

ME 5339
HOMEWORK SET NO. 10

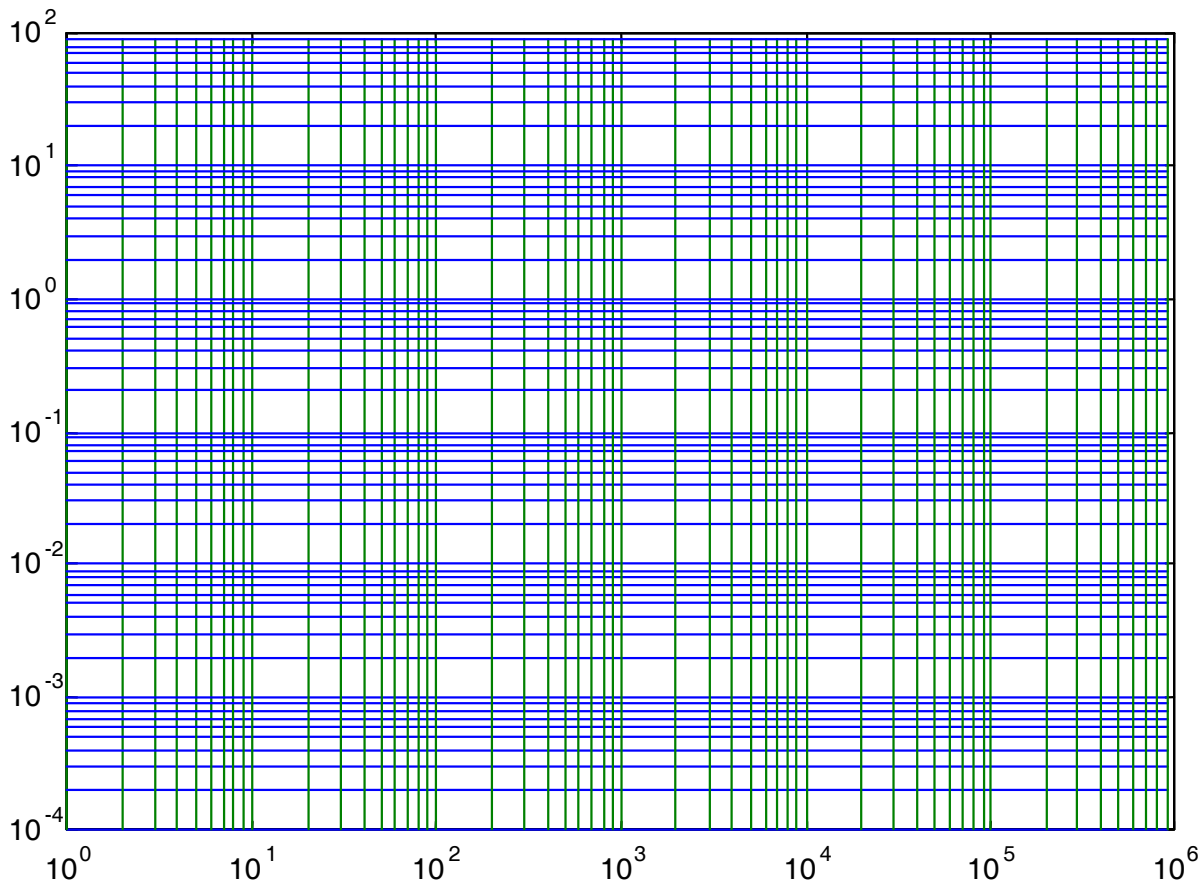
Due Apr. 17, 2008
Three of the problems will be graded.

Problem 10.1

The following stress-strain and strain-life properties are given for a steel:

$$E=30 \times 10^3 \text{ ksi}, \sigma_f' = 150 \text{ ksi}, \epsilon_f' = 1.0; b = -0.105; c = -0.640$$

- a) Draw on log-log coordinates the elastic strain-life, plastic strain-life, and the total strain, $\Delta\epsilon/2$ vs. $2N_f$ curve and Determine the transition life ($2N_t$).
- b) Determine the elastic, plastic, and total strain amplitude for a life of $2N_f$ of 2×10^6 reversals.
- c) Determine the elastic, plastic, and total strain amplitude for a life of $2N_f$ of 500 reversals.
- d) Determine the transition life



Problem 10.2

A machine part is made of a steel with $S_{ult}=100\text{Ksi}$, $S_y= 80 \text{ Ksi}$ and a fully corrected endurance limit, $S_e=25 \text{ Ksi}$. The stress components are $\sigma_a=16/d^2$ and $\sigma_m=30/d^2$ in Ksi.

If $d=2$ inches, find a safety factor by using

- a) Goodman model
- b) Gerber model
- c) Morrow model

If safety factor is equal to 3, find the diameter of the part by using

- d) Goodman model
- e) Gerber model
- f) Morrow model

Problem 10.3

The endurance limit of a steel member is 12 MPa and the tensile strength is 385 MPa. What is the fatigue strength corresponding to a life of 70,000 cycles?

Problem 10.4

Estimate the endurance strength of 1 32-mm diameter rod of AISI 1035 steel having a machined finish and heat-treated to a tensile strength 710 MPa.