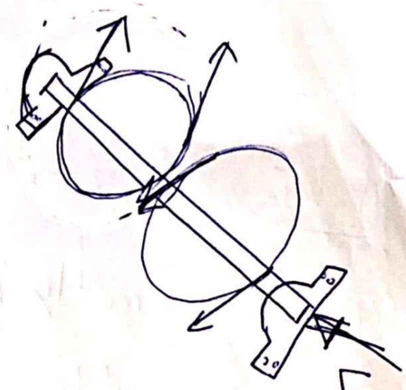
6- calculate F_e at new $i = 2$

7- C_{10} = , ~~does~~ is this the same bearing as before? if yes stop, if no do this again.

the one directly before it, we do this for تأكيد

Selecting the right bearing

Radial and thrust forces



1 We do everything I wrote having a radial force.

2 We do not find C_{10} just yet, we go to

$$F_e = X_i V F_r + Y_i F_a$$

$F_a \rightarrow$ thrust force.

$F_r \downarrow$ use reaction force of the bearing equal to thrust force

1- use $i=2$ $X_2 = 0.56$ $Y_2 = 1.63$ at first.

2- C_{10} at this value, $C_{10} = a_f F_e \left(\frac{x_D}{x_0 + (\theta - x_0)(1-R_D)^{\frac{1}{b}}} \right)^{\frac{1}{a}}$

3- $\frac{F_a}{C_0} \rightarrow$ get this from C_{10}

4- e at this value

5- $\frac{F_a}{V F_r}$ $\leq e$ $i=1$

$> e$ $i=2 \rightarrow$ at what value?

⑤ We end up using goodman failure criterion $\underline{\underline{n}}$ and see if it failes or not.

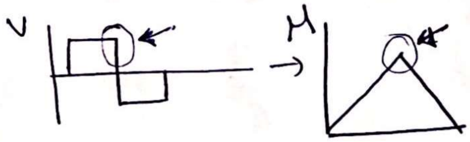
Shaft design :

Failure-fatigue analysis:

① We first begin as we did in chapter 11, $\Sigma T = 0$ $\Sigma M = 0$ $\Sigma F = 0$ to find reactions of bearings and force values.

② We make a shear + moment diagrams for all forces, we find in y direction, and z direction.

③ We find from the diagrams the point on which has maximum stress



and find $M_a = \sqrt{M_{y\,max}^2 + M_{z\,max}^2}$ on that point.

$$T_m = r \times F$$

④ We begin with Ch6 moves until we get to K_f, K_{fs} and find them.

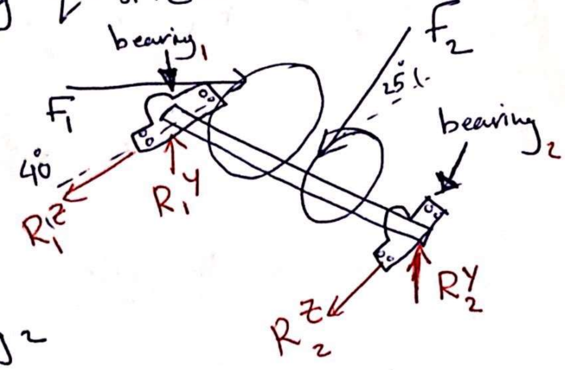
③ $R_1 = \sqrt{R_1^{y2} + R_1^{z2}}$

$R_2 = \sqrt{R_2^{y2} + R_2^{z2}}$

we take larger, and this is F_D "

④ C_{10} then table 11-2.

Solving a gear-bearing question:



Selecting the right bearing:

Only radial force

① $R_{\substack{\text{system}\\\text{pair}}} = R_{\text{bearing 1}} \times R_{\text{bearing 2}}$

$\sqrt{R_{\text{system}}} = R_{\text{of one bearing}}$ (what C_{10} equation will you use?)

② $\Sigma T = 0$ around shaft

$\Sigma M^y = 0$ on one of the bearings (we look at forces in z direction) + use reaction too

$\Sigma M^z = 0$ on one of bearings (we look at forces in y direction) + use reactions t

$\Sigma F^y = 0$

$\Sigma F^z = 0$

$T = \underset{\substack{\downarrow\\\text{on what}\\\text{it is going around}}}{r} \times F$, $M = \underset{\substack{\downarrow\\\text{to where it}\\\text{will bend about}}}{r} \times F$

$\hat{i} \times \hat{j} = \hat{k}$, $\hat{j} \times \hat{k} = \hat{i}$, $\hat{k} \times \hat{i} = \hat{j}$

if for example the bending moment goes around z axis then its initiated stress should be:

$$\sigma_{xx \text{ or } yy} = \frac{M_z \, y}{I_{zz}} \to (r \text{ in case of rod})$$

$$\sigma_{xx \text{ or } yy} = \frac{F}{A}$$

of. [illegible] normal stresses

→ if any are both in xx or yy You can sum them up.

$$\tau_{max} = \frac{T r}{J}$$

(from torque)

after this, you should be able to find max shear stress, you can also find principal stresses:

$$\sigma_{1,2 \; max, min} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

and θ_s, θ_p, and $\sigma_{avg} = \frac{\sigma_x + \sigma_y}{2}$

Lastly, You could get asked about Mohr's circle which is on OneNote.

A Summary for what we have learnt from

Ch 1 ⇒ Ch 3-5 → 3-12 ⇒ Ch 5 von mises + tresca.

Ch 1: You might get asked to find FOS or reliability using data given.

Ch 3-5 → 3-12: asked about maximum shear stress and principal stresses.

$\boxed{1}$ Find critical section, which will be farthest away from forces, and has the least diameter or ابعاد, and will not be at the neutral axis N.A of this section.

$\boxed{2}$ We want to ننقل the forces given on every "حالة تغير طعجة" ... in the bar/rod to see what kind of moment they make, is it bending or torque? using ناتج

$M / T = \vec{r} \times \vec{F}$ depending on the direction

take the whole distance.

$\boxed{3}$ Using right hand rule, we use our thumb as direction to see how this moment لاف so we can know what we need to know about σ, τ

$\boxed{4}$

$$\tau_{\text{max shear}} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

we consider these bending moment + normal ~~[illegible]~~ forces

we consider this shear stress from torque.