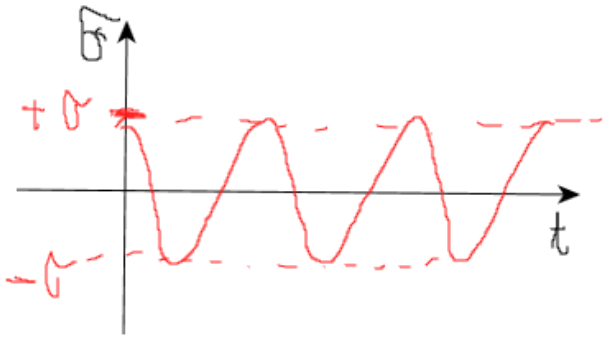
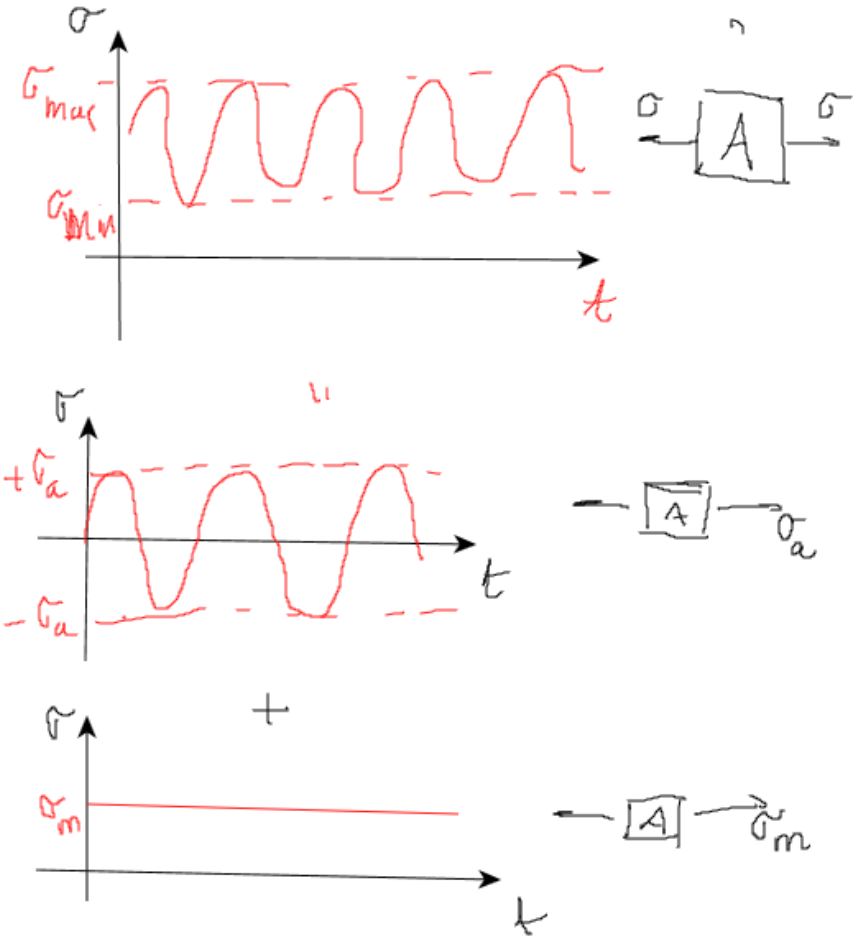
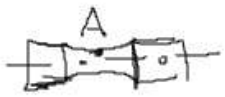
Ensaio de fadiga
Estado de tensão uniaxial
Tensão reversa (simétrica)
(Normal)



$$\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2} \quad e \quad \sigma_a = \frac{\sigma_{max} - \sigma_{min}}{2}$$





C.P. Padrão

σ — [A] → $\sigma = (\sigma_a + \sigma_m)$

Registrar o σ_f ou a condição de falha (escoamento/ruptura)

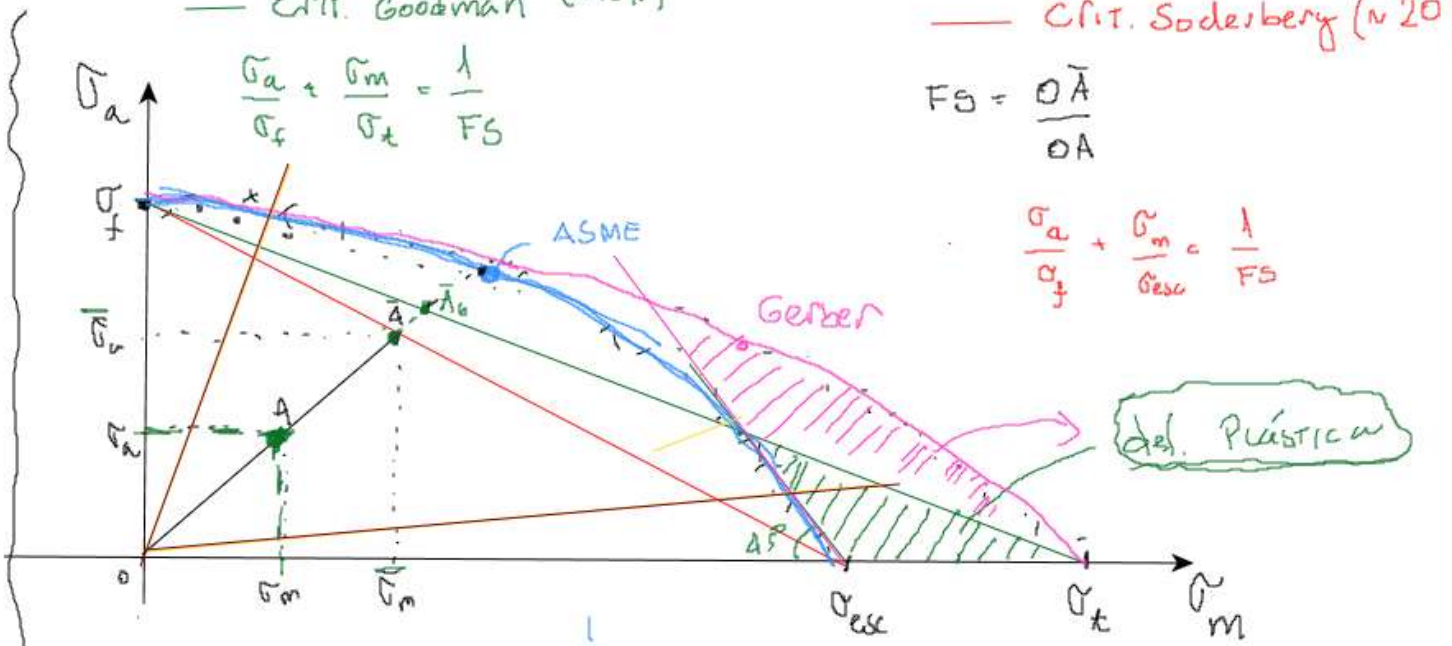
— Crit. Goodman (~1995)

$$\frac{\sigma_a}{\sigma_f} + \frac{\sigma_m}{\sigma_t} = \frac{1}{FS}$$

— Crit. Soderberg (~20)

$$FS = \frac{OA'}{OA}$$

$$\frac{\sigma_a}{\sigma_f} + \frac{\sigma_m}{\sigma_{esc}} = \frac{1}{FS}$$



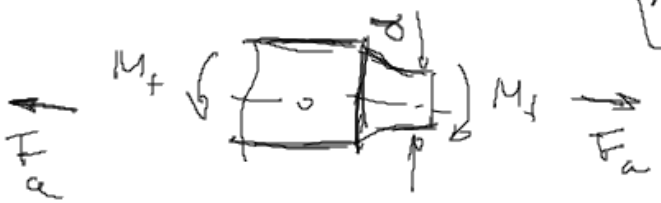
— Critério ASME (~60)

$$\left(\frac{\sigma_a}{\sigma_f}\right)^2 + \left(\frac{\sigma_m}{\sigma_{esc}}\right)^2 = \frac{1}{FS^2}$$

— critério Gerber (~1880)

$$FS \cdot \frac{\sigma_a}{\sigma_f} + \left(FS \cdot \frac{\sigma_m}{\sigma_t}\right)^2 = 1$$

$M_f = 50\,Nm$ $\quad F_a = 20\,kN$



$d = 20\,mm$

$K_f = 1{,}75$ (flexão)

$K_t = 1{,}80$ (tração)

$\sigma_f = 273\,MPa$

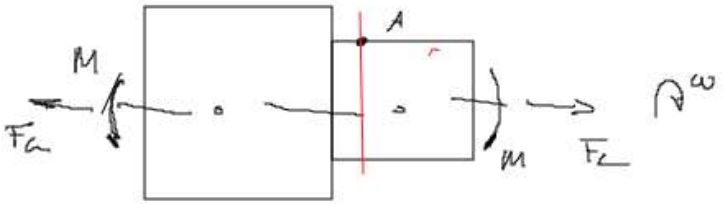
$\sigma_{esc} = 750\,MPa$

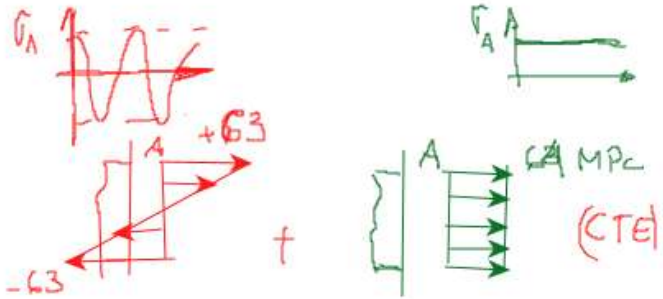
$\sigma_t = 900\,MPa$

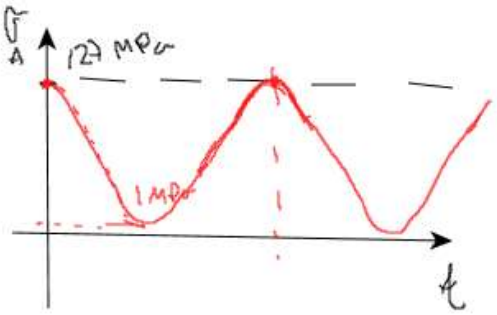
flexão

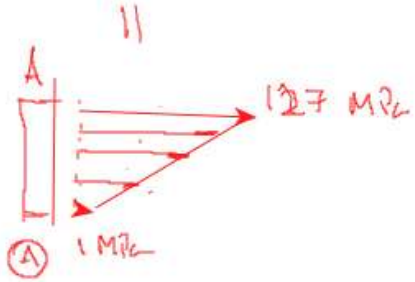
$$\sigma = \frac{32\,M}{\pi d^3} \text{ (flexão)} = 63\,MPa$$

$$\sigma = \frac{4\,F_a}{\pi d^2} \text{ (Força Normal)} = 64\,MPa$$









$\sigma_{max} = 127$ MPa

$\sigma_{min} = 1$ MPa

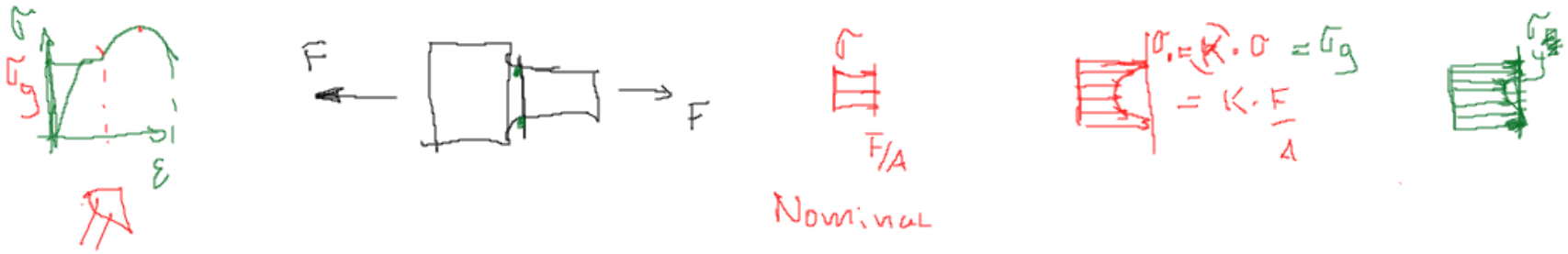
$\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2} = 64$ MPa

$\sigma_a = \frac{\sigma_{max} - \sigma_m}{2} = 63$ MPa

Critérios

$$\text{Se: } \frac{\sigma_a}{\sigma_f} + \frac{\sigma_m}{\sigma_{esc}} = 1 \qquad \frac{1,75 \cdot 63}{273} + \frac{64}{750} = \frac{1}{FS} \Rightarrow \boxed{FS = 2,0}$$

Concentrador de tensão: relevante apenas para a tensão alternada
Na tensão média é esperada a plastificação ao redor do concentrador de tensão.



Go: $\frac{\sigma_a}{\sigma_f} + \frac{\sigma_m}{\sigma_t} = \frac{1}{FS} \Rightarrow \frac{1,75 \cdot 63}{273} + \frac{64}{900} = \frac{1}{FS}$

$\boxed{FS = 2,1}$

Se o material for frágil (apresentar comp. no ensaio de tração) então deve ser considerada a conc. de tensão em σ_m.

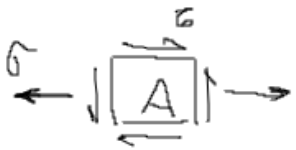
$FS \Rightarrow \frac{1,75 \cdot 63}{273} + \frac{1,80 \cdot 64}{900} = \frac{1}{FS}$ $\quad FS = 1,88$

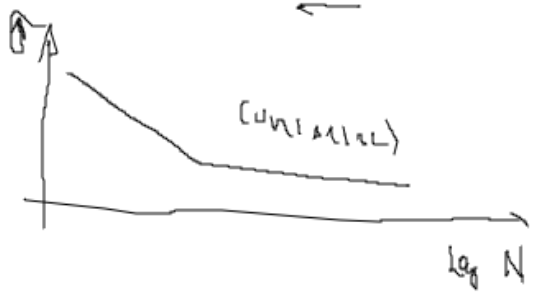
ASME

$$\left(\frac{\sigma_a}{\sigma_f}\right)^2 + \left(\frac{\sigma_m}{\sigma_{esc}}\right)^2 = \frac{1}{FS^2}$$

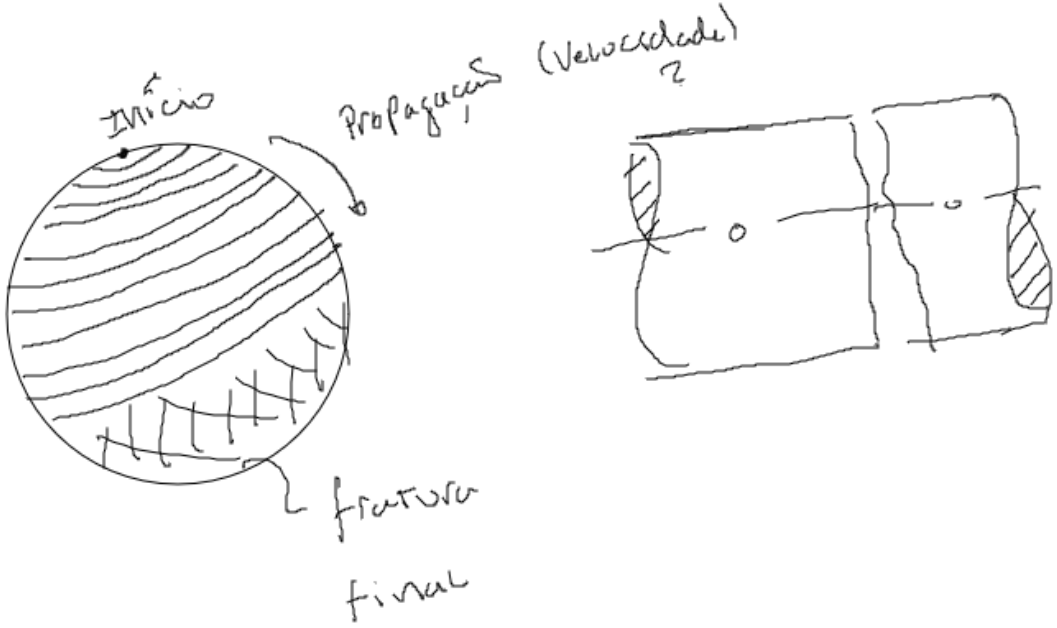
$$F_S \Rightarrow \left(\frac{1{,}75 \cdot 63}{773}\right)^2 + \left(\frac{64}{750}\right)^2 = \frac{1}{FS^2}$$

$$\boxed{FS = 2{,}4}$$





Com como dimensionar à fadiga para estados de tensão multi-axiais?


Início
Propagação
(Velocidade)
2
fratura
final