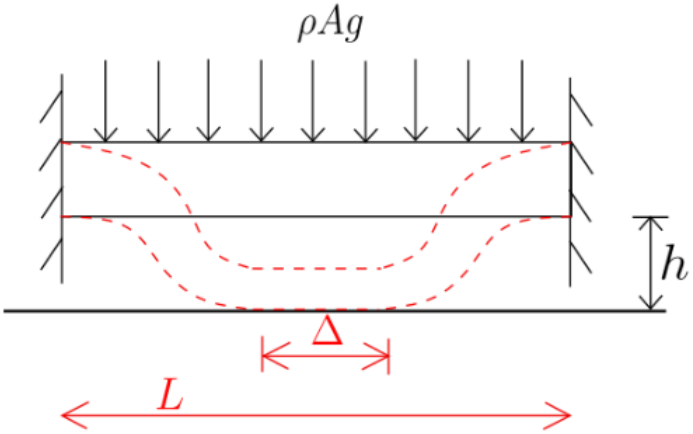
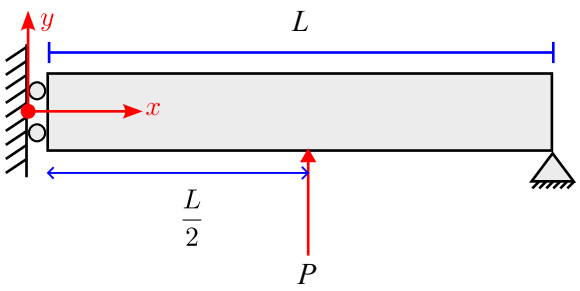
Tutorial 10

APL 104 - 2022 (Solid Mechanics)

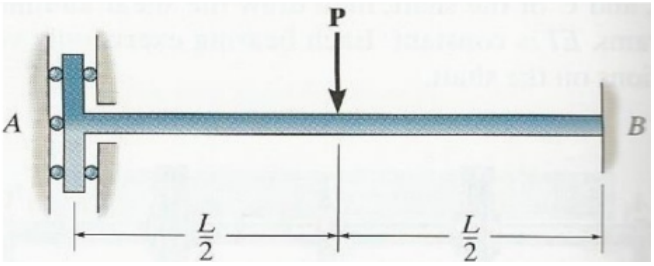
1. Consider a beam clamped at both its ends. The beam sags down due its own weight as shown in Figure 10, the distributed weight being $\rho\ A\ g$. However, the ground position (h below the beam) is such that the some part of the beam rests on the ground upon deformation while the remaining part just hangs. Find the length of the beam Δ which will rest on the ground.



2. Suppose a beam is kept with roller support at one end ($x = 0$) constrained to only move in y-direction and pinned at the other end ($x = L$) as shown. Beam is subjected to transverse load (P) at the middle of the beam. Which of the following holds true when the beam is modeled as a Euler Bernoulli beam?



3. For the beam shown, find the reaction moment and deflection at A (use Timoshenko beam theory).



4. Think of a beam which is clamped against both transverse deflection as well as rotation at both the ends (see figure).

   (a) Write down the two governing equations to obtain transverse deflection of this beam if it behaves as a Timoshenko beam. Also obtain the boundary conditions.

   (b) Can you think of reducing the two equations in part (a) into a single ordinary differential equation in terms of just the transverse deflection? Similarly, also write down all the boundary condition such that the cross-sectional rotation variables doesn't show.

   (c) Can you deduce the equation which gives us the critical buckling load of the beam? (You don't have to solve it)