Appendix I

Data Structure

In this thesis, the data structure is based on the combination of the half-edge and hierarchical ring data structure. Figure A1 shows the representation of the data structure. There are four main types of data classes: Vertex, Face, Half Edge and Loop double linked-lists. The half-edge data structure enables each vertex to reach its neighboring vertices within the same triangle while the hierarchical ring data structure help each vertex to identify every triangle that is related to it in an orientation manner. The hierarchical ring and half-edge data structures are shown in Figure A2 and A3 respectively.

Basing on the data structure shown in Figure A2, each vertex can access to its triangles by the class Loop (orange rectangle). Each class Loop will refer to an HalfEdge class, which, in turn, points to a Face class. However, to ensure the linear time access, the Loop linked-list should be sorted in its triangle connection order (either clockwise or counter-clockwise). In this way, the vertex can access to its triangles within $O(h)$ time where $h$ is the vertex degree.

At the same time, the half-edge data structure enables each vertex to access to its neighboring vertices within triangle in constant time through the HalfEdge class. Solid green line in Figure A3 shows this vertex-to-vertex connection within each triangle. Both of these data structure helps each vertex to be able to access to all of its surrounding vertices in linear time.
Figure A1 – Data structure of the triangular mesh.
Figure A2 – Hierarchical ring data structure.

Figure A3 – Half-edge data structure.