Report - Cloth simulation

Design

This cloth simulation consists on a mesh, simulating the movement and physics of a piece of cloth. **Use advice:** If the program doesn't simulate properly the cloth, you can try to execute it again, no reset. Close the window and execute it again.

He have tried so hard to correct it, but we can't. We think that the problem is caused by the DeltaTime, is the only variable external from the program. The DeltaTime depends on the computer's time.

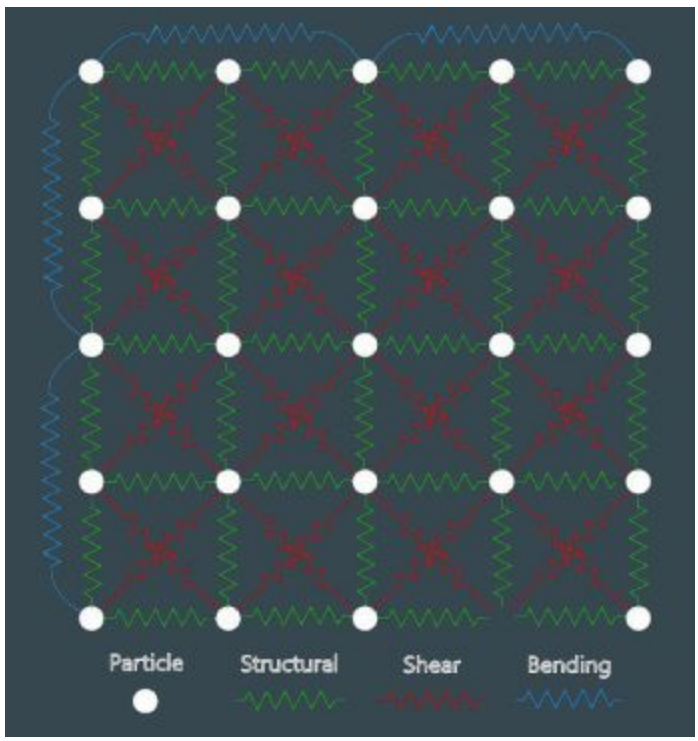
The mesh

The mesh has a measure of 14 x 18 vertex, connecting each to the next one. This mesh is affected by forces, which make their movement looks like a piece of cloth. This forces simulates springs, in different ways:

- Structural or stretch springs: This forces are applied to the next vertex, dividing the cloth intro 4 vertex squares.

- Shear springs: The shear are applied to the next diagonal vertex, crossing the rectangle created by the stretch springs.

- Bending springs: The forces that affects the second vertex in each way.



In order to simulate a cloth we need to calculate the force between each particle composing the mesh creating a spring-like force. We computed those forces for each particle, first, by checking if the contiguous particles (stretch, shear and bending) existed and then adding their effect on the total force of the particle. At the end of that check we added the gravity force in order to create a realistic cloth. All those forces are stored in an own array in order to calculate its movement using a Verlet solver.

So, the simulator first calculates the position and velocity of each particle with the Verlet solver, then the force for each particle is computed (at the first iteration the only force added is the gravity force), and finally, a correction of the position is done in order to simulate the max elongation between particles. Each computing is done in its own “for” iterator because the particles depend on other particles values.

Also we have to say that the mesh have collisions against each wall of the simulation box, and also collision response to the sphere that is created inside this box.

GUI

We will have a window form which we can modify some parameters. We can change the values of the constants that affects to all forces: stretch, shear, bending and also we can change the maximum elongation of each edge.

With the elongation we define a maximum distance of each edge, so the cloth have no extreme deformation and looks like a real piece of cloth.

The user can also reset the simulation whenever he wants. If it’s not the case, the simulation will reset automatically each 20 seconds, re-simulating the cloth mesh and moving and scaling the sphere at random values (Always inside the simulation box).

We have also a button to ignore the sphere collision.