Materials

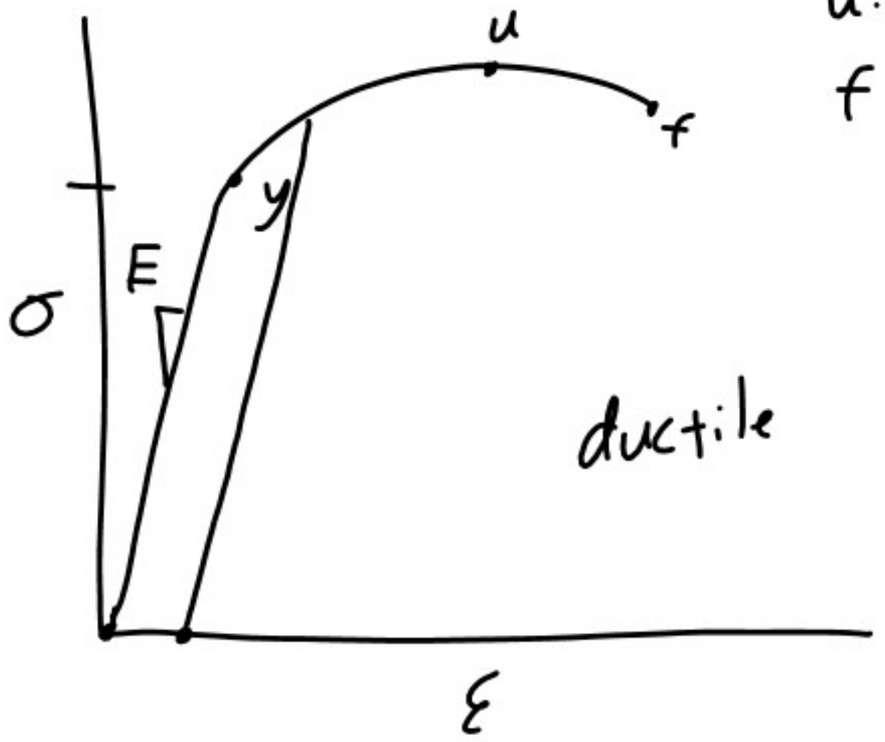
- Stress
- Strain

$$\sigma = \frac{F}{A}$$

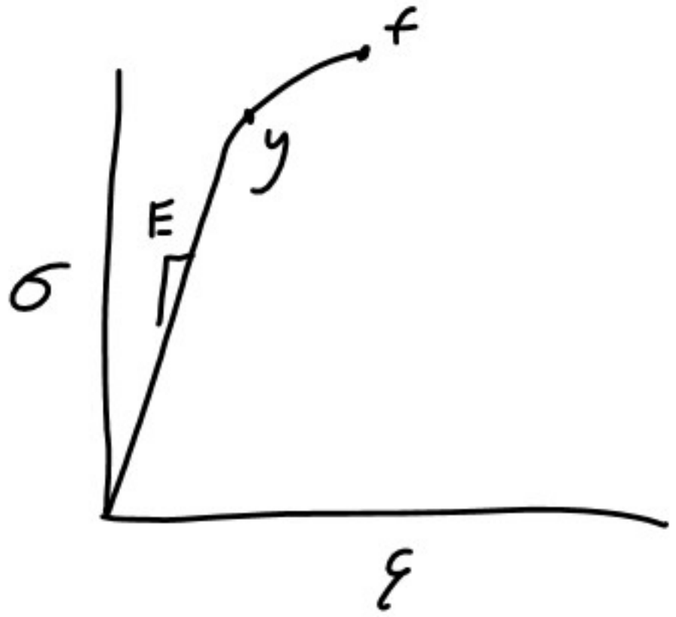
$$\varepsilon = \frac{l - l_0}{l_0} = \frac{\Delta l}{l_0}$$

Engineering Stress

y: yield
u: ultimate
f: failure

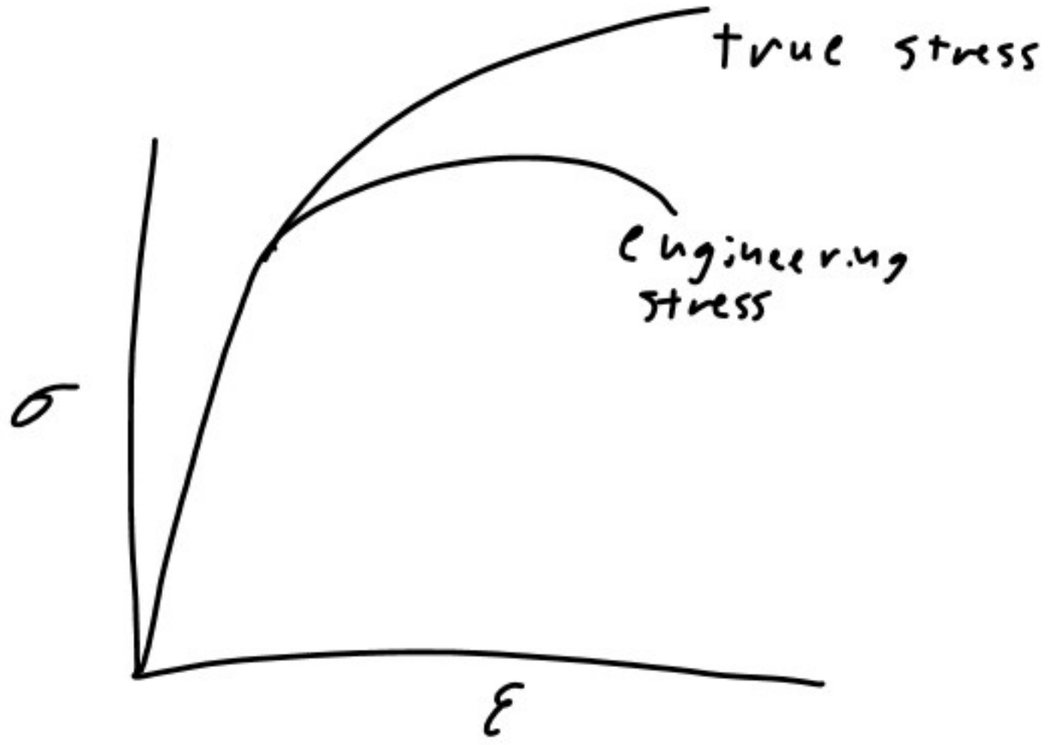


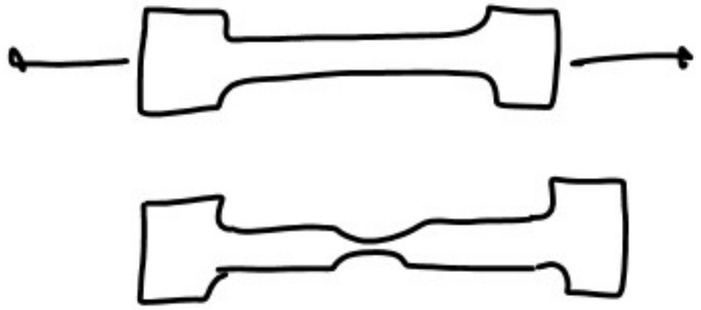
ductile



$$E = \frac{\sigma}{\varepsilon}$$

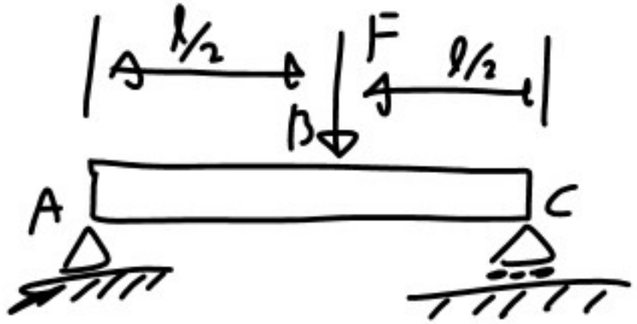
True Stress

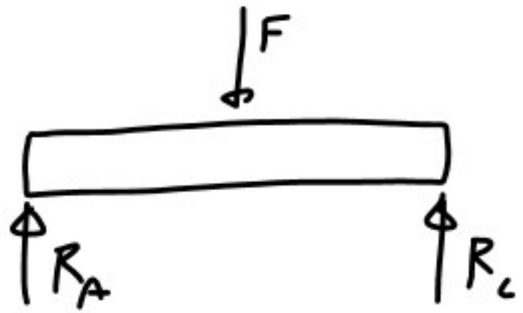




$$\sigma = \frac{F}{A}$$

Beam Deflection



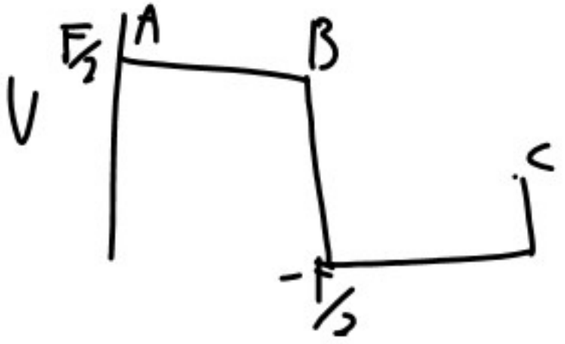


$$\Sigma F_y = R_A + R_C - F = 0$$

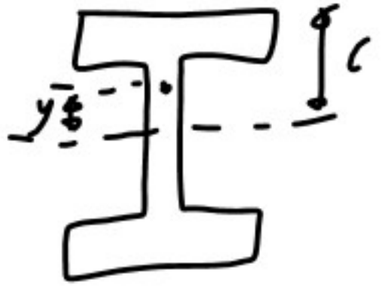
$$\Sigma M_B = \tfrac{1}{2} R_C - \tfrac{1}{2} R_A = 0$$

$$R_A = R_C$$

$$R_A = R_C = \frac{F}{2}$$

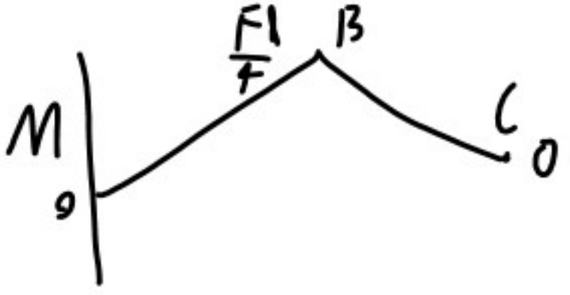


$$M_B = F/2 \; l/2 = \frac{Fl}{4}$$



$$\sigma_x = \frac{-My}{I}$$

$$\sigma_m = \frac{Mc}{I} \quad \text{max stress}$$



$$\frac{d^2y}{dx^2} = \frac{M(x)}{EI}$$

$$\int \frac{d^2y}{dx^2} = \int_0 \frac{M(x)}{EI} = \int_0 \frac{1}{EI} \frac{F}{2} x\,dx\,dx \qquad M(x) = \frac{F}{2}x$$

$$\frac{dy}{dx} = \frac{1}{EI}\frac{F}{2}\frac{x^2}{2} + C_1$$

at $x = l/2$ $\quad dy/dx = 0$

$$\frac{dy}{dx} = \frac{1}{EI}\frac{F}{2}\frac{l^2}{8} + C_1 = 0 \qquad C_1 = \frac{-Fl^2}{16EI}$$

$$y = \frac{1}{EI}\int \frac{F}{2}\frac{x^2}{2} + C_1\,dx$$

Table A-9

$$y = \frac{1}{EI}\frac{F}{2}\frac{x^3}{2\cdot 3} + C_1 x + C_2$$

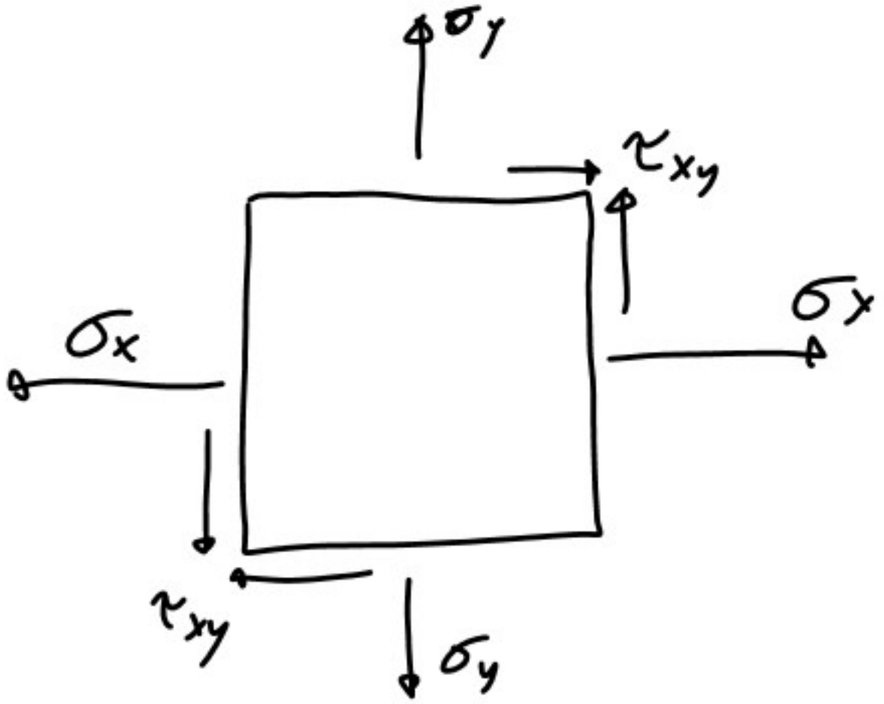
at $\quad x = 0 \quad y = 0$

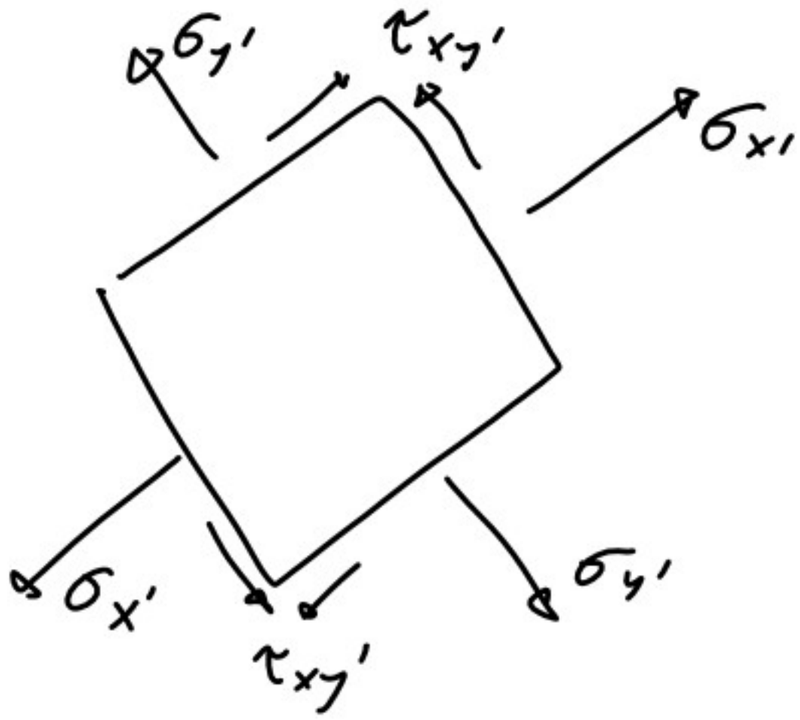
$$y = C_2 = 0$$

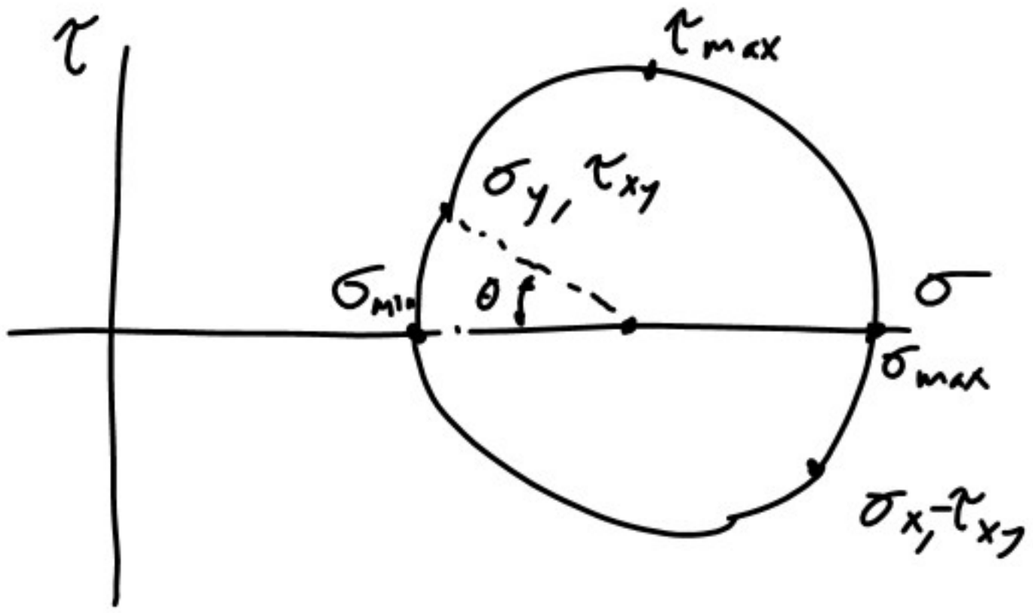
from A to B

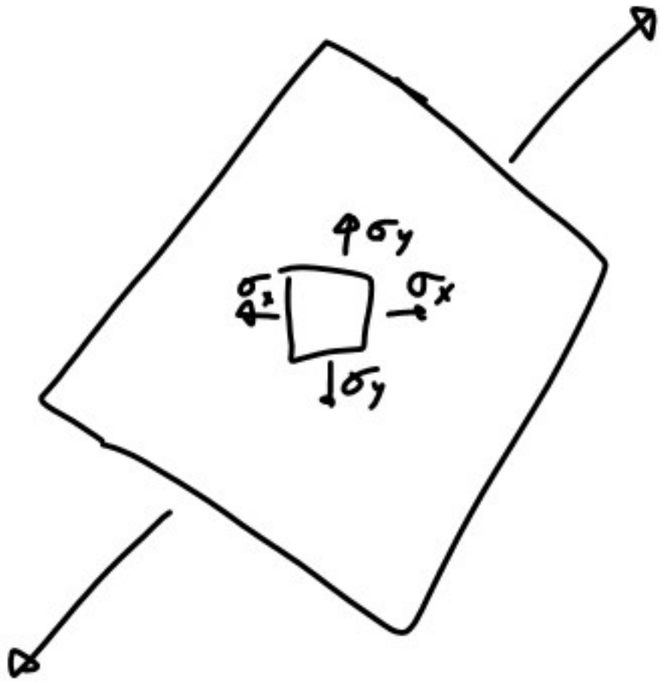
$$y = \frac{Fx^3}{12EI} - \frac{Fl^2}{16EI}x$$

Mohr's Circle






τ
τmax
σy, τxy
σmin
θ
σ
σmax
σx, -τxy


σy
σx
σy