Midterm Report Auxetic Structures:

MAE 263F
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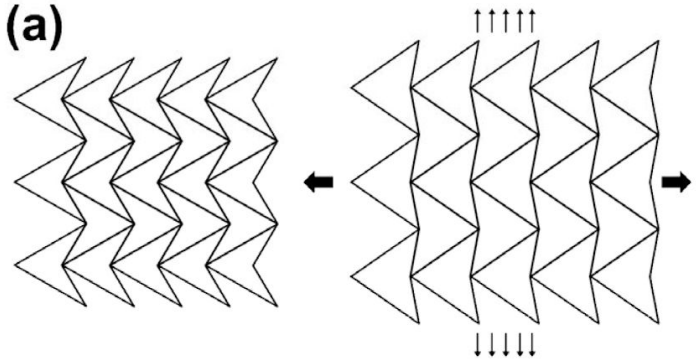
Steps and Current Status

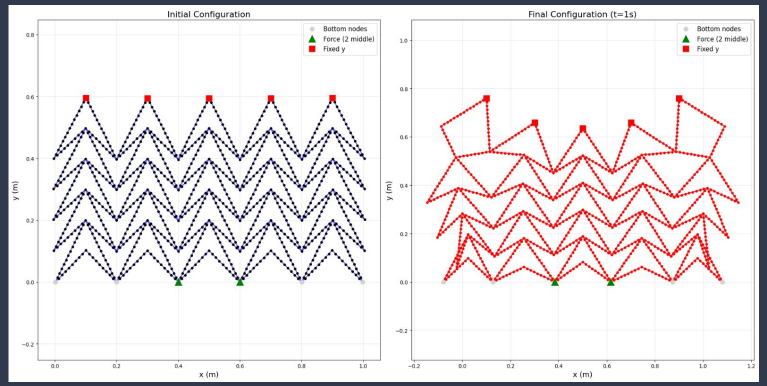
1. Shaping function for first shape in the lattice
    a. triangle (4 nodes)
2. Form nodes to along the edges
3. Function to duplicate shape into lattice
    a. For loop duplicate
    b. Replace overlapping
4. Apply Material properties of TPU
5. Apply compression/tension force in one axis
6. Measure height and width of the lattice
7. Measure the Poisson Ratio

Forces to consider:

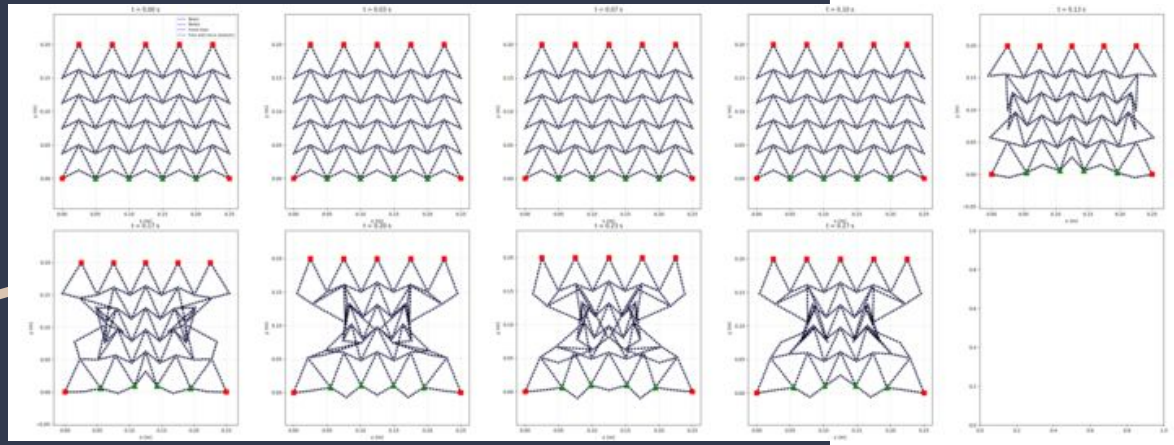
- Bending, stretching, Inertial, Applied Load (weight/applied force)

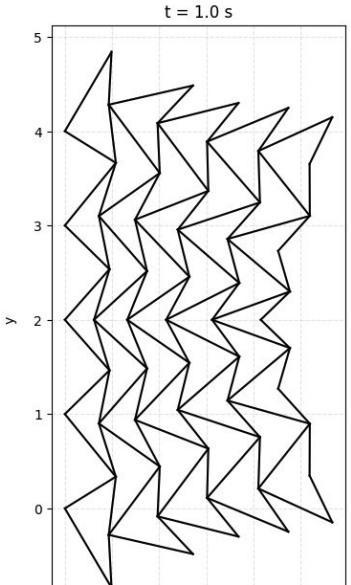


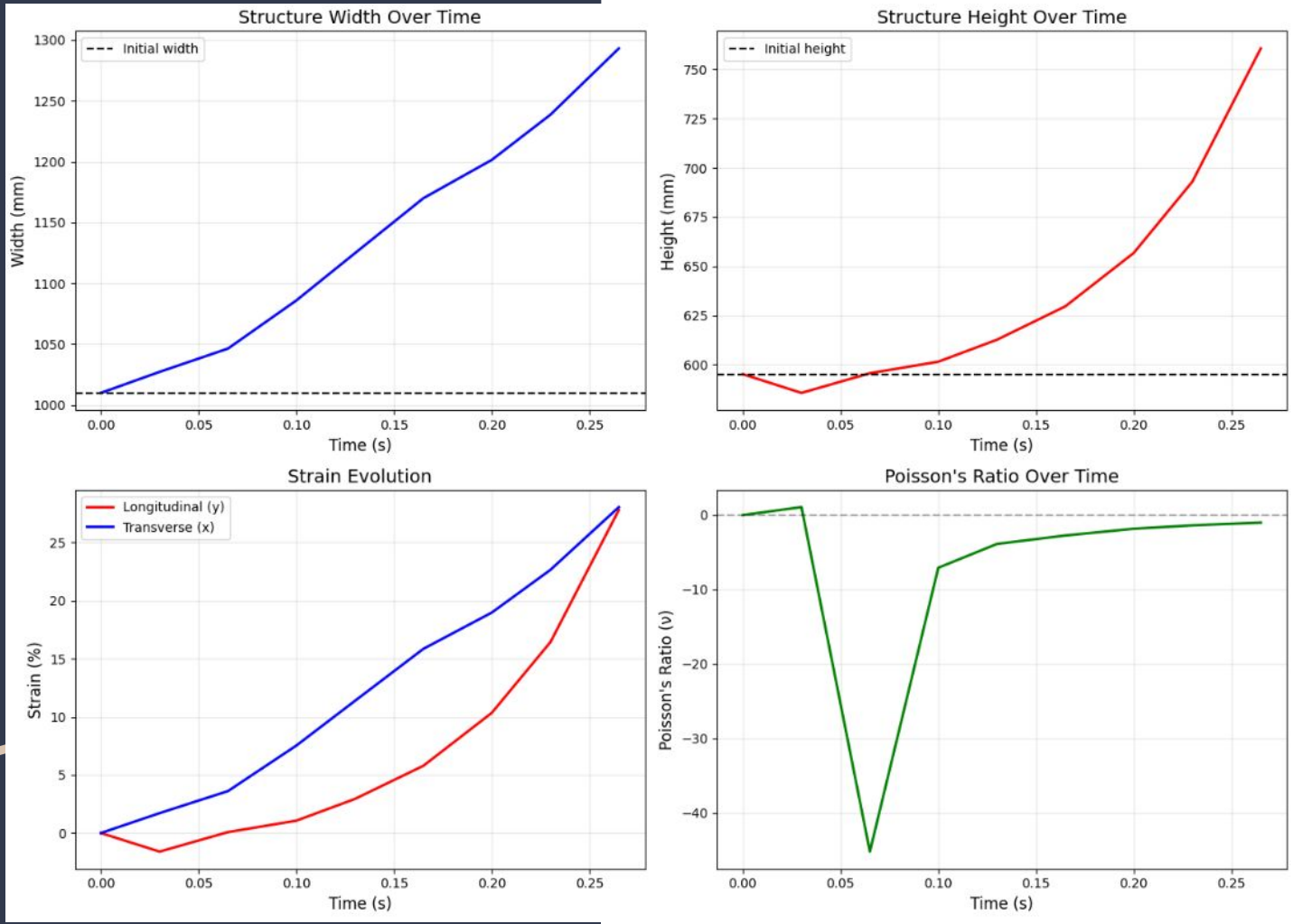
Results



- Lattices are interconnected
- Compression and Tension seem to work
- Lattice seem to display the work of a lattice structure





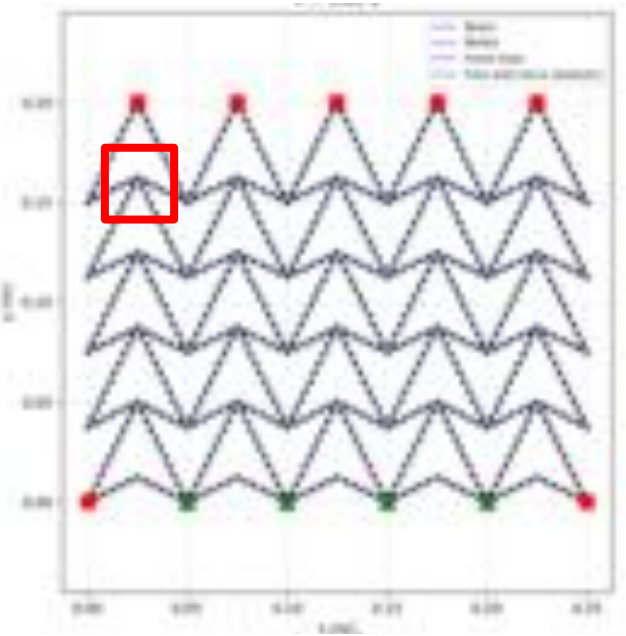

Structure Width Over Time
Initial width
Width (mm)
Time (s)
Structure Height Over Time
Initial height
Height (mm)
Time (s)
Strain Evolution
Longitudinal (y)
Transverse (x)
Strain (%)
Time (s)
Poisson's Ratio Over Time
Poisson's Ratio (ν)
Time (s)

Issues

- Node Overlap
- “Hinge” effect at the vertex (four different interconnected springs)

Current ideas:

- Stiff “X” joint for the vertex
  - Replace the vertex node with five “nodes” that are connected
  - Center node has a fixed angles for the other four nodes
- Might use a collision function for a repelling force for overlap cases



Forward

- Implementing fixes and fixing code
- Calculations to observe are energy absorption and stiffness(elasticity)
- Making and testing 2 other lattice structures to test on the structures