Cloth Simulator

Final Project

CS 155
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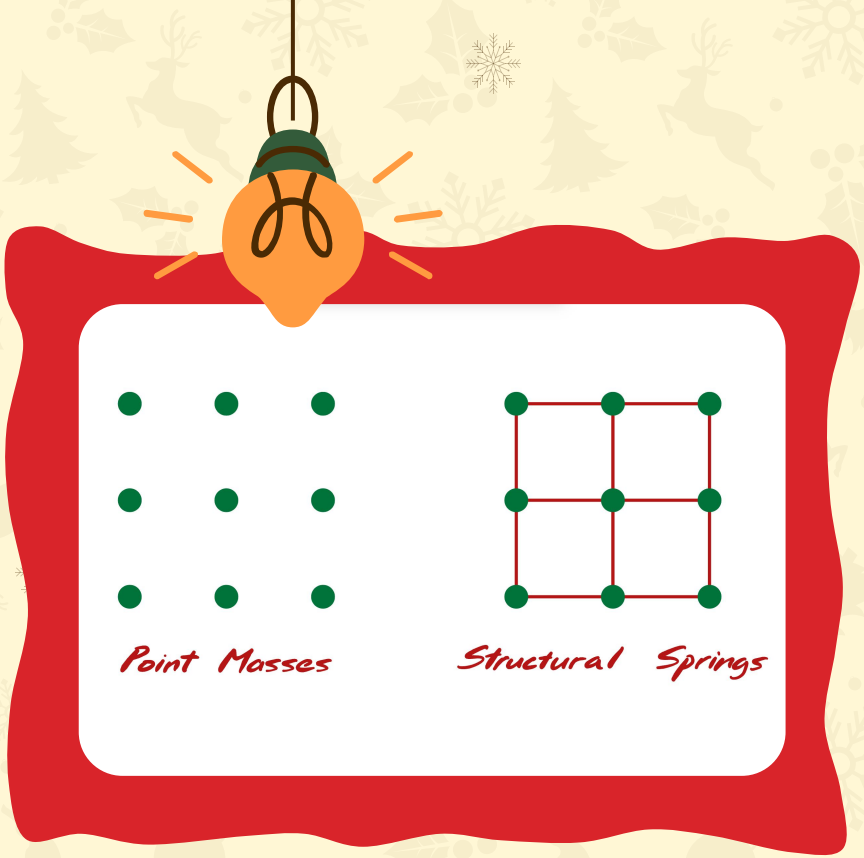
and Kishore Rajesh

Physics



Mass-Spring Model:

- cloth behavior approximated $m \times n$ grid of point masses
- point masses connected by springs

Forces:

- Internal (spring) force
- Viscous damping
- Gravity
- Wind

Cloth Simulator [code flow]

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December 4th, 2023 * Computer Graphics * Professor Slocum

simulation.py:

```
import math
import numpy as np
```

Point

- Set of **x and y coordinate**
- Also has **x and y velocities** and **accelerations**
- Has a fake **"z-value"** for z-buffering

Link

- **Set of two points**
- **Becomes broken** when distance between points exceeds threshold

Patch

- **4 Links** (Top, Bottom, Left, Right)
- **Set of four points**
- **Becomes broken** when at least one link is broken
- **Front color**
- **Back color**
- Fake **"z-value"** which is the average of the z-value of the points

Cloth

- **Array of points** with **links between the points**
- Each **patch** is the square formed by the consequent grid of the links
- **Can "drag" a point** and the link/patch updates
- Can optionally **"rotate"** the grid in 3d space

main.py:

```
import pygame
import math
import random
import numpy as np
import matplotlib.pyplot as plt
```

```
from matplotlib.colors import
    rgb_to_hsv, hsv_to_rgb
import cv2

from simulation import Cloth
```

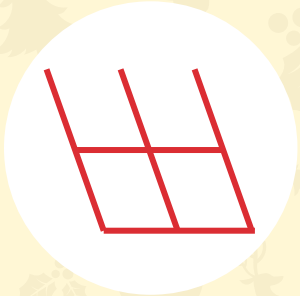
main() runs the game

colors the cloth and background

- iterates through the patches and **assigns a normal value to each patch**
- uses normal value to determine the color of each patch -> gives a **double-sided effect**
- the **background color changes** based on how many patches are flipped

Process

Initial state



Changed link color

Added patches

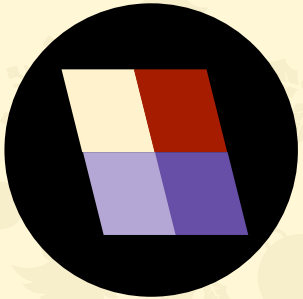
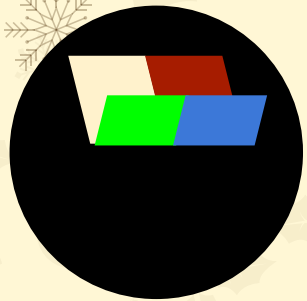
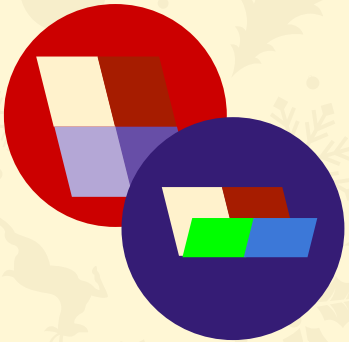


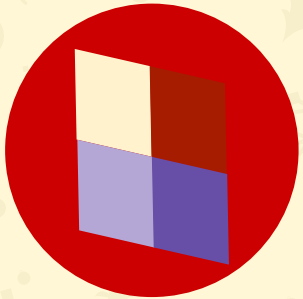
Image support + bkgd color



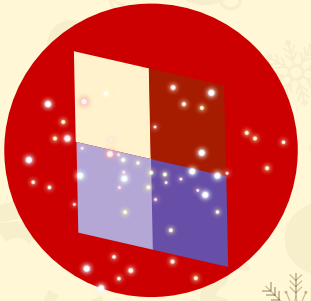
Double sided effect



Connected bkgd color to flipped amount

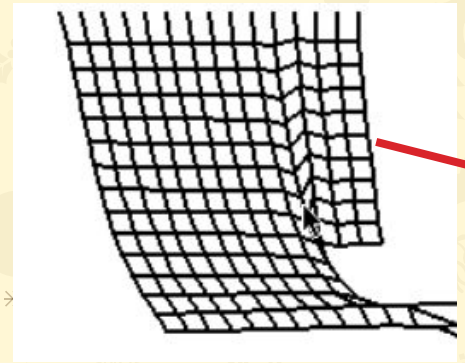


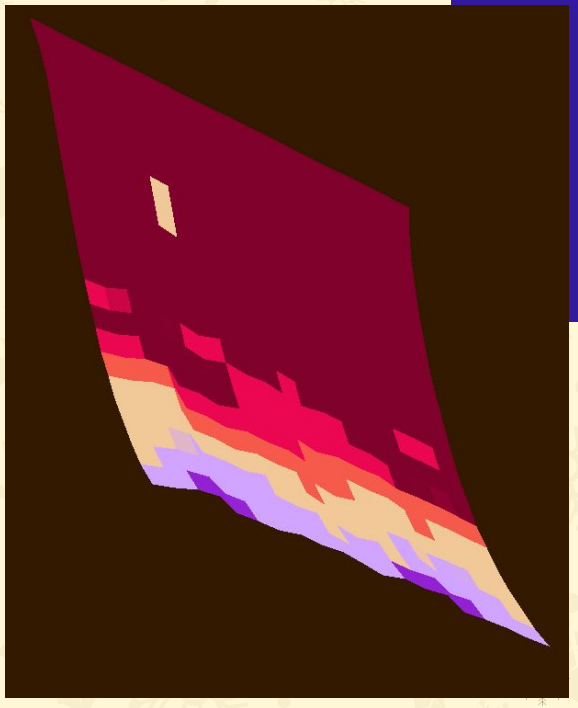
Added rotation

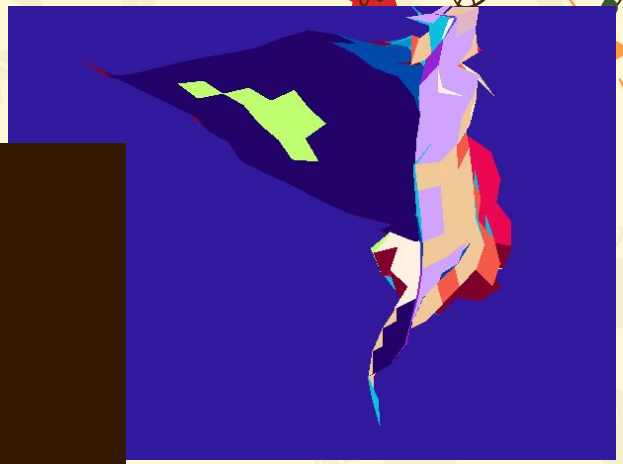


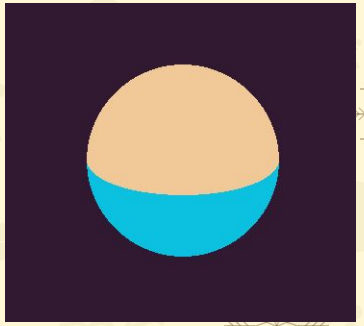
Added particle effects

Final Result:









Thanks!

References:

- PyCG 6: Cloth Simulation
- Cloth Simulation (Pygame)
- Github