

ME 535 Computer-Aided Geometric Design

Course Project

November 11, 2018

1 Project goals

The goal of this course project is for students to develop mathematical and computational skills for constructing and interrogating freeform geometric models. More specifically, students are expected to construct freeform shapes via tensor-product Bézier patches, B-spline patches, NURBS patches, and/or triangular patches, and to tessellate the patches into triangles for 3D printing usage. Subdivision surfaces are also appropriate.

2 Project requirements

The final project deliverables should include

- *Presentation on December 12 class.*

The presentation should summarize the design, its intended use and functions, the types and number of patches used, the continuity between the patches, and the tessellation process.

- *3D printed prototype*

A physical prototype is due December 12 class.

- *Source code*

A source code should be given so the resulting design and shapes can be reproduced.

- *STL file for the design*

An ASCII version of STL file for the final design needs to be submitted.

- *Project report*

The report should detail the technical aspects of the shape modeling, such as types and number of patches and continuity as well as the process of reaching the final design.

You can form a team of 1 ~ 2 person(s). The expectation for a two-person team is higher than that for a single person team.

3 Time line

- Surface patches: November 30 (recommended)
- STL file: email to the instructor qian@engr.wisc.edu by December 5 if you do not have the means to print the part yourself.
- Final presentation and report: December 12.

4 References

- STL file format <http://people.sc.fsu.edu/~jburkardt/data/stla/stla.html>
[http://en.wikipedia.org/wiki/STL_\(file_format\)](http://en.wikipedia.org/wiki/STL_(file_format))
- Free STL viewer
MiniMagics: <http://software.materialise.com/minimagics-stl-viewer>
SolidView/Lite: <http://www.solidview.com/Products/SolidViewLite>
- Check the quality of STL files
Meshlab: <http://meshlab.sourceforge.net/>
Netfab: <https://www.netfabb.com/>
Rhino3D: software available in CoE Computer Labs.

5 Alternative project topics

If you are interested in pursuing other project topics, please talk with the instructor. Potential alternative topics include

- Develop code for computing reflection lines for NURBS surfaces. This code should be able to examine the surface continuity, e.g. teapot or other freeform surfaces.
- Develop code for NURBS based or triangular patch based mesh generation.
- Develop custom surface fitting routines.
- Develop prototype software for freeform surface based shape optimization.