

MAE 263F: Homework 2

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I. ASSIGNMENT 1

A. Assignment Guidelines/Expectations

This assignment prompts us to simulate an elastic rod with given total length, radius, location of nodes, twist angles, and physical parameters. We are required to simulate the deformation of the rod under gravity for the first 5 seconds, and then to plot the z-coordinate of the last node with time.

Our first task is going to be to find the number of nodes and the time step using sensitivity analysis. We will then use the provided code titled *Discrete Elastic Rods*, modified to fit our specific problem, to complete this assignment.

B. Number of Nodes and Time Step

We want to choose an appropriately high number of nodes such that the z-coordinate of the last node does not vary with N . We plot the z-coordinate for the following values of N : 10, 20, 25, 30 and then 22. We find that at $N = 22$, the value for the z-coordinate of the last node stabilizes to -0.04 m and does not change for values past that, so we choose $N = 22$ for our number of nodes.

Similarly, we find that the optimal time step is 0.01 seconds.

C. Simulate the deformation of rod and plot the z-coordinate of the last node with time.

After choosing the correct number of nodes, we verify that everything in the pre-existing code matches our given requirements and plot the z-coordinate of the last node with time. We observe that it stabilizes to 0.04 m as t approaches 5 seconds for a time step of $dt = 0.01$.

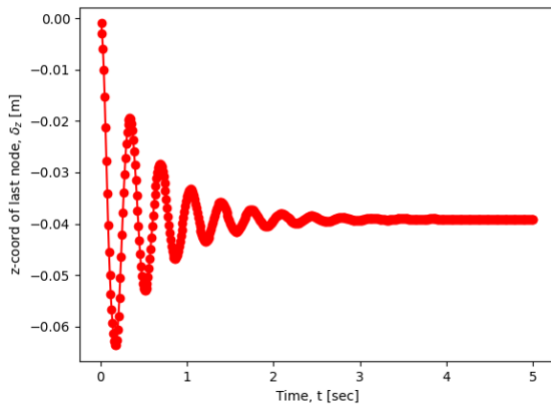


Figure 1: Z-Coordinate of the last node with respect to time.