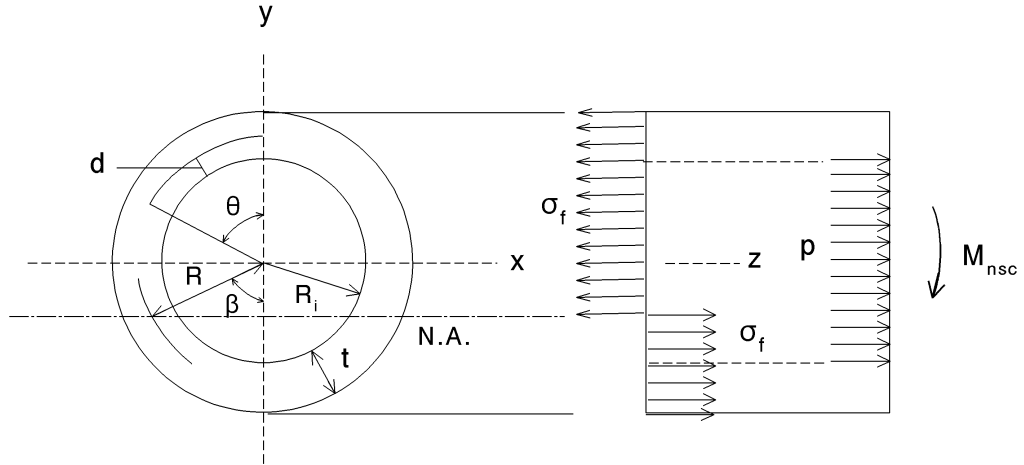


Problem 2:

(a) For $\theta < \pi - \beta$ (Entire Crack in Tension Zone)



$$\begin{aligned} \sum F_z = 0 &\Rightarrow 2R\theta(t-d)\sigma_f + 2R(\pi-\beta-\theta)t\sigma_f - 2R\beta t\sigma_f = \pi R_i^2 p \\ &\Rightarrow \theta(t-d) + (\pi-\theta)t - 2\beta t = \frac{\pi R_i^2 p}{2R\sigma_f} \\ &\Rightarrow \theta - \theta(d/t) + \pi - \theta - 2\beta = \frac{\pi R_i^2 p}{2R\sigma_f t} \\ &\Rightarrow \beta = \frac{\pi - \theta(d/t)}{2} - \frac{\pi R_i^2 p}{4R\sigma_f t} \end{aligned}$$

$$\begin{aligned} \sum M_x = 0 &\Rightarrow M_{nsc} = 2\sigma_f R^2 (t-d) \int_0^\theta \cos \phi d\phi + 2\sigma_f R^2 t \int_0^{\pi-\beta} \cos \phi d\phi + 2\sigma_f R^2 t \int_0^\beta \cos \phi d\phi \\ &\Rightarrow M_{nsc} = 2\sigma_f R^2 [(t-d) \sin \theta + t \{ \sin(\pi-\beta) - \sin \theta \} + t \sin \beta] \\ &\Rightarrow M_{nsc} = 2\sigma_f R^2 t [2 \sin \beta - (d/t) \sin \theta] \end{aligned}$$