ME 370

Homework Assignment #21

1. Problem 6-15
   • Use Modified Goodman and calculate the number of cycles to failure as well as the factor of safeties against yielding and fatigue
2. Problem 6-16
3. Problem 6-22

6-15 A solid round bar with diameter of 2 in has a groove cut to a diameter of 1.8 in, with a radius of 0.1 in. The bar is not rotating. The bar is loaded with a repeated bending load that causes the bending moment at the groove to fluctuate between 0 and 25 000 lbf · in. The bar is hot-rolled AISI 1095, but the groove has been machined. Determine the factor of safety for fatigue based on infinite life and the factor of safety for yielding.

6-16 The rotating shaft shown in the figure is machined from AISI 1020 CD steel. It is subjected to a force of $F = 6$ kN. Find the minimum factor of safety for fatigue based on infinite life. If the life is not infinite, estimate the number of cycles. Be sure to check for yielding.

Problem 6–16
Dimensions in millimeters
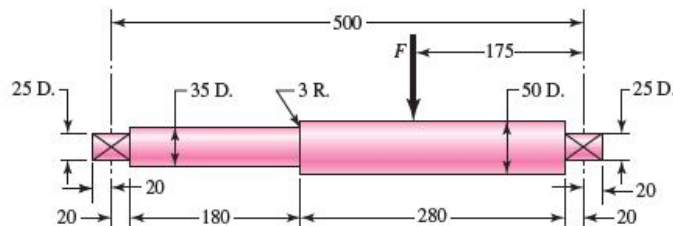
6-22 Repeat Prob. 6–20 but with a steady torsional stress of 15 kpsi, an alternating torsional stress of 10 kpsi, and an alternating bending stress of 12 kpsi.

6-20 A bar of steel has the minimum properties $S_e = 40$ kpsi, $S_y = 60$ kpsi, and $S_{ut} = 80$ kpsi. The bar is subjected to a steady torsional stress of 15 kpsi and an alternating bending stress of 25 kpsi. Find the factor of safety guarding against a static failure, and either the factor of safety guarding against a fatigue failure or the expected life of the part. For the fatigue analysis use:
(a) Modified Goodman criterion.
(b) Gerber criterion.
(c) ASME-elliptic criterion.