tetrahedralization*** into an *inhouse* developed data visualization framework **AnuVi**.

1 Problem definition

The problem can be decomposed into:

1. Understanding Constrained Delauney tetrahedralization problem
2. Studying other solutions
3. Selecting and implementing the solution most suited to the ***real*** problem at hand

2 Analysing subparts of the problem

In this section, individual components of the problem will be analysed in detail.

2.1 Constrained Delaunay tetrahedralization

Input:

1. Set of points, $P \in R^3$ over *euclidean* space
2. Set of segments, $S = \{(p_1, p_2) | p_1, p_2 \in P\}$ called *constraint segments*

Problem:
Compute connectivity over points in P called *volume mesh* say M, such that any tetrahedron T in M satisfies *empty sphere* criterion and M must *preserve* constraint segments.

2.1.1 Empty sphere criterion

It simply states that for any tetrahedron T in CDT, there must not be any vertex lying *inside* the circumsphere of T. If there are more than 4 vertices sharing a circumsphere then CDT for those set of points and constraint segments will not be *unique*.

2.2 Studying proposed solution(s)

In this work, author will implement and analyze CDT method described in paper '*Meshing Piecewise Linear Complexes by Constrained Delaunay Tetrahedralizations*' by Hang Si and Klaus Gärtner.