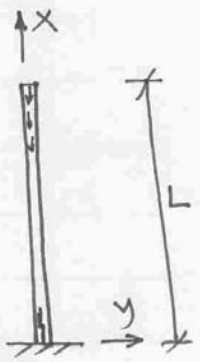
Homework # 6

1) Using the energy method, find the critical height ($L_{critical}$) for a cantilever column under its own weight. given:

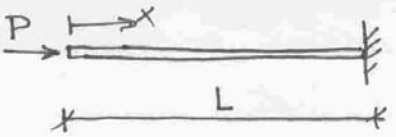


ρ = mass density of column.

g = gravity acceleration.

A = Cross-sectional area of column.

2) A cantilever column, with a clamped end at $x=L$, is under a compressive load (P) (at the free end, $x=0$).



rigidity

If the bending ~~stiffness~~ of the column varies as follows

$$EI(x) = EI_0\left(1 + \frac{I_1}{I_0}\frac{x}{L}\right)$$

Derive the stability equation by utilizing:

1) The principle of the minimum total potential energy.

3) Use both the methods of Rayleigh and Timoshenko to estimate the critical load for a uniform cantilever of length L:

a) with one sine term for the deflected shape

b) with a parabolic expression that satisfies the boundary conditions $x=0$, $y=0$ at the free end and $(dy/dx)=0$ at the fixed end.

4) Use Rayleigh method to estimate the critical load for the step-wise prismatic cantilever strut shown.

Assume a one-term sine expression for the deflected shape.