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Artificial Life

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Lab 1

For this Lab assignment, I chose to observe and alter the behavior of the MPM simulation. I used the file 'diffmpm.py' which runs a Differentiable Elastic Object Simulator. The simulation is a 2D elastic body whose goal is to move from the left to the right side of the screen as fast as possible. The default geometry for diffmpm is show below:
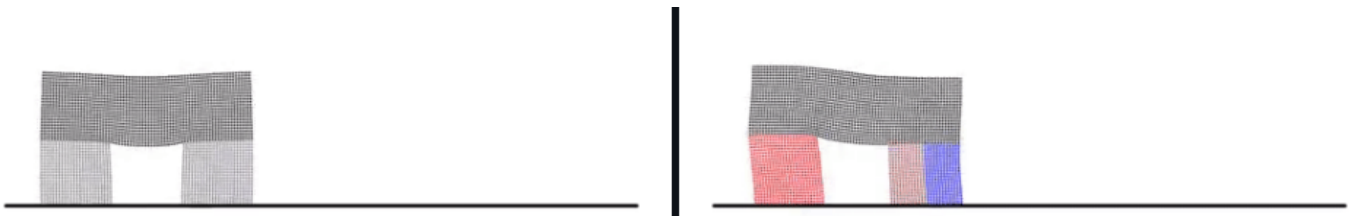
This geometry, in multiple trials of simulation, typically the default geometry develops a sort of galloping motion, running and hopping along the screen.

I chose to investigate (albeit much differently shaped than a true circle) the concept of a wheel in nature as discussed briefly in class. To do this simply, I made what I call a 'filled in donut' shape. There are four rectangles serving as actuators in a ring, with the center being the non-actuated component necessary for simulation. I attempted two sizes of this donut, referred to hereon as small and big donut. Pictures are shown below:
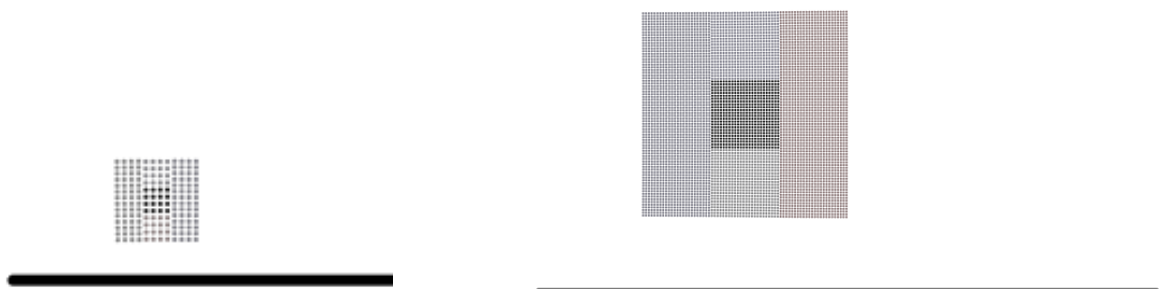
Each geometry was ultimately able to successfully locomote, with interesting behaviors developing, particularly for the small donut, in which it would start its motion by moving left such

that it bounced off the wall and used it as a boost to move to the right even faster. I enjoyed seeing this unique behavior where despite its small size and simple shape, it successfully moved quickly and efficiently to the right of the screen.

The graphed results of the Optimization of Initial Velocity are shown below, with the small donut on the left and the large donut on the right. The small donut had much more variation, possibly due to its light weight and bounciness compared to the large donut, which had a relatively smooth optimization.
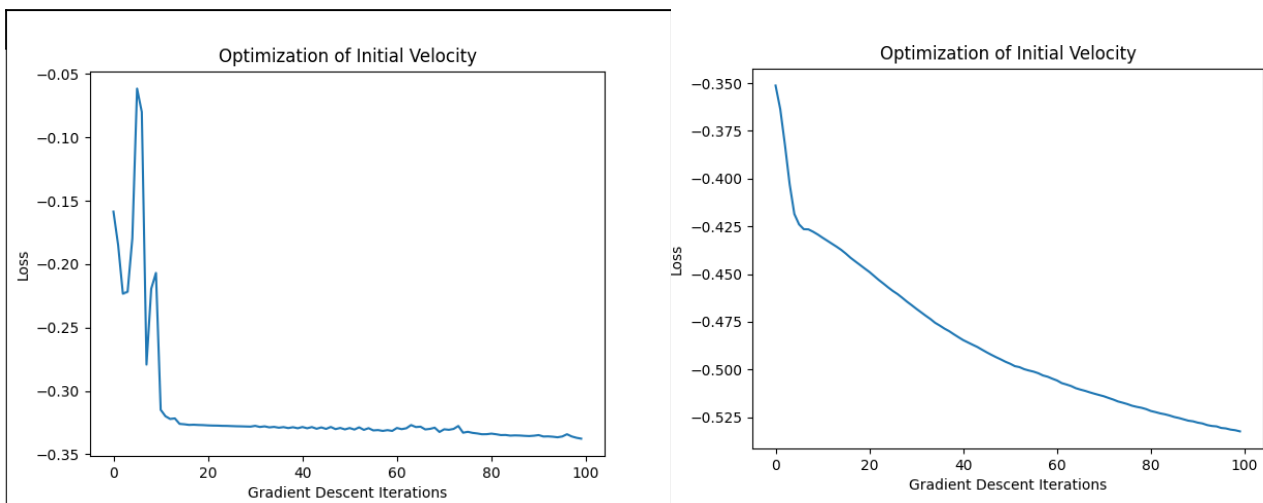
For future work, I am considering continuing the wheel concept but perhaps making it more round.