These course notes are an excellent introduction to writing a physically based simulator:


We talked about how to simulate particles and how to extend a particle simulation into a spring/mass cloth simulation. The integrator you choose can determine cloth behavior, and we talked about a variety of integrators to compare, including Euler, RK4, and various semi-implicit techniques. It is possible to develop a fully implicit integrator for cloth, and that is the subject of this paper:


This paper has a good practical discussion about different integrators and discusses the design decisions behind Maya nCloth, nParticle, etc.


You can find a clear writeup about the spring mass system’s behavior and a reminder for how to solve those differential equations here. Reading this paper may help you to set damping parameters in a correct proportion to how you set stiffnesses.


We talked about techniques for resolving contact and collisions. I mentioned a paper on how to do penalty method forces “right.” This is the paper:

We talked about this paper, which talks about particle simulation with constraints and Verlet integration in the context of simulating rag doll characters for the game Hitman.


I also showed some videos from a constraint based cloth simulation system written by a CMU MS student. The writeup can be found here: http://www.cs.cmu.edu/~ytoh/stickyfingers.pdf

Videos can be seen here: http://www.kentoh.com/publications/

Check out the following paper for an overview of point based methods in general for simulation.


Some Simulation References

Fortunately, there are many good simulation engines out there. You do not have to write your own! Here are some references to get you started.

Open Dynamics Engine http://www.ode.org/

Bullet Physics Library http://bulletphysics.org/wordpress/

Also check out this SIGGRAPH 2011 course: http://bulletphysics.org/siggraph2011/

Karen Liu’s RTQL8 http://www.cc.gatech.edu/~karenliu/RTQL8.html

Karen Liu’s DART http://dartsim.github.io/

Emanuel Todorov’s MuJoCo has apparently not yet been released? http://www.mujoco.org/

Box2D http://box2d.org/

Gazebo http://gazebosim.org/