

Practical Assignment 1

(Mesh and Surface Analysis and Surface Smoothing)

Task 1 (Mesh Analysis).

Create a tool for mesh analysis that computes

- the shape regularity of all triangles,
- the valence of all vertices,
- the three angles of all triangles, and
- the length of all edges.

The tool should display statistics for each of the quantities including the minimum value, the maximum value, the mean value, and the standard deviation. In addition, the tool should allow to visualize the distribution of shape regularities of the triangles over the mesh by coloring the triangles.

Task 2 (Surface Analysis).

Create a tool for surface analysis that computes

- the genus of the surface,
- the area of the surface, and
- the absolute value of the mean curvature (length of the mean curvature vector) for every vertex.

For the absolute value of the mean curvature, the tools should display statistics (including the minimum value, the maximum value, the mean value, and the standard deviation). In addition, the tool should visualize the distribution of the absolute mean curvature over surface by coloring the vertices.

Task 3 (Surface Smoothing).

Create a tool for surface smoothing that offers the *iterative averaging* and the explicit integration of the *mean curvature flow*, which were discussed in the lecture. The tool should allow to specify the stepwidth τ .

Task 4 (User Manual and Summary of Experiences).

Write one short user manual for all three tools. Apply your tools to analyze and smooth 3D meshes and write a short summary of your experiences (2-3 pages). Both, the manual and the summary, should contain images as illustrations.