Homework5_SUN

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***Abstract*— This is HW4 for 263F**

I. QUESTION1

The classical Euler beam prediction is:

$$\frac{ql^4}{8YI} = \frac{1000\cdot 0.002\cdot 0.01\cdot 9.81\cdot 0.1^4}{8\cdot 10^7\cdot\frac{0.01*0.002^3}{12}} = 0.0367\text{m}$$

which is reasonable for a super thin plate with low Young's modulus.

The thin plate is meshed into a rectangle with 20 nodes and 19 tringles as seen in Figure 1. The geometric and material properties were also changed according to the problem statement. The initial meshed thin plate is seen in Figure 2. The settings of the simulations are dt = 0.001, total running time is 21 seconds. Snapshots with 5 5-second intervals are seen in Figures 3,4,5,6,and7.

Figure1. meshed thin plate

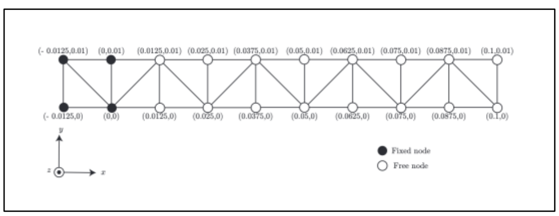


Figure2. Configuration of the mesh

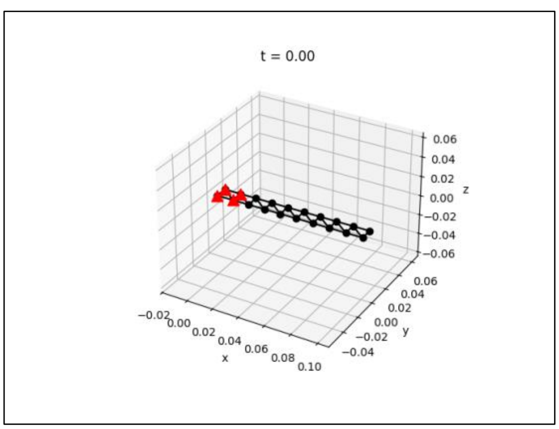


Figure3. end tip displacement at t = 0s

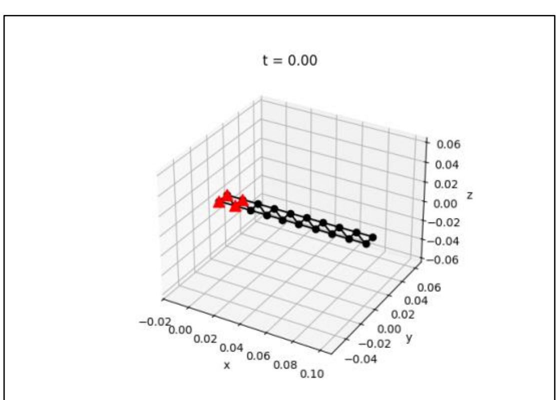


Figure4. end tip displacement at t = 5s

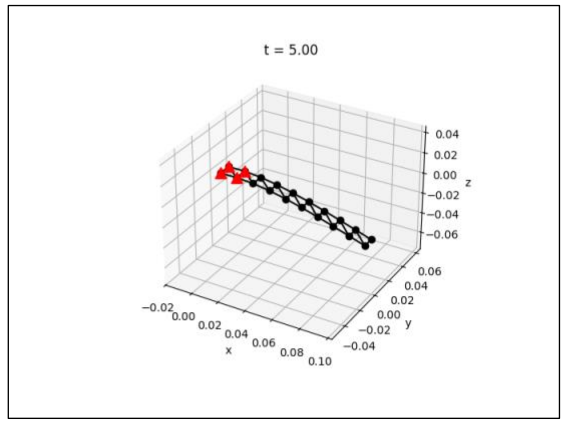


Figure5. end tip displacement at t = 10s

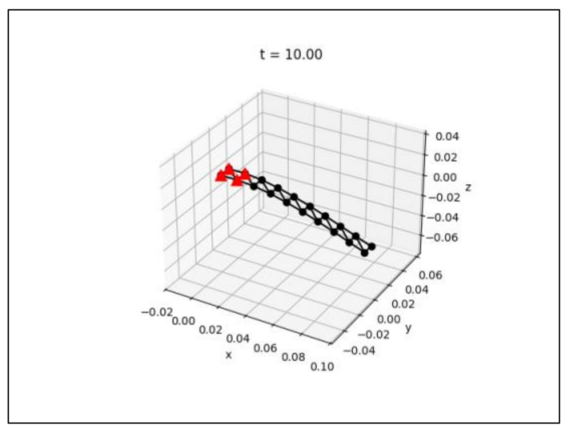


Figure6. end tip displacement at t = 15s

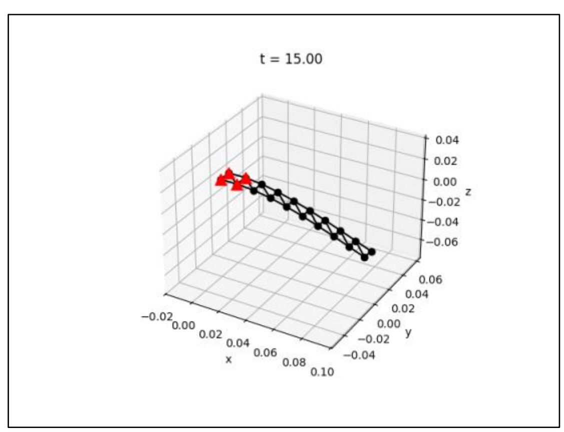
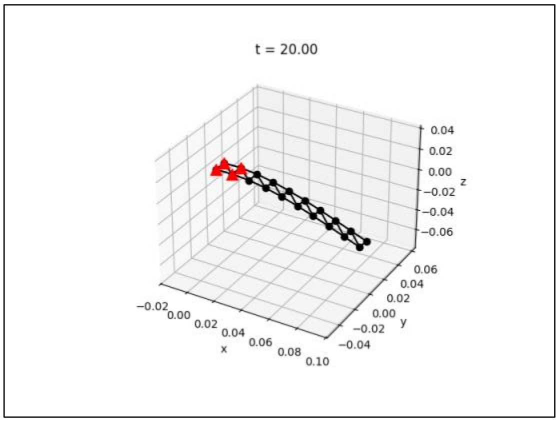


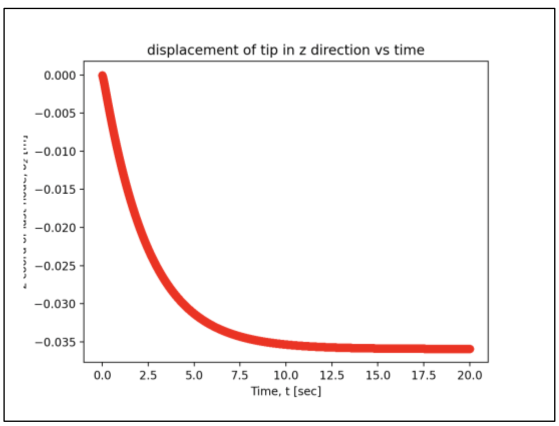
Figure7. end tip displacement at t = 20s



After the system reaches steady states, the end tip of the thin plate settles at z = -0.035m, a pretty decent simulation result compared to the classical Euler beam prediction. The snapshot of the end tip displacement vs. Time is seen in Figure 8. The normalized error is

$$\frac{0.035 - 0.0367}{0.0367} \times 100\% = 4.63\%$$

Figure8. end tip displacement vs.time



ACKNOWLEDGMENT

The source code is taken from Dr.khalid’s Google Colab notebook shared on Slack, then modified by Shixuan Sun to accomplish HW5