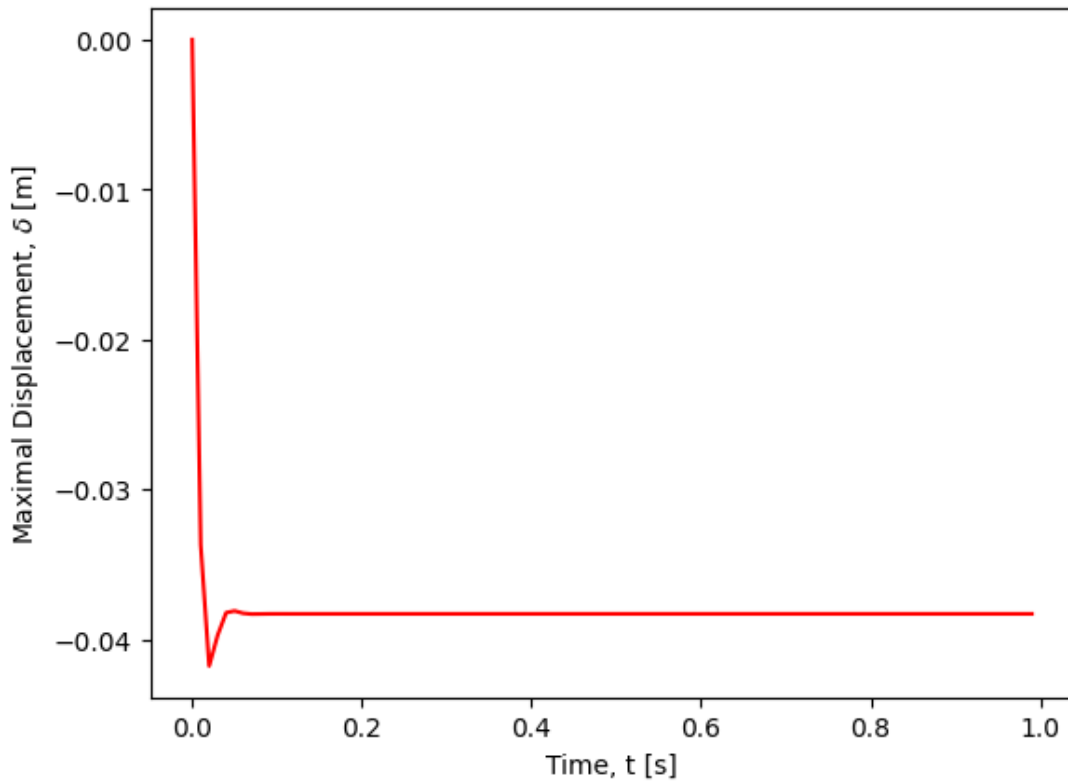1.



The maximal displacement does go to steady state, and the theoretical maximal displacement is -0.038 m, and the simulation result is -0.0383 m. They are close to each other with about 0.8% error.

$$y_{max} = \frac{Pc(l^2 - c^2)^{1.5}}{9\sqrt{3}EIl} = \frac{-2000 \times 0.25 \times (1^2 - 0.25^2)^{1.5}}{9\sqrt{3} \times (70 \times 10^9 \times \frac{\pi}{4}(0.013^4 - 0.011^4)) \times 1}$$

$$= -0.038 \, m$$

2.

The theoretical maximal displacement is linear to the external force, but the actual maximal displacement is non-linear. In other words, it can only handle small displacement with small force.

The figure shows after the external force is larger than 3000 N, the simulation and beam theory values start to diverge.