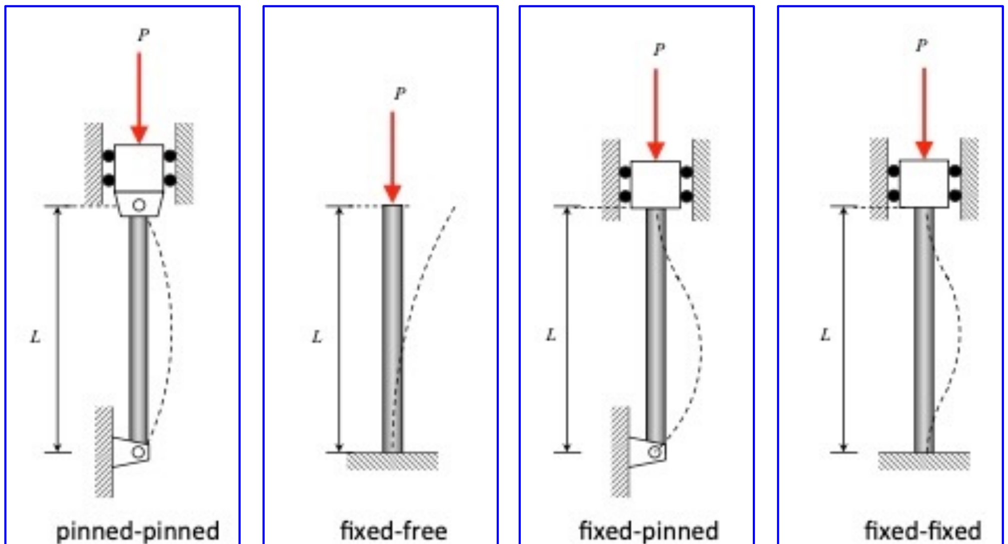
Summary: Euler buckling theory

PROBLEM: A perfectly straight column of length L is acted up by an axial load P that is perfectly aligned with the longitudinal axis of the column. Above a critical load of P, P_{cr}, the undeformed state of the column experiences an instability, where for $P > P_{cr}$ the column experiences a non-zero static deformation. The Euler buckling theory predicts this critical load as:

$$P_{cr} = \pi^2 \frac{EI}{L_{eff}^2}$$

where E is the Young's modulus of the material, I is the second area moment for the column cross-section and L_{eff} is the "effective length" of the column, with L_{eff} depending on the physical length and the boundary conditions for the column. Values for L_{eff} are shown below for four sets of column boundary conditions.



$L_{eff} = L$ | $L_{eff} = 2L$ | $L_{eff} = 0.7L$ | $L_{eff} = 0.5L$