CAS 737 Computer Animation Winter 2024
Assignment 4

Physics Simulation - Cloth

In this assignment, we will implement cloth simulation as a particle system connected with springs.

Code

To simplify the problem, cloth simulation here is in 2D xy-space. The following python files are provided for you to have an easy start:

- ui.py: user interface with cloth visualization implemented. Users can use mouse control to drag the closest point on cloth.
- cloth.py: defines cloth, which is a grid of particle points connected with springs.
- spring.py: each spring connects two particle points on cloth
- particle.py: defines each grid point on cloth, including information of position, velocity, acceleration, force etc.

Tasks

You can run ui.py, which gives you a static cloth. To simulate its motion, there are five TODOs in the code. Your task is to fill in the implementation for the five TODOs.

- TODO 1: for each particle point, there is a fake gravity force pulling the cloth downward. Try using a very small number in y-direction to generate flowy effect, e.g. 0.00005. You can also tune the value that works on your machine.

- TODO 2: for each spring on the cloth, compute its force by calling spring's apply_force function.

- TODO 3: for each particle point, call its update function to update its status (position, velocity, acceleration etc.) based on the computed forces applied to it.

- TODO 4: compute spring force. Apply Hooke's law and damping force, and tune the coefficients accordingly on your machine (e.g. k=0.8, c=0.02). If the simulation becomes unstable, try capping the forces to a range.

- TODO 5: update particle status. Based on total forces applied on the particle, use Newton's second law to compute its acceleration. Use the Euler Method to update the particle's velocity and position. If the simulation becomes unstable, try capping position

to a range. To stabilize the simulation, try fixing deltaTime=1, or you can tune a value that works for your machine.

The general framework of the cloth simulation code is provided. You are responsible to tune the parameters or hack to make the simulation stable and plausible.

Submission

Submit the following files through Avenue:

- Source python code “cloth.py”, “spring.py” and “particle.py”.
- Three captured screen videos, two good simulation results with different effects, and one bad simulation result. Each video should be about 60s-long. Name the three videos as “good1.mov”, “good2.mov”, “bad1.mov”. Other commonly used video formats are also allowed.
- Report the configurations of the three simulated results.

Deadline: April 5, 2024