Meshes and Computational Geometry
Master 2 Informatique ID3D – Université Lyon 1- Ecole Centrale de Lyon

TP3 – Split triangles into 3, Flip edges, Elementary geometric predicates

For implementation work, the triangular mesh data structure will be used to store triangulations of the surface of an object (3D points) as well as triangulations of points in 2D (z=0). The aim of this session is to add two elementary operations to your triangular mesh data-structure.

Triangle split

Complete your `mesh` and/or `face` classes with an operation that splits a triangle `face` into 3 by insertion of a new vertex that is located at the position provided in parameter of the member function. Ensure that the integrity of the data structure is well preserved.

Edge flip

Complete your `mesh` classes with an operation that flips the edge shared by two neighboring triangular faces. Once again, you should ensure that the integrity of the data structure is well preserved.

Orientation test

Given three 2D points (z=0), write the geometric predicate returning a positive value if these 3 points are oriented counter-clockwise, negative if they are oriented clockwise or 0 if they are aligned for the arithmetic used to encode the coordinates.

In triangle test

Given a 2D triangle, write the geometric predicate returning a positive value if an input point is located inside a triangle, negative if it is located outside or 0 if it is located on the boundary.

Naive insertion of a point in a 2D triangulation

Complete your `mesh` class to provide a member function that inserts a point in a 2D triangulation, with no care of triangles quality. For insertion outside the convex hull, infinite edge flip operations can be used, or a bounding box can be used.