

# 7.1 (Shigley)

AISI 1045  $\rightarrow$  tensile strength 95 kpsi  
yield  $\rightarrow$  70 kpsi

(a)  $S_n$  endurance limit

(b) life  $S_a = 55$  kpsi given stress

(c)  $10^4$  cycles, find load.

(a)  $S_n' \approx 0.5 S_{ut} = 0.5(95) = \underline{\underline{47.5 \text{ kpsi}}}$

$$\log S_f = \log a + b \log N$$

$$\Leftrightarrow S_f = a N^b$$

given  $S_f$  find  $N$

given  $N$  find  $S_f$

$$N = 10^3 \quad S_f = 0.9 S_{ut} \Rightarrow a 10^{3b} = 0.9 S_{ut} \quad (1)$$

$$N = 10^6 \quad S_f = 0.5 S_{ut} \Rightarrow a 10^{6b} = 0.5 S_{ut} \quad (2)$$

$$(1) \Rightarrow \log_{10}(0.9 S_{ut}) = \log_{10} a + 3b$$

$$(2) \Rightarrow \log_{10}(0.5 S_{ut}) = \log_{10} a + 6b$$

$$(2) - (1) \Rightarrow b = \frac{1}{3} \log_{10} \left[ \frac{0.5 S_{ut}}{0.9 S_{ut}} \right] \quad (3)$$

subst (3) into (1) or into (2)

$$\Rightarrow a = \frac{(0.9 S_{ut})^2}{(0.5 S_{ut})}$$