MAE 259B: Mechanics of Slender Structures and Soft Robots Homework 1

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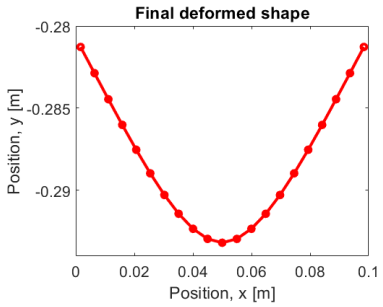
I. Assignment 1: Simulation of the motion of a sphere falling inside viscous fluid

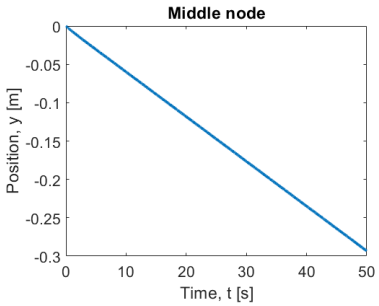
1. When the radii are the same, the turning angle become 0 and all the three spheres drop with the same velocity, which agrees with intuition.
2. For the explicit method, when the time step size raises up, the simulation fails to generate solutions since the position of each sphere goes infinity.

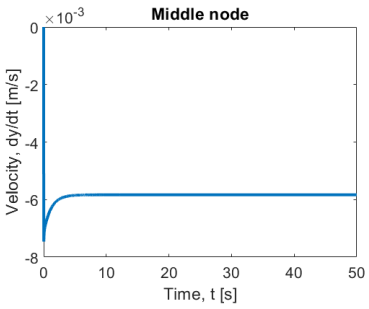
Method	Benefits	Drawbacks
Explicit	Easy to program	Inaccurate, small time step
Implicit	Accurate, larger time step	Complicated to use



II. Assignment 2: Simulation of the motion of a sphere falling inside viscous fluid

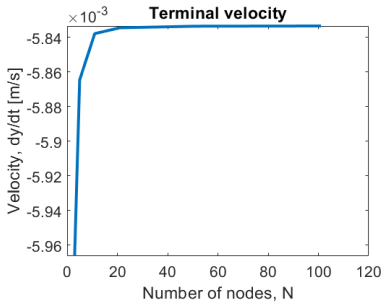
1. Terminal velocity is -0.0058 m/s

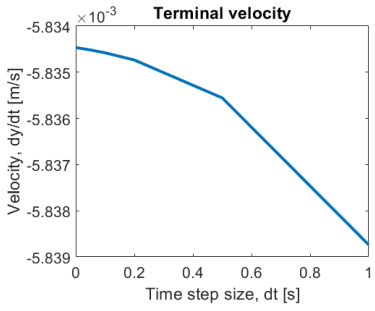




2. The final deformed shape is

3. The size of spatial discretization and temporal discretization have effect on simulation speed and accuracy. Large number of nodes and small time step size lead to slow but accurate simulation results.





III. Assignment 3: Simulation of the deformation of elastic beams and comparison with Euler-Bernoulli beam theory

1. y_{max} eventually reach a steady value, which agrees with the theoretical prediction value.

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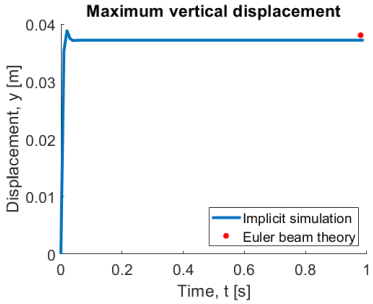
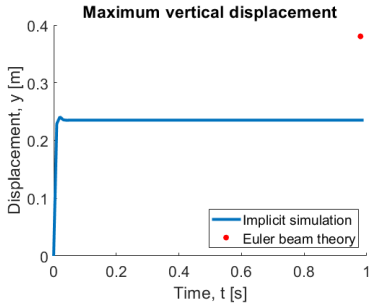


2. The simulation could handle with high load condition. The difference between two method can not be ignored.



When $P \approx 5000N$, the two solutions begin to diverge.