Homework 1

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I. Assignment 1

A. Q1

They should fall at the same speed as all the external forces on them are the same.

Simulation proved it.

B. Q2

For implicit method, Δt from 10e-2 to 10e-5 all works well But for explicit method, Δt cannot be too large, testing results shows that even 10e-4 still results into disaster (singular value).

II. Assignment 2

A. Q1

5.83472e-3 m/s

- Velocity vs. time

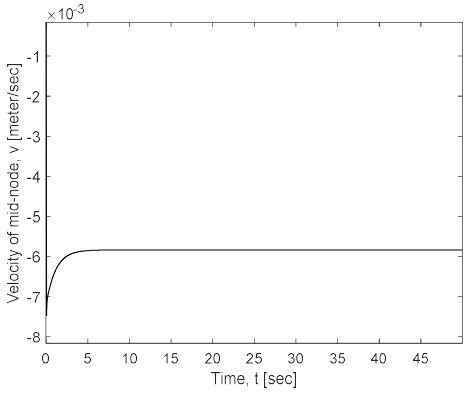

Figure 1. Velocity vs. time

- Position vs. time

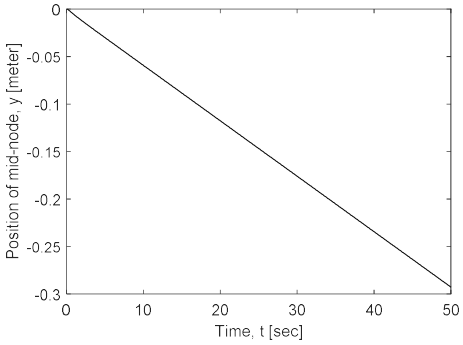

Figure 2. Y position vs. time

B. Q2

- Deformed shape

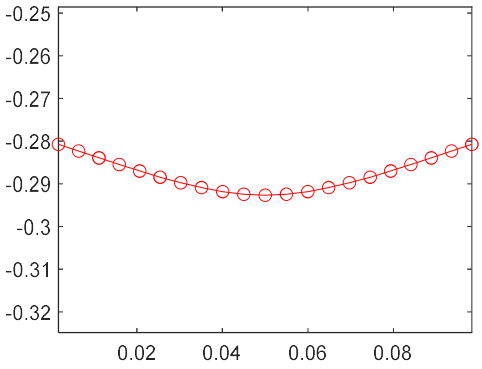

Figure 3. Final deformed shape of beam

C. Q3

Larger dt discretization makes more inaccurate velocity error while more nodes make simulation more accurate.
It fits intuition, but not should choose appropriate value as the trade-off between accuracy and computation time.

- Velocity variation vs. dt discretization

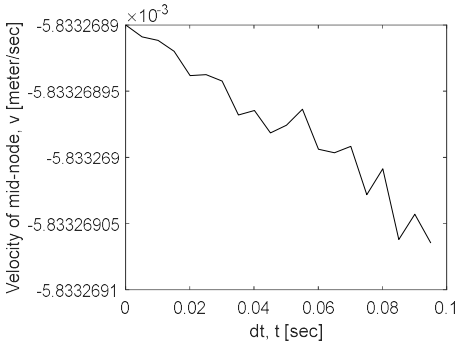

Figure 4. Velocity variation vs. dt discretization

- Velocity variation vs. nodes number

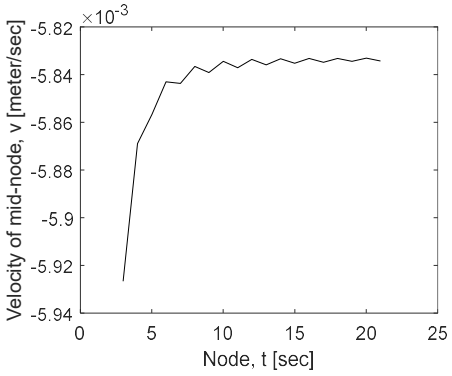

Figure 5. Velocity variation vs. nodes number

III. ASSIGNMENT 3

A. *Q1*

- If P = 2000N

Theory prediction:

0.038m

Simulation:

0.039m

- If P =20000N

Theory prediction:

0.3804m

Simulation:

0.2456m

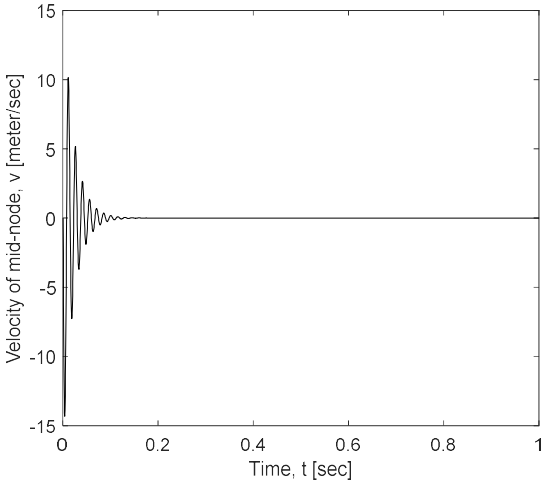

Figure 6. Displacement vs. time

B. *Q2*

The gap between simulation and theory results is going up along with larger and larger P.

The intersection of P is less than 500N, but the error bound of P=500 is less than 10e-4.

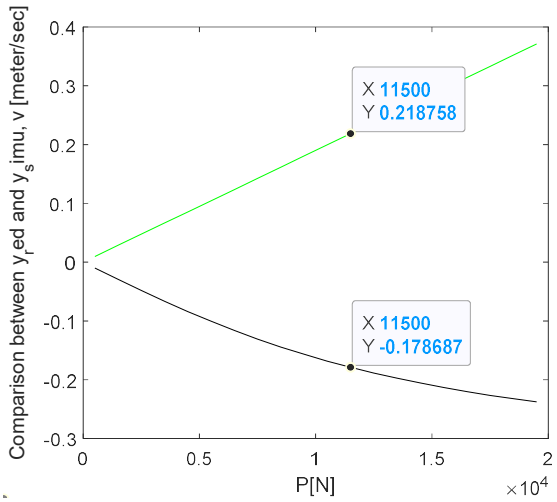

Figure 7. Gap between theory and simulation along with P