OBJECTIVE OF THIS ASSIGNMENT: Was to design the tension bar diameter and required thread size for AISI 1020 STEEL.

PART A - Tension bar calculations

Using supplied VB program

$d := 16.63ft$ Optimum positiion of tension bar

$F_{max} := 2459lb$ Maxumum force calculated using VB program.

$F_{min} := 215lb$ Minimum Force calculated using VB program

$\theta := 31.0deg$ Angle Calculated using VB program.

Force Mean : $F_m := \frac{(F_{max} + F_{min})}{2}$ $F_m = 1.337 \times 10^3 lb$

Force Alternating $F_a := \frac{(F_{max} - F_{min})}{2}$ $F_a = 1.122 \times 10^3 lb$

Sy :Material Yield Strenth

Su : Material Tensile Strenth $S_y := 51000 \frac{lb}{in^2}$ $S_u := 61000 \frac{lb}{in^2}$

Endurance strenth procedure :

$Sn := 22000 \frac{lb}{in^2}$ For rolled bar having a value of 61000psi

$C_s := 0.94$ Assume Dia. = .875 in Fig.5-8 $K_t := 1$ No stress concentration in this design.

$C_m := 1$ Material is wrought steel rod

$N := 4$ N = Saftey factor Saftey factor of 4 was used because of the unsertanty of some loads or the possability of shock loading.

$C_{st} := 0.8$ For tensile stress

$C_R := 0.81$ For 0.99 reliability Table 5-2

$S_{n1} := Sn \cdot (C_s) \cdot (C_m) \cdot (C_{st}) \cdot (C_R)$ $S_{n1} = 1.34 \times 10^4 \frac{lb}{in^2}$

$A := N \cdot \left(\frac{F_m}{S_y} + \frac{K_t \cdot F_a}{S_{n1}} \right)$ $A = 0.44 in^2$

From table A2-2(b)
.875 - 9 UNC

$A_1 := 0.462in^2$

$\sigma_{max} := \frac{F_{max}}{A_1}$ $\sigma_{max} = 5.323 \times 10^3 \frac{lb}{in^2}$

$\sigma_{min} := \frac{F_{min}}{A_1}$ $\sigma_{min} = 465.368 \frac{lb}{in^2}$

$$\sigma_m := \frac{\sigma_{max} + \sigma_{min}}{2} \qquad \sigma_m = 2.894 \times 10^3 \frac{lb}{in^2}$$

$$\sigma_a := \frac{\sigma_{max} - \sigma_{min}}{2} \qquad \sigma_a = 2.429 \times 10^3 \frac{lb}{in^2}$$

$Sn := 22000 \frac{lb}{in^2}$ for rolled bar having a value of 61000Ksi

$C_s := 0.92$ Assume Dia. =7/8 in Fig.5-8

$C_m := 1$ Material is wrought steel rod

$K_t := 1$ No stress concentration

$C_{st} := 0.8$ For tensile stress

$C_R := 0.81$ For 0.99 reliability Table 5-2

$$S_{n2} := Sn \cdot (C_s) \cdot (C_m) \cdot (C_{st}) \cdot (C_R) \qquad S_{n2} = 1.312 \times 10^4 \frac{lb}{in^2}$$

$$N := \frac{1}{\left(\frac{\sigma_m}{S_y} + \frac{K_t \cdot \sigma_a}{S_{n2}}\right)} \qquad N = 4.134$$

SAFTEY FACTORY

From table A2-2(b)
.875 - 9 UNC is the standardized thread size of the area of .44in sq.

In conclusion the calculations above prove that the standardized tension bar diameter of .875in Appendix 4
give a more than satisfactory saftey factor of 4.134.