METU **Department of Computer Engineering** **Fall/Spring**

CENG 789—Digital Geometry Processing

TERM PROJECT
Instructor: Y. Sahillioğlu

Suggestions:

- Morphing: Linearly interpolate edge lengths and dihedral angles. Compute the vertex positions.
- Parameterization: Map a 3D surface to 2D or sphere; see the Parameterization lecture slides.
- Remeshing: parameterization-based or surface-based; see the Remeshing lecture slides.
- Deformation: Least-squares or physically-based; see the Deformation lecture slides.
- Symmetry Axis Extraction: Compute the curve on mesh whose points are all nearly equal geodesic distance from both v and $r(v)$ for all vertices v. Here, $r(v)$ is the reflective symmetric point of v.
- Skeleton Extraction: Apply consecutive edge collapses in order to thin the surface into a skeleton.
- Modeling by Connectivity: Make every edge length as close as possible to each other while keeping the surface locally smooth. This is cool because you will be discovering the natural shapes hidden in the connectivities of polygon models. Possible solutions are remeshing and energy minimization.
- Surface Reconstruction: Produce meshes from 3D point clouds using implicit and explicit methods.
- 3D Art Gallery Problem: Compute the visibility guarding of 3D solid shapes using a few guards.

Some papers associated with the items above: As-Rigid-As-Possible Surface Morphing, Multi-Resolution Mean Shift Clustering Algorithm for Shape Interpolation, An Intrinsic Solution to the Vertex Path Problem, Spanning Tree Seams for Reducing Parameterization Distortion of Triangulated Surfaces, Mesh Parameterization with a Virtual Boundary, Merging polyhedral shapes with scattered features, Remeshing With a Fast Spherical Parameterization Method, Interactive Geometry Remeshing, Isotropic Surface Remeshing without Large and Small Angles, Least-squares Meshes, Meshless Deformations Based on Shape Matching, Finding Surface Correspondences Using Symmetry Axis Curves, Skeleton Extraction by Mesh Contraction, Connectivity Shapes, Computing 3D Shape Guarding and Star Decomposition.

Your Own Topic (upon approval):

Some keywords for inspiration: cage, correspondence, CSG, descriptors, fabrication, FFD, PCA, repairing, retrieval, segmentation, simplification, subdivision, surfacing, tetrahedralization. See the course website for thumbnail images and brief descriptions for these keywords.

Submission Your project constitutes 40% of your final grade. Arrange a demo day with me at ys@ceng.metu.edu.tr and prepare a well-structured project report where you mention your solution, results, encountered problems, and interesting observations.