OpenGL Cloth Simulation using Mass-Spring Model

Project Specifications

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April 30, 2017

1 Background

Cloth simulation has been an interesting subject in computer graphics for quite a long time [1, 2]. Many different approaches have been proposed but no model has really proven itself to be strictly prevailing. With the aim of achieving realistic looking virtual environments and characters, a good cloth simulation is very important, though visual fidelity, as usual, comes to the cost of computational complexity.

2 Problem

Implement from the ground up a cloth simulation. The user should be able to move a first-person-view camera around the simulation in real-time. The simulation should demonstrate the evolution in time of the cloth model and its interaction with another solid object.

3 Implementation

The mass-spring model will be employed given its long history in the field and the good amount of documentation available. The whole project will be developed in `C++` with the use of the `OpenGL API` as underlying graphics library. Moreover, the `SDL2` library will be used to handle user interaction and operating system window management. The choice of the previously mentioned low level technologies instead of a more complete graphics SDK is due to the personal interest in learning the fundaments of the `OpenGL` library and its shader pipeline.

4 Perceptual Evaluation

When dealing with real-time physics simulations, model parameters can play a big role in computational performance. A possible perceptual study could imply the parametrization of the cloth simulation model and testing the user response to the different possible values. This can be useful to evaluate the threshold from realistic to non-realistic models and to find the right trade-off between visual quality and computational complexity.

5 Roadmap

The starting point will be on achieving a functioning `OpenGL` running environment capable of correctly displaying geometry and textures. On top of that, the basic cloth model and the possibility for the user to interacting with the view-port camera will be implemented. The third step will imply developing the interaction between the cloth and other geometry in the scene. Optionally, techniques to avoid the self-penetration of the cloth object will be considered.

References

[1] Lander J. (1999). *Devil in the blue-faceted dress: Real-time cloth animation.* Game Developer Magazine, 21.

[2] Baraff D., Witkin A. (1998). *Large steps in cloth simulation.* In Proceedings of the 25th annual conference on Computer graphics and interactive techniques (pp. 43-54). ACM.