

EME 150A Fall 2015 Homework #07

Date: Monday, November 16, 2015

DUE: Monday, November 23, 2015 before class in Box D in the MAE department.

Problem 1

(1) Estimate the endurance limit and the low cycle fatigue strength for an axially loaded ground steel specimen with $S_{ut} = 150\text{ksi}$, $d = 1.0\text{in}$, and $T = 70^\circ\text{F}$. (2) Determine the expected life for $\sigma_a = 75\text{ksi}$ and $\sigma_m = 0\text{ksi}$.

Problem 2

Determine the required diameter for a round steel element that is axially loaded from -2500 to 2500 lb in fully reversed cycles. Assume it is ground, $S_{ut} = 150\text{ksi}$, and is loaded at $T = 70^\circ\text{F}$. Determine the diameter for infinite life and 10^3 cycles.

Problem 3

Given a 2024-T3 aluminum specimen forged to 2.0in round, determine the fatigue strength for 3×10^7 cycles of loading for fully reversed torsion. Note that for non-ferrous metals, the unmodified fatigue strength is taken at $N = 5 \times 10^8$ cycles (see Table A-24).

Problem 4

A simple hot rolled 1020 steel cantilever beam of length 0.6 m is loaded transversely at the end with a fully reversing load of $\pm 5\text{kN}$. The beam has a rectangular cross section with a width of 40mm. What is the required height of the beam's cross section to guarantee safe operation up to $N = 10^4$ cycles with a design factor of 2? Neglect any stress concentrations.