MAE263F Homework 2

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I. Problem 1

The maximum vertical displacement is shown in the following figure.

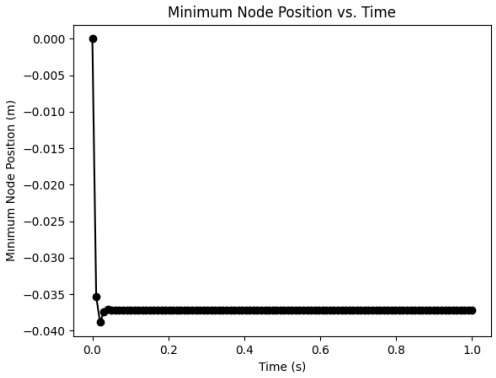

Fig. 1. $\Delta t = 0.01s$: The maximum vertical as a function of time

- The y_{max} reaches the steady value.
- The simulation result of y_{max} is -0.03717.
- The theoretical prediction from Euler beam theory is -0.03804.
- The relative error is 2.2871%

II. Problem 2

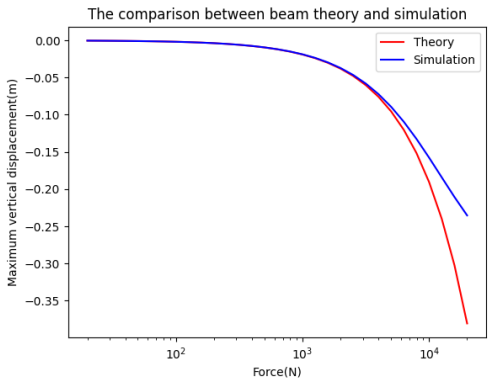

Fig. 2. Comparison between beam theory and simulation

- The benefit of simulation is that it can deal with situations where Force P is large.
- As shown in this figure, the error gradually increases as the P increases.
- When the Force P = 3990N, the relative error between theory and simulation is 4.74%, Which can be seen as the place these two simulations start to diverge.
- When the P is under 2000N, the simulation result is close to that of beam theory.

III. Additional Problems

The assumption is that the error between simulation and theory will reduce when N increases. To demonstrate this, Use P = 2000N, dt = 0.01s, change the N into different numbers.

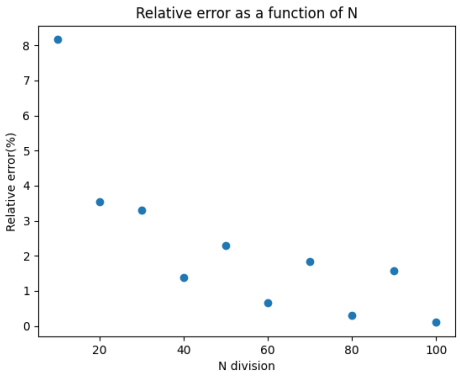

Fig. 3. Relative Error VS N

There is a trend that Error between simulation and theory will decrease as N increases.