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Simulation of Fabric Wetting Based on Particle Sampling.

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SUMMARY

- A fast sampling method for fabric boundaries is proposed
- The forces of the sampled particles and fluid particles were calculated
- Update the positions and velocities of fluid particles and cloth particles

INTRODUCTION

For numerous fabric movement phenomena, many scholars have designed different physical models and parameters to fit in physical simulations[1]. There have been varying degrees of progress from ordinary single-layer pure cotton fabrics to down inflatable materials, sweaters, and more. There are also better methods for handling collisions between fabrics, rigid bodies, and fluids[2]. However, there are still many issues worth exploring regarding the interaction between fabric and different objects.

APPROACH

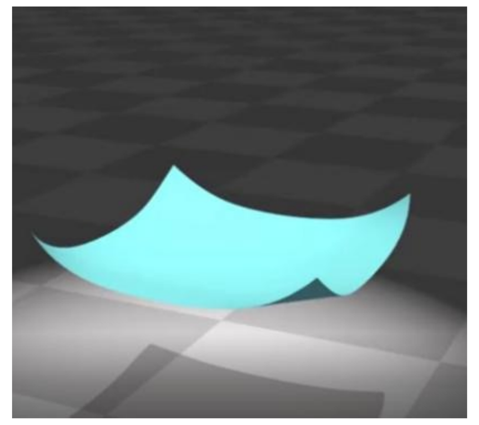
In the collision detection of cloth and fluid, most people use the CCD method to update the positions of fluid particles and cloth triangles based on the collision time. The problem with this method is that the collision time calculation error is relatively large, and it also requires judgment of collisions between points, surfaces, and edges, which increases the computational workload. Therefore, the boundary sampling method is used to achieve bidirectional coupling between the fluid and the cloth. The boundary particle sampling method used in this article is an improvement on thereference method[9].

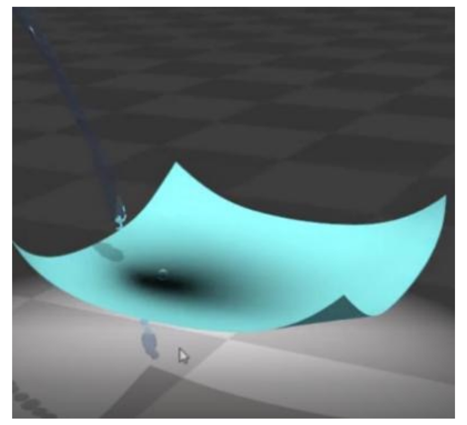
METHODS

Most fabric wetting uses the triangular surface of the fabric as the basic water absorption unit. Although this can simplify the wetting model, it is very unstable when the collision unit is more complex. In this article, the sampled particles are used as the basic water absorption unit. The wetting of the fabric is simulated in three steps: water absorption, diffusion, and drainage. Firstly, it is water absorption simulation. When a fluid collides with a porous solid, we need to calculate whether the porous particles at the current collision position can continue to absorb water. If the saturation of porous particle i at this position satisfies the condition $S_i<S_{max}$.

RESULTS

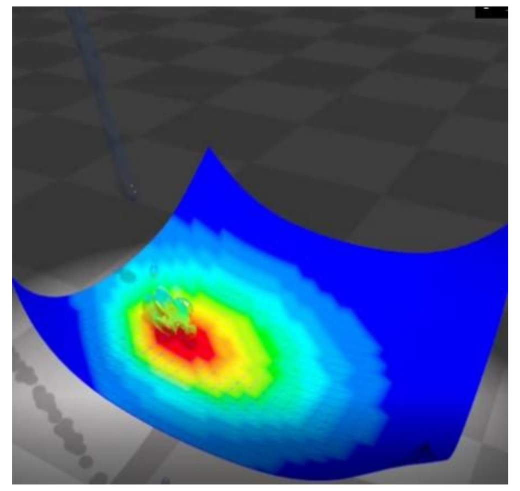
Figure 4 shows a partially saturated rectangular cloth that is kept horizontal, constrained in all its corners, and then relaxed. The fluid is transported to the center of the fabric through a diffusion process, where it begins to drip, and (a) to (b) show the wetting process. Figures 5, (a) and (b) show the drainage under the action of gravity. (b) Display our cloth particle model.

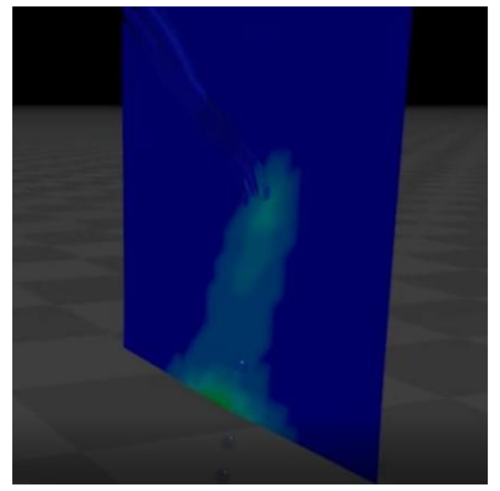




ANALYSIS

To validate our diffusion experiment, we tested the horizontal (a) and vertical (b), respectively. The darker the color, the greater the saturation. See Figure 6.





DISCUSSION

To make the animation more realistic, GPU parallel computing is used to accelerate the simulation. The experimental results indicate that our model can effectively simulate the process of fabric absorption and drainage.

CONCLUSIONS

We propose a new porous wetting model for simulating fabric wetting. Firstly, during the preprocessing process, analyze and sample the edges and interior of the fabric triangle; Then calculate the force acting on the fluid particles and the sampled particles, and apply the force acting on the sampled particles to each particle of the fabric triangle; Finally, use a three-step simulation method to simulate the wettingeffect.

ACKNOWLEDGMENTS

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