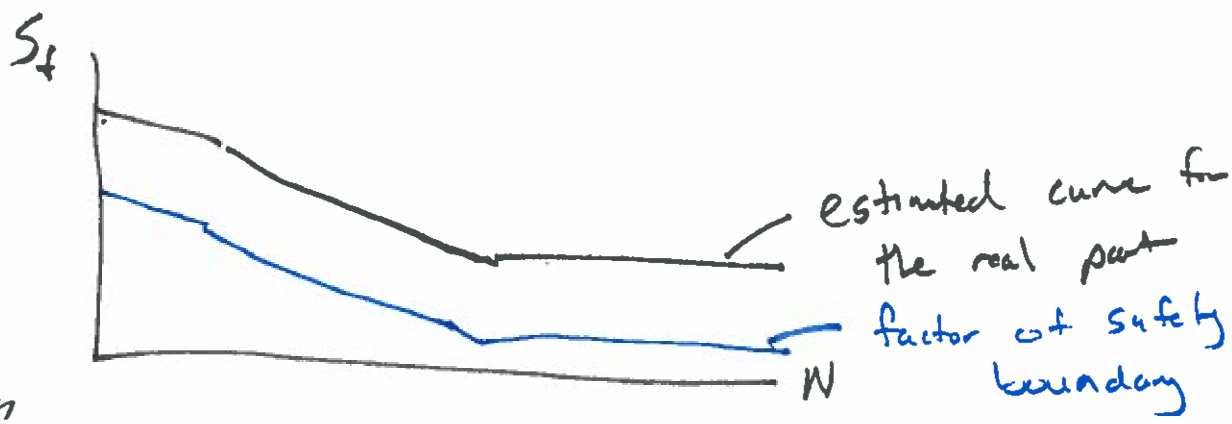
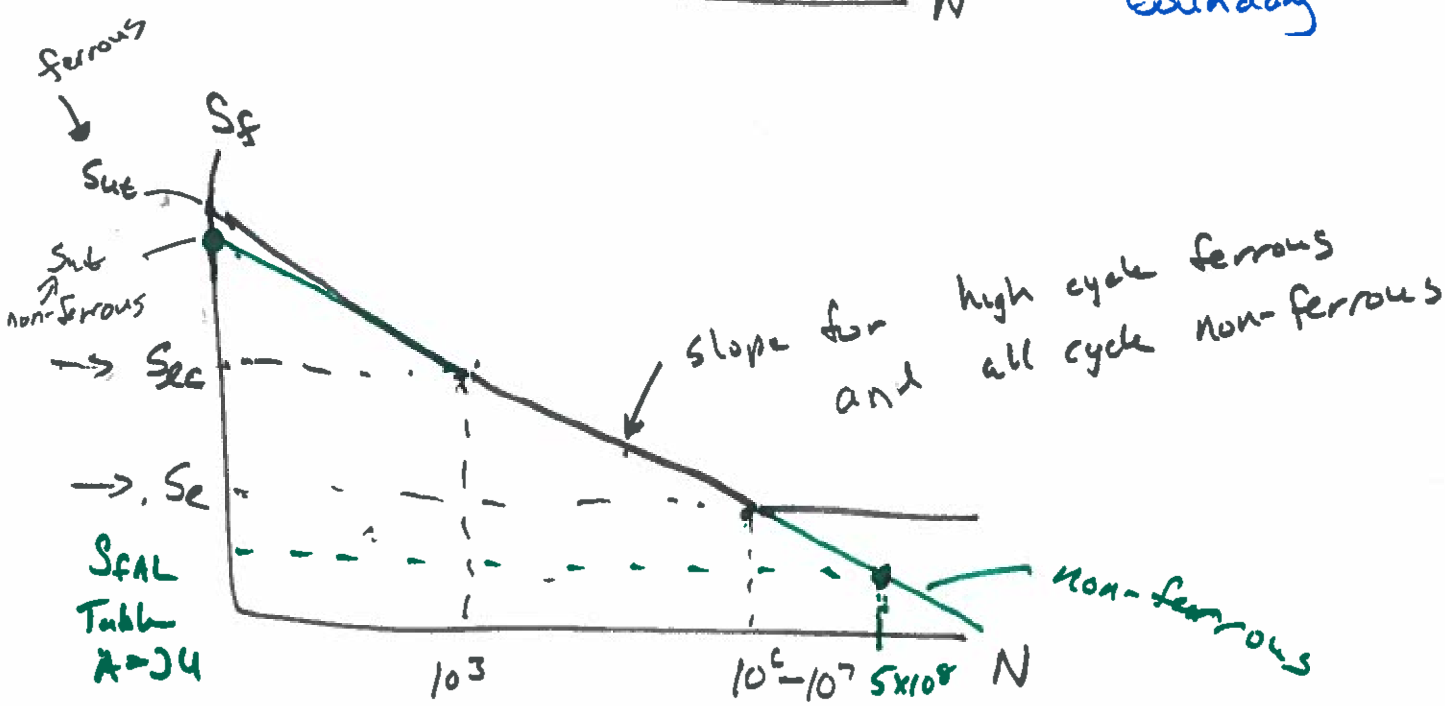


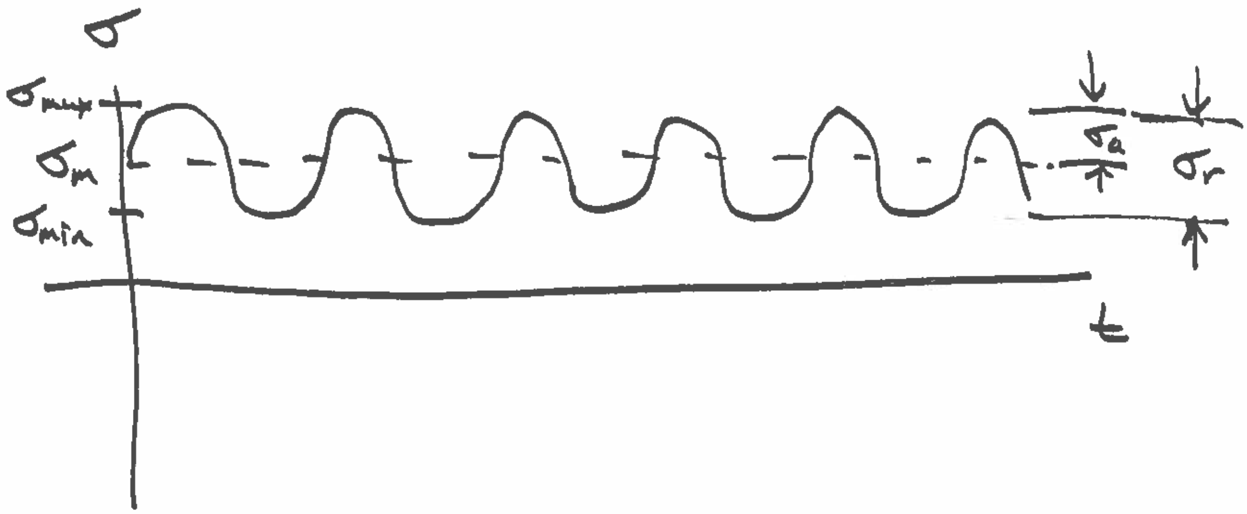


$$S_f \geq \underline{S_{ut} f}$$

$$N = \left(\frac{f S_{ut}}{a}\right)^{1/b}$$

Fluctuating Stress

NON-zero mean stress



$$\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2} \qquad \sigma_a = \left| \frac{\sigma_{max} - \sigma_{min}}{2} \right|$$

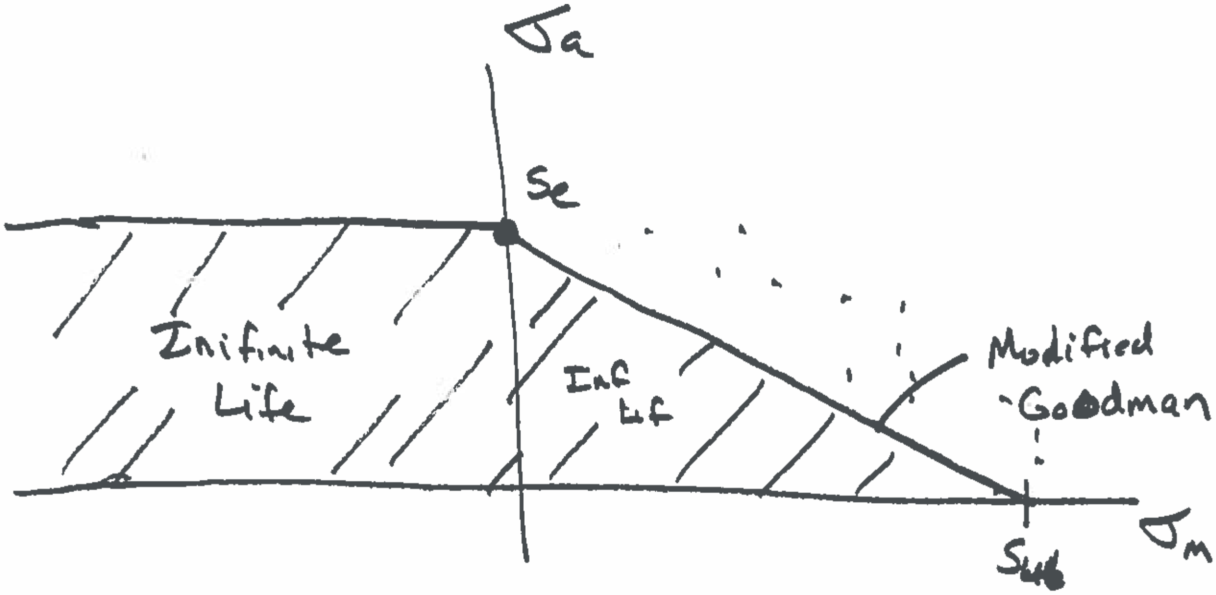
$$\sigma_r = \left| \sigma_{max} - \sigma_{min} \right| \qquad r = A = \frac{\sigma_a}{\sigma_m}$$ (slope of the load line)

If $\sigma_m < 0$ (compression), S_f is same as Moore test, by you also need to check for yield

If $\sigma_m > 0$ (tensile), S_f is <u>less than</u> Moore results
also check for yielding

If $\sigma_a = 0$ ⇒ then part fails in yield or ultimate

If $\sigma_m = 0$ ⇒ fully reversed ⇒ part fails @ $\sigma_a = S_e$ (S_f)
^ or L-25-2

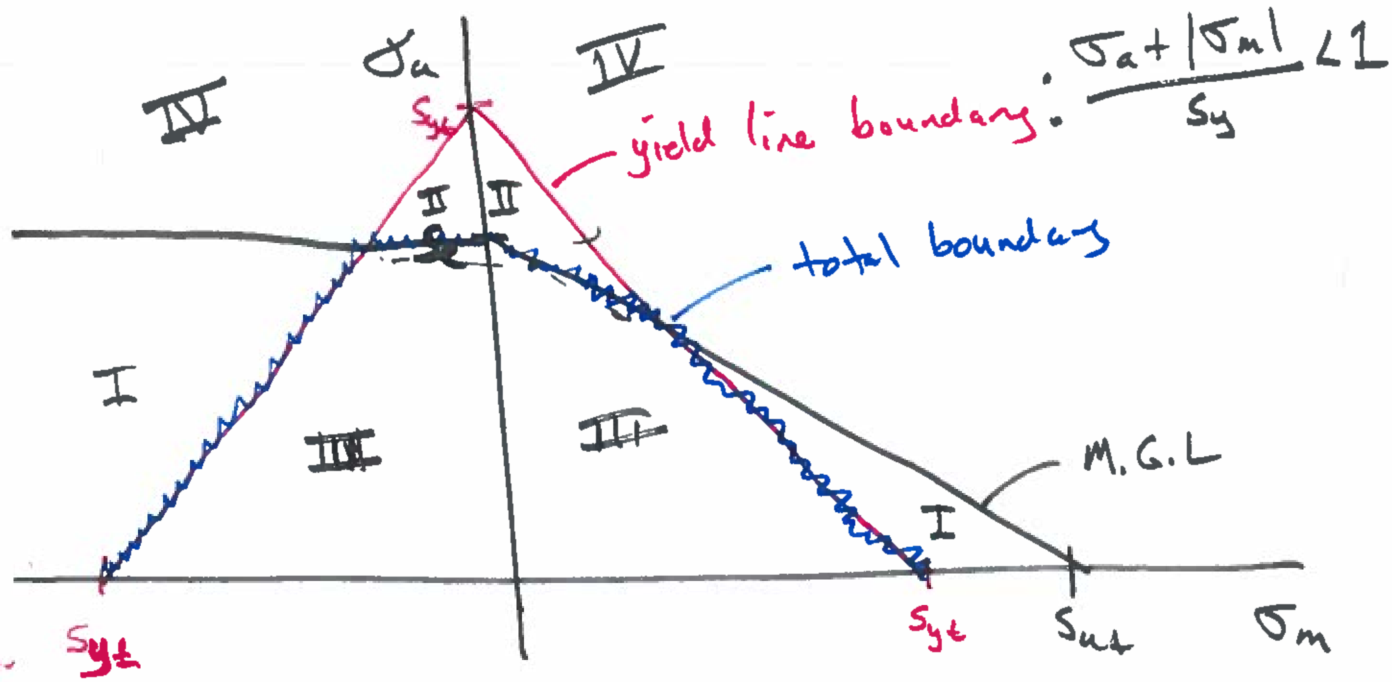


Design Relationships

1) $\dfrac{\sigma_a}{S_e} + \dfrac{\sigma_m}{S_{ut}} < 1 \qquad \sigma_m > 0$

2) $\dfrac{\sigma_a}{S_e} < 1 \qquad \sigma_m < 0$

Now consider yielding (ductile)



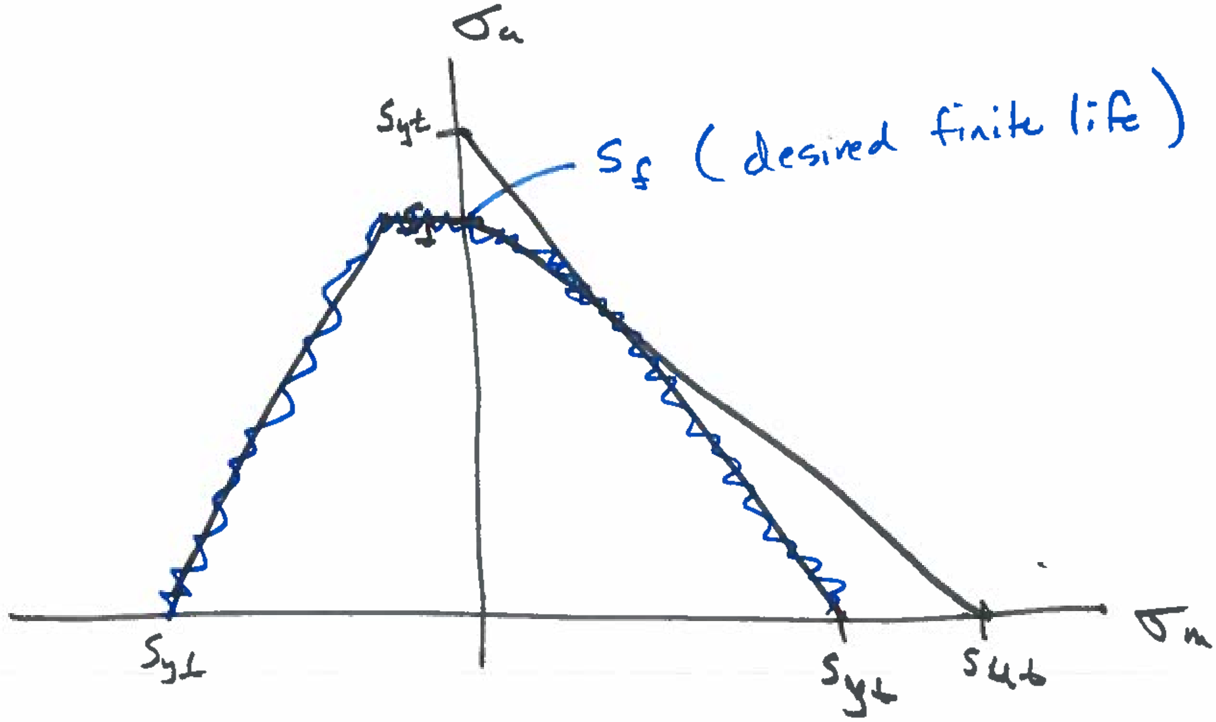
Regions:

I: Immediate failure due to yielding

II: finite life (fails after N cycles)

III: inifinite life

IV: failure due to yielding, fracture, or fatigue



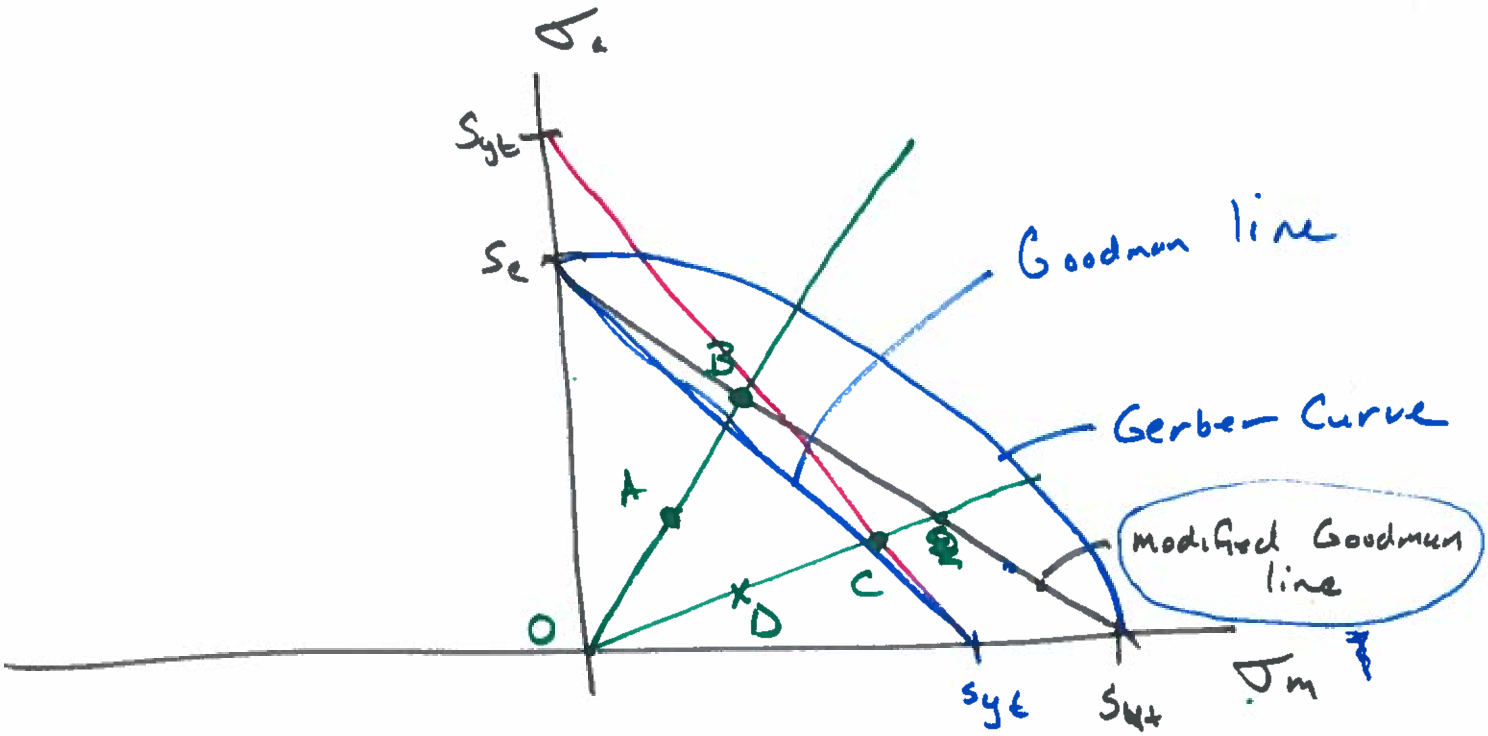
Finite life us $\underline{S_f}$ instead of $\underline{S_e}$

For safe design in finite life (σ_a, σ_m):

$$S_f = a N^b$$

$$a = \frac{(f S_{ut})^2}{S_e} \qquad b = -\frac{1}{3} \log\left(\frac{f S_{ut}}{S_e}\right)$$

f: Fig 6-18



Gerber:

$$\frac{\sigma_a}{S_e} + \left(\frac{\sigma_m}{S_{ut}}\right)^2 < 1, \quad \sigma_m > 0$$

Factor of Safety

Goodman

$$n = \left(\frac{\sigma_a}{S_e} + \frac{\sigma_m}{S_{ut}}\right)^{-1} = \frac{\overline{OB}}{\overline{OA}}$$

yielding

$$n = \frac{S_y}{\sigma_a + \sigma_m} = \frac{\overline{OC}}{\overline{OD}}$$