BEJOYA DAS TUMPA
Lecturer Dept. of FSE, GUB

VARYING LOADS AND STRESS CONCENTRATIONS

Stresses may very well vary in a quite irregular and perhaps unpredictable manner. There will be a maximum and minimum stress, an average or mean stress S_m, and a variable or alternating component of the stress S_a. The average or mean stress S_m, and the alternating component S_a are:

$$S_m = \frac{Smax+Smin}{2}$$

And $S_a = \frac{Smax-Smin}{2}$

Where a compressive stress is a negative number. For a complete reversal $S_m = 0$; that is, $S_{min} = -S_{max}$ and $S_a = S_{max}$. In every case, $S_{max} = S_m + S_a$

Stress ratio defined as

$$R = \frac{Smin}{Smax}$$

With stresses used algebratically; R = -1 for completely reversed stress.

Moment, $S_m = \frac{Mm\,C}{I}$

From Soderberg Line,

$$\frac{1}{N} = \frac{Sms}{Sys} + \frac{Sas}{Sns}$$

Here, N = 1.6

S_{ns} = Shearing endurance strength

S_{ys} = Shearing yield strength

S_{ms} = Mean shear stress

S_{as} = Alternative shear stress

Endurance strength

Endurance strength is used to describe a property of materials: the amplitude (or range) of cyclic stress that can be applied to the material without causing fatigue failure.

For wrought steel in its more commonly met commercial forms, it is often assumed that the average endurance limit for an average Su is

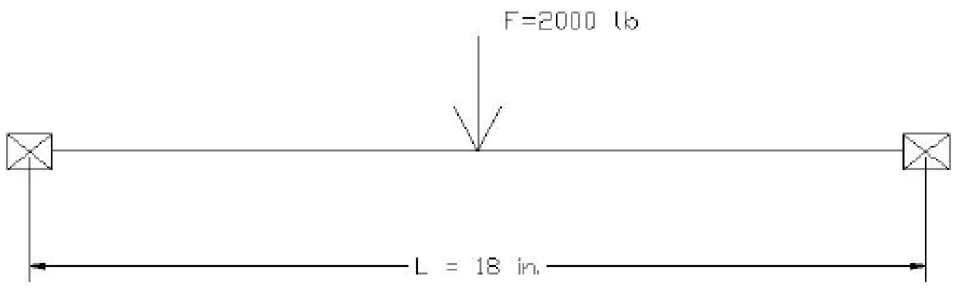
$S_n' = 0.5\ S_u$

And

$S_{ns} = 0.6\ S_n' = 0.6$ (Endurance strength, rotating beam)

Problem:

A shaft supported as a simple beam, 18 in. long, is made of carburized AISI 3120 steel (Table AT 10). With the shaft rotating, a steady load of 2000 lb. is applied midway between the bearings. The surfaces are ground. Indefinite life is desired with *N* =1.6 based on endurance strength. What should be its diameter if there are no surface discontinuities?



Solution:

Please collect the hard copy!!!!