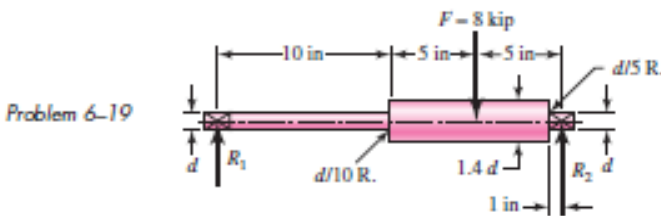


ME326
Assignment 3

Due Nov. 5, 2014

6-7 A steel rotating-beam test specimen has an ultimate strength of 150 kpsi and a yield strength of 135 kpsi. It is desired to test low-cycle fatigue at approximately 500 cycles. Check if this is possible without yielding by determining the necessary reversed stress amplitude.

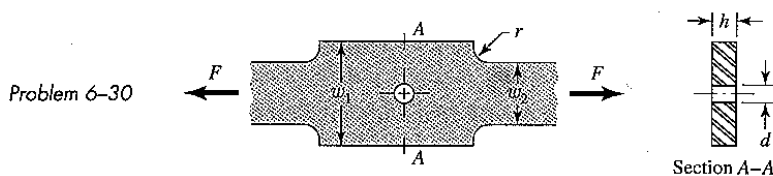
6-19 Bearing reactions R_1 and R_2 are exerted on the shaft shown in the figure, which rotates at 950 rev/min and supports an 8-kip bending force. Use a 1095 HR steel. Specify a diameter d using a design factor of $n_d = 1.6$ for a life of 10 hr. The surfaces are machined.



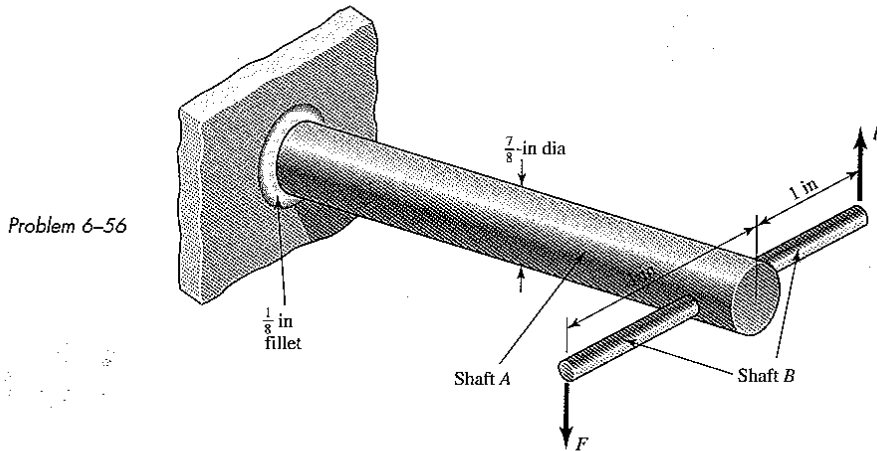
6-20 A bar of steel has the minimum properties $S_e = 40$ kpsi, $S_y = 60$ kpsi, and $S_{ut} = 80$ kpsi. The bar is subjected to a steady torsional stress of 15 kpsi and an alternating bending stress of 25 kpsi. Find the factor of safety guarding against a static failure, and either the factor of safety 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.

6-30 The figure shows the free-body diagram of a connecting-link portion having stress concentration at three sections. The dimensions are $r = 0.25$ in, $d = 0.40$ in, $h = 0.50$ in, $w_1 = 3.50$ in, and $w_2 = 3.0$ in. The forces F fluctuate between a tension of 5 kip and a compression of 16 kip. Neglect column action and find the least factor of safety if the material is cold-drawn AISI 1018 steel.



- 6-56** In the figure shown, shaft *A*, made of AISI 1020 hot-rolled steel, is welded to a fixed support and is subjected to loading by equal and opposite forces *F* via shaft *B*. A theoretical stress-concentration factor K_{ts} of 1.6 is induced by the $\frac{1}{8}$ -in fillet. The length of shaft *A* from the fixed support to the connection at shaft *B* is 2 ft. The load *F* cycles from 150 to 500 lbf.
- (a) For shaft *A*, find the factor of safety for infinite life using the modified Goodman fatigue failure criterion.
- (b) Repeat part (a) using the Gerber fatigue failure criterion.



- 6-59** A flat leaf spring has fluctuating stress of $\sigma_{\max} = 360$ MPa and $\sigma_{\min} = 160$ MPa applied for $8 (10^4)$ cycles. If the load changes to $\sigma_{\max} = 320$ MPa and $\sigma_{\min} = -200$ MPa, how many cycles should the spring survive? The material is AISI 1020 CD and has a fully corrected endurance strength of $S_e = 175$ MPa. Assume that $f = 0.9$.
- (a) Use Miner's method.
- (b) Use Manson's method.