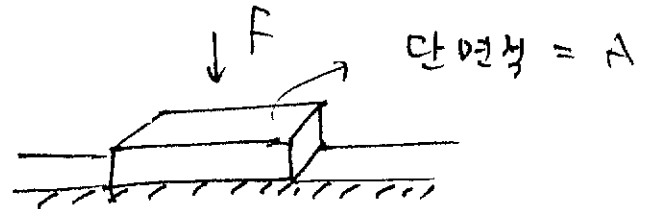


# \* Axial Stress

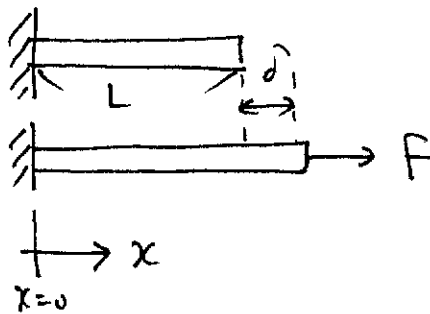
① Axial load



$$\bar{\sigma}_{avg} = \frac{F}{A} = \text{average stress over } A$$

(F ≡ force or load)

② Strain



$$\epsilon(x) = \lim_{\Delta x \rightarrow 0} \frac{\Delta \bar{d}}{\Delta x}$$

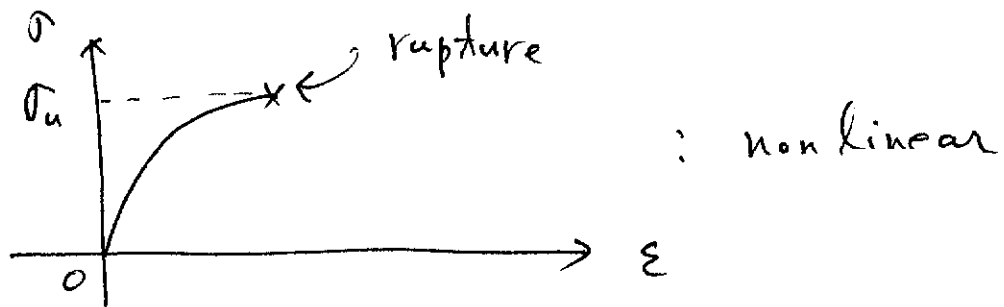
$$= \frac{d\bar{d}}{dx}$$

$$\epsilon_{avg} = \frac{\bar{d}}{L} : \text{average strain}$$

( $\bar{d}$  ≡ total deformation)

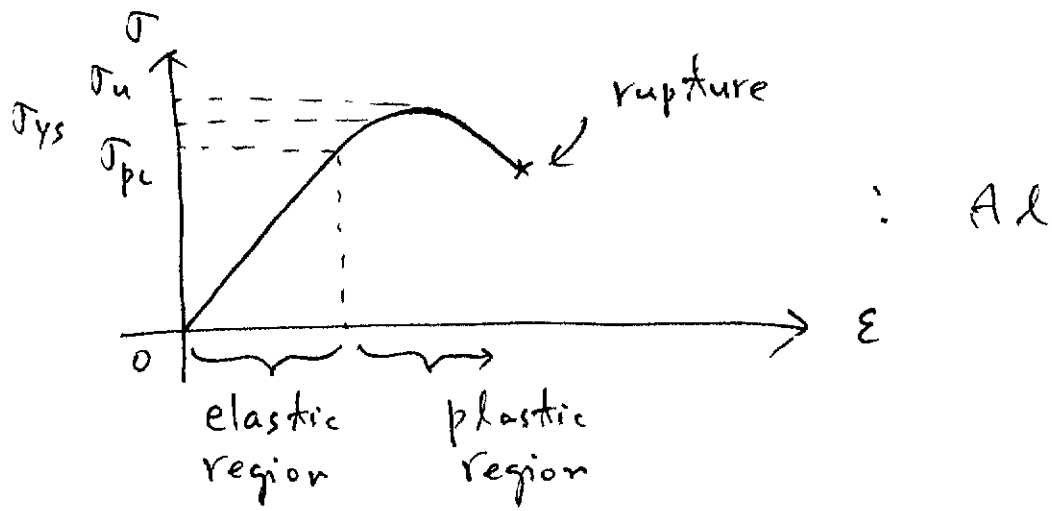
③  $\sigma$  &  $\epsilon$  Curve

㉑ Brittle material (ex, glass)

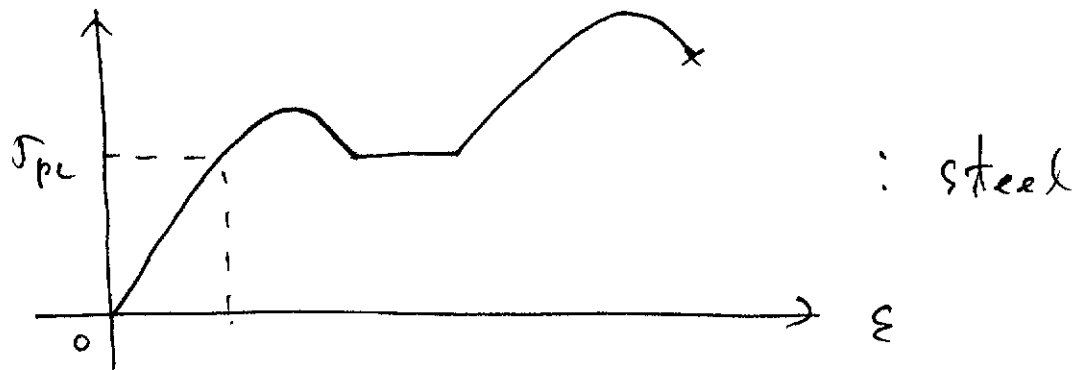


$\sigma_u$  = ultimate stress

㉒ Ductile material (ex, Al, steel)



$\sigma_{ys}$  = yield stress



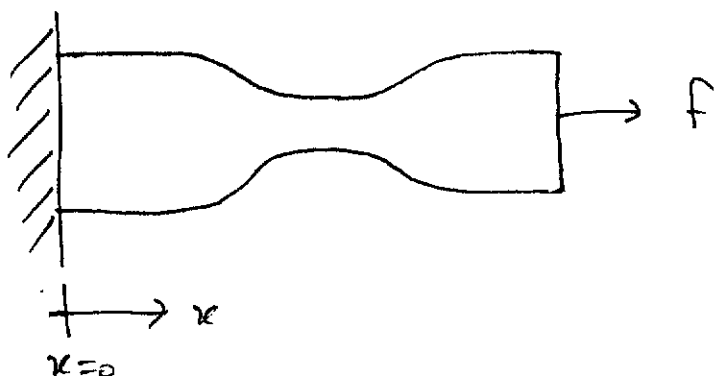
For elastic region ( $\sigma \leq \sigma_{pc}$ ),

$$\sigma = E \epsilon \quad (\text{linear})$$

or can,  $E = \text{modulus of elasticity} \hat{=} \text{Young's modulus}$

$$\boxed{\text{Abu}} \quad \sigma = \frac{F}{A}, \quad \epsilon = \frac{\delta}{L}, \quad \sigma = E \epsilon$$

\* Axial Load Formula ( $\sigma \leq \sigma_{pc}$ )



$$\sigma(x) = \frac{F(x)}{A(x)} = E(x) \varepsilon(x)$$

$$\Rightarrow \varepsilon(x) = \frac{F(x)}{E(x) A(x)}$$

$$\varepsilon(x) = \frac{d\bar{d}}{dx} \quad \text{or} \quad d\bar{d} = \varepsilon(x) dx$$

$$\bar{d} = \int_{x_j}^{x_{j+1}} \varepsilon(x) dx = \int_{x_j}^{x_{j+1}} \frac{P(x)}{E(x) A(x)} dx$$

Uniform load  $\Rightarrow \bar{d} = \frac{P}{AE} = \text{constant}$

따라서,  $x_{j+1} - x_j = L$  (total length) 이면

$$\bar{d} = \frac{PL}{AE} \quad (\sigma \leq \sigma_{pl})$$