Homework 5

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I. Results

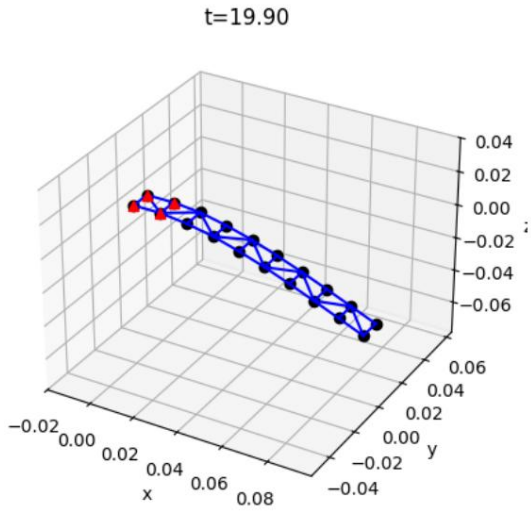

Figure 1: The thin beam configuration in steady-state.

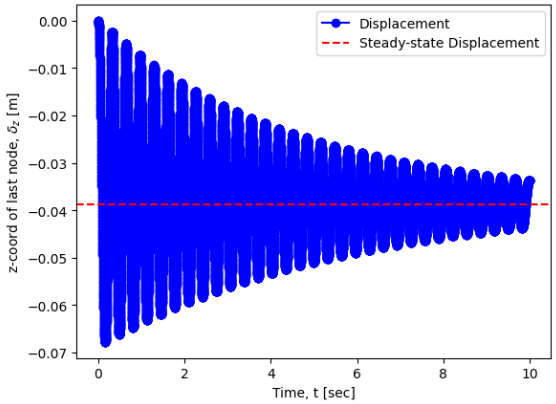

Figure 2: Displacement at z-coordinate from discrete plate simulation (δ_z) with respect to time.

The steady displacement from discrete plate simulation (δ_{plate}) is 0.03867 m, and the theoretical prediction (δ_{EB}) is

$$\delta_{EB} = \frac{ql^4}{8YI} = \frac{\rho whgl^4}{8YI} = \frac{1000 \times 0.01 \times 0.002 \times 9.8 \times 0.1^4}{8 \times 10^7 \times \left(0.01 \times \frac{0.002^3}{12}\right)} = 0.03675\ m \quad (1)$$

Where ρ is density of the beam, w is beam width, h is beam thickness, l is beam length, Y is Young's modulus, I is second order of cross area, g is gravity.

The normalized difference (Δ) is

$$\Delta = \frac{\delta_{plate} - \delta_{EB}}{\delta_{EB}} = 0.0522 = 5.22\% \quad (2)$$