

# Final Project

Handout date: 11/04/2020

Proposal submission deadline: 11/16/2020, 23:59 EST

Project submission deadline: 12/01/2020, 23:59 EST

Demo date: 12/02/2020 03:35 - 04:50 PM

This final project accounts for 55% of your final grade.

## Goal of this exercise

This is the final project of the class. From the given list of papers, you are free to decide which paper you want to work on. By this point, you should be able to read the paper, understand the concepts and the algorithm described in the paper, and implement the algorithm successfully using C++.

## Submission

1. Follow the link (to be sent by email) to create your repository;
2. Implement the following tasks based on the framework developed in Assignment 2;
3. Add a report document in pdf, ppt, or markdown format as a report of what you did and difficulties you met for the project;
4. Push the code into the repository before deadline.

## 1 Mandatory Tasks

### 1.1 Proposal

This task worth 10 points towards your final grade.

You have to read through the given list of papers at least twice and prepare an 1-page proposal document, detailing the input, the output and the specific steps of the algorithm of the paper you choose to work on. This document should be in .pdf format and uploaded to the git repository of your final project by 11/16/2020, 23:59 EST.

## 1.2 Implementation

This task worth 35 points towards your final grade.

The grade of this task will be given depending on the correctness and completeness of the algorithm part of the project (wrt the project proposal).

### 1.2.1 Shape Analysis

#### Mandatory tasks

- Input: 3D triangle mesh (e.g. Bunny), the desired number of patches  $k$ , and metric (support both of the two metrics  $L^2$  and  $L^{2,1}$ )
- Reproduce exactly the partitioning (left and middle) of Figure 3 (25 points)
- Without restarting the program to support the change of arbitrary number of  $k$  (5 points)
- One-key click to export the coloring of the original triangle mesh to files in obj format, which means that the clustering result can be directly viewed in [MeshLab](#) (5 points)

#### Optional tasks

- Farthest point seeding in Section 3.5 (5 points)
- Polygonal Meshing in Section 4, the result should be exactly as Figure 3, right (10 points)

### 1.2.2 Simulation

#### Mandatory tasks

- Reproduce exactly the cloth moving as shown in Figure 4 (25 points)
- Interactive adding external forces (e.g. through mouse click and dragging) (5 points)
- One-key click to export the simulation sequence to files in obj format, which means that the simulation result can be directly viewed in [MeshLab](#) (5 points)

#### Optional tasks

- Damping in Section 3.5 (5 points)
- Collision Detection in Section 3.5 and Figure 8 (10 points)

### 1.2.3 Simplification

#### Mandatory tasks

- Implement the Algorithm in Section 5 and producing exactly as the result shown in Figures 9 and 10. (25 points)
- Without restarting the program to support the change of arbitrary number of target triangle element  $k$  as long as  $k$  is smaller than the input (5 points)
- One-key click to export the simplification result to files in obj format, which means that the simplification result can be directly viewed in [MeshLab](#) (5 points)

#### Optional tasks

- Preserving boundaries in Section 6 (5 points)
- Inversion-free in Section 6 (5 points)

### 1.2.4 Parameterization

- Implement the ARAP energy and producing exactly as the result shown in Figures 8, right. (25 points)
- Render both the 3D model and the 2D planar shape in the same Scene (5 points)
- One-key click to export the parameterization result to files in obj format, which means that the mapping result can be directly viewed in [MeshLab](#) (5 points)

#### Optional tasks

- ASAP energy in Section 4.2 (5 points)
- LSCM in Section 4.5 (10 points)

**Remark.** Normally, there is no need to use other libraries than the ones you already employed for assignment 2. If you believe that some library you have to use in order to finish this task, please obtain the approval of the instructor before the usage, otherwise, zero points will be given for this task.

### 1.3 Final Report and Presentation

This task worth 10 points towards your final grade.

**Note that, you must have the final report and perform the presentation to get your final grade for this computer graphics course, which means that you may fail the class without this task been done.**