Estimate S-N curve & C.L.F curves for axial loading, of precision steel parts with $S_u = 150$ kpsi $S_y = 120$ kpsi commercially polished surfaces.
Cross sectional Dims < 2 in

S-N curve $S(10^3)$ $S_n = S(10^6)$

$S_{10^3} = (0.75)(150) = 112$ kpsi

$S_n = S_n' \, C_L \, C_D \, C_S$

$S_n' = (0.5)(S_u) = (0.5)(150) = 75$ kpsi

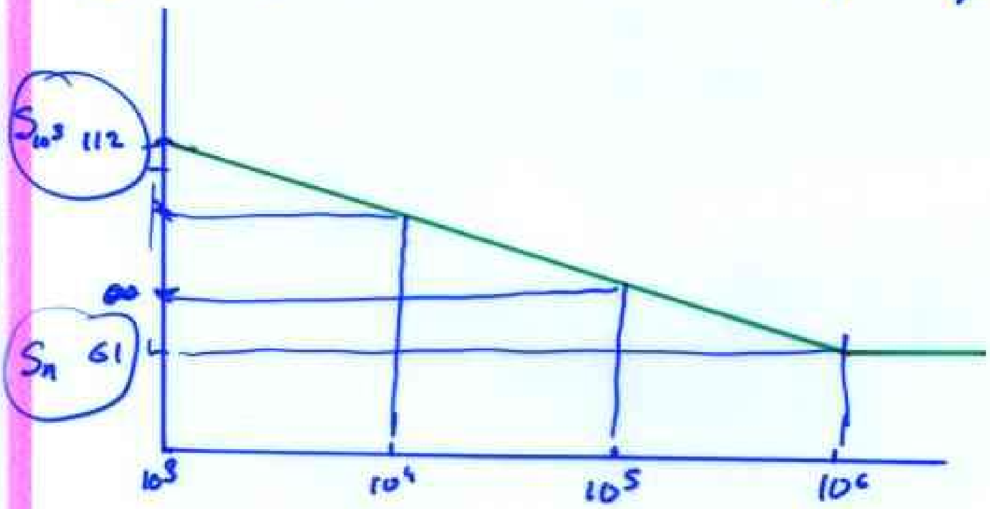
C_S polished $= 0.9$

C_L axial $= 1.0$

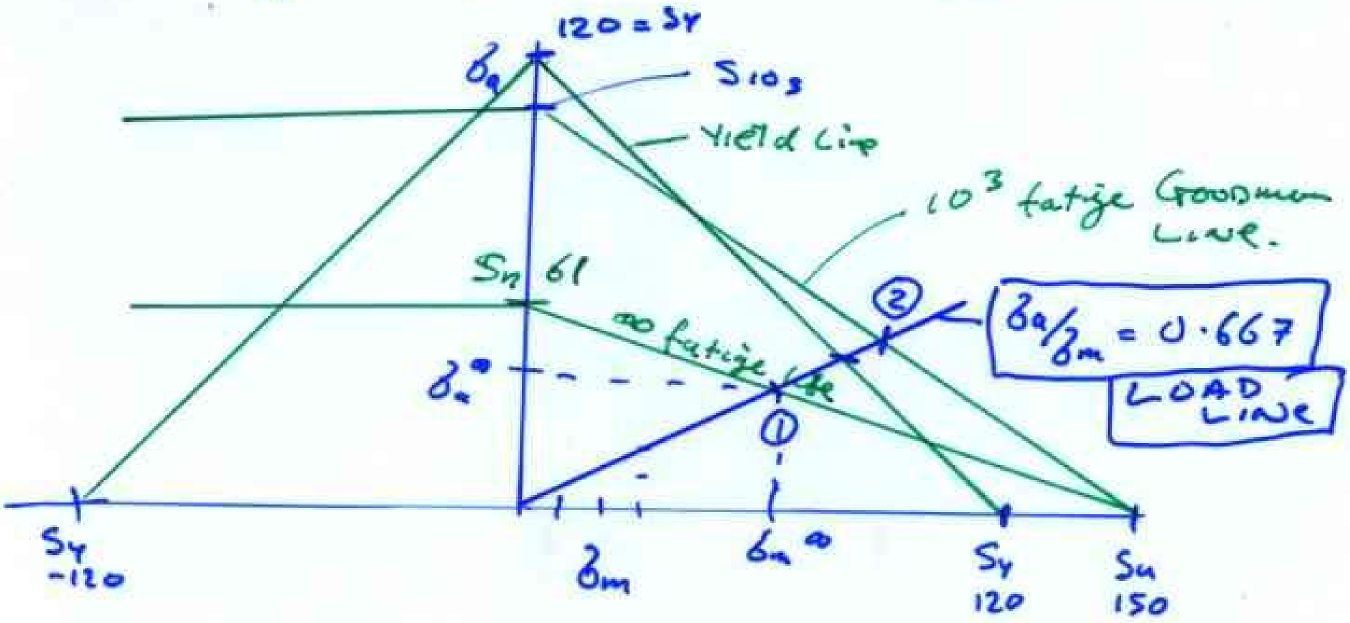
C_D precision axial, $= 0.9$

$S_n = (1.0)(0.9)(0.9)(75) = 61$ kpsi

Estimate S-N curve on Log-Log paper.



Constant Life Fatigue curves. Linear plot NB.



Round tensile link
negligible stress concentration
fluctuating load 1000 lb → 5000 lb
min max
precision manufactured
polished $S_u = 150$ kpsi S_y 120 kpsi
F.S. of 2 to be used
find diameter for ∞ life
" " " 10^3 cycles.

"P" load P_m mean $= \left(\frac{1000 + 5000}{2}\right) \times FS = \underline{6000}$

$$P_a = \left(\frac{5000 - 1000}{2}\right) \times FS = \underline{4000}$$

$\sigma_m = P_m/A$ $\sigma_a = P_a/A$ A is cross sectional area.

$$\frac{\sigma_a}{\sigma_m} = \frac{P_a/A}{P_m/A} = \frac{P_a}{P_m} = \frac{4000}{6000} = 0.667$$

$$\boxed{\frac{\sigma_a}{\sigma_m} = 0.667} \text{ LOAD LINE}$$