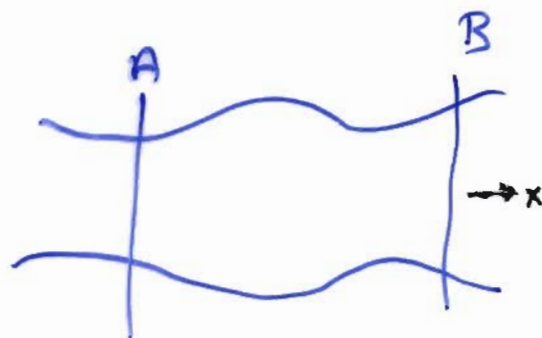


Deformation of Axially-Loaded Statically-Determinate Members

$\sigma = \frac{P}{A}$; $\epsilon = \frac{\Delta L}{L_0}$; $\sigma = E\epsilon$ \Leftarrow These are usually facts \Rightarrow

$\delta = e_{B/A} = u_B - u_A = \int_A^B \frac{P(x)}{A(x)E(x)} dx$
 \uparrow relative displacement

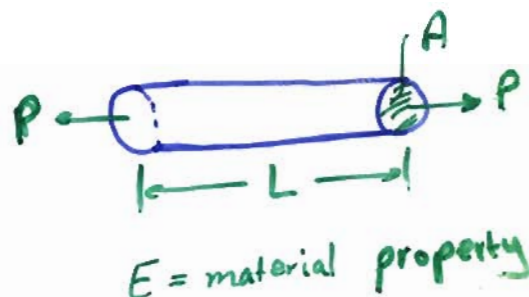


Methods of Solution:

- ① Direct integration: normal integration of the eq. above
- ② Discrete elements: finite number of segments with constant P/AE
- ③ Superposition: Take F_1, F_2, \dots separately and sum the results (for linear elastic only)

For a Uniform rod (bar, member, ... etc.),
 $A, E,$ and P are constant.

\Rightarrow
$$e = \frac{PL}{AE}$$



For more than one uniform rods:

$$e_{\text{Total}} = \sum_{i=1}^n e_i = \sum_{i=1}^n \left(\frac{PL}{AE} \right)_i$$

i = number of segments (elements)

$$\begin{aligned} \delta = e &= \int_0^L \frac{P}{AE} dx \\ &= \frac{P}{AE} \int_0^L dx \\ &= \frac{PL}{AE} \end{aligned}$$