Homework 2

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MAE 263F Soft Robotics

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Task 1: Plot Maximum Displacement

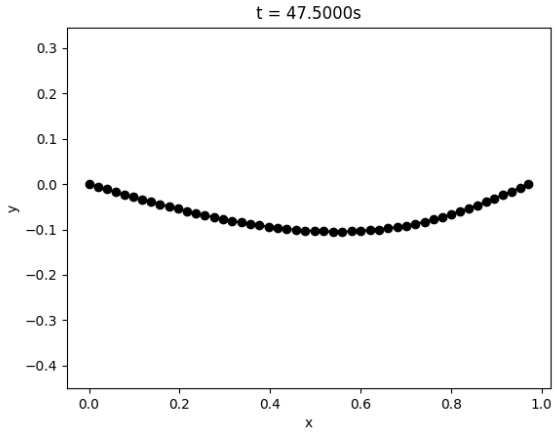

Figure 1: Final deformed shape of the beam (P=2000)

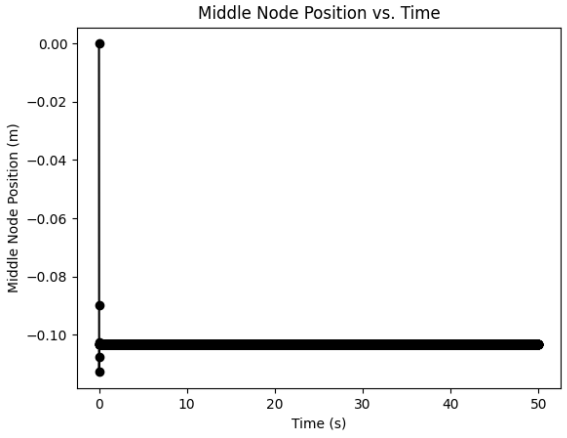

Figure 2: Maximum vertical displacement (P=2000)

In these graphs, $y_{\max}$ does eventually reach a maximum value around $-0.1\,\mathrm{m}$. When we use the Euler beam theory equation below:

$$y_{\max} = \frac{Pc(l^2 - c^2)^{1.5}}{9\sqrt{3}\,EIl}$$

we also get a similar value of 0.114 which is very close to our simulated value.

Task 2: Comparison with larger loads

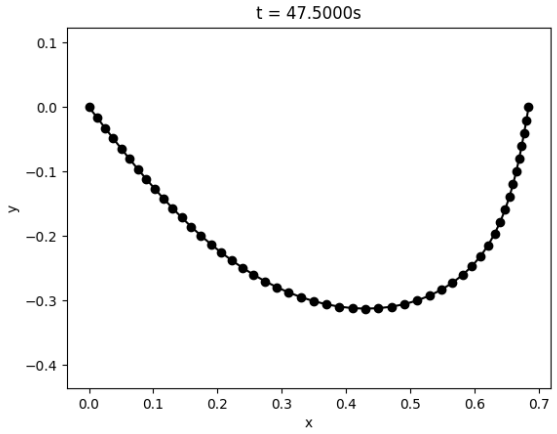

Figure 3: Final deformed shape of the beam (P=20000)

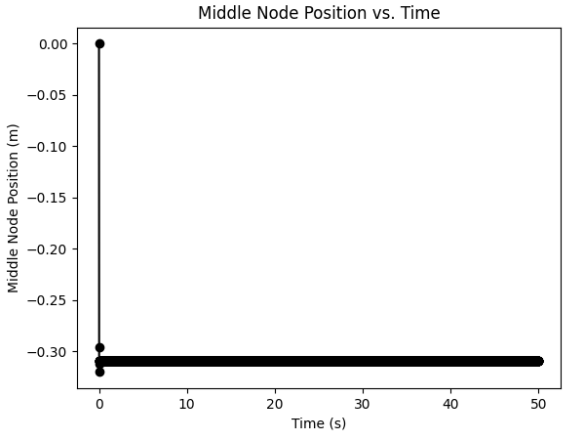

Figure 4: Maximum vertical displacement (P=20000)

Because Euler beam theory only applies for small deformation, we get an displacement difference larger than an order of magnitude at higher loads. Using the Euler beam equation we calculate a displacement of 1.14 meters when our simulation predicts a 0.3 meter displacement. This shows that as the load value increases, the Euler beam equation diverges from the true value.