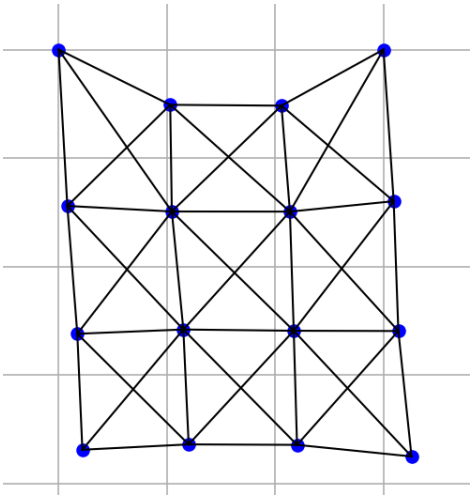
Lab 4- 2D Mass Spring Simulation



Setup:

Create a 2D grid of masses arranged in a rectangle (e.g., 10 rows x 15 columns).

Connect each mass to its immediate neighbors (vertical, horizontal, and diagonals).

Fix the top-left and top-right corner masses.

Apply gravity to all masses.

Simulation:

Use the relaxation method to compute net force on each mass.

Update each free mass's position by adding a small multiple of the net force.

Repeat until the maximum force is below a set tolerance.

Experimentation

Try the following scenarios:

A. **Default setup**: fixed corners, gravity only.

B. **Central load**: apply a downward external force on the center of the grid.

C. **Edge load**: apply downward force on one edge.

D. **Different fixed points**: fix top edge instead of corners.

Bonus 1 (+5 points): Add color to the springs to show stretching/compression visually.

Bonus 2 (+5 points): Simulate tear/breakage by removing overstretched springs.

Bonus 3 (+10 points): Add damping and animate the dynamic settling process with Euler.

Questions:

1. How does the structure deform under gravity alone?
2. How does the location of external load affect deformation?
3. What happens when more points are fixed?
4. How does increasing the spring constant affect the sag?
5. What real-world structures does this model resemble?

Submission:

Submit your assignment on Canvas. (compress them!)

report.pdf

- Plots of the final deformed grid for at least 2 scenarios
- Brief answers to questions above
- Reflections on modeling assumptions and physical realism

MassSpringSim2D.py