Lezione 5 - Detail Design 2 (Allignment & Centering)

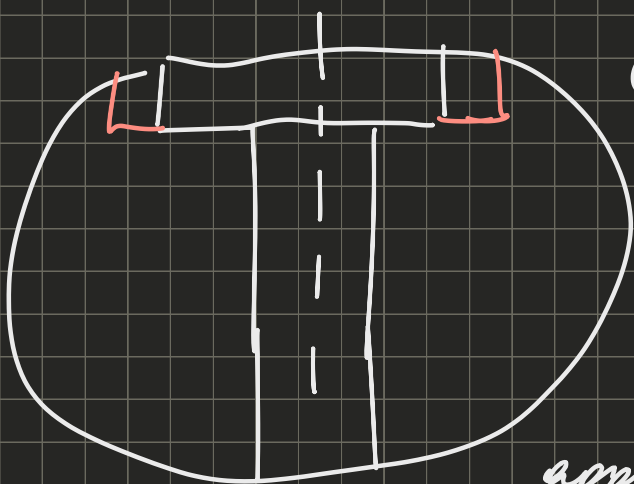
- Allignment and centering
- Discussion of engineering design details

Allignment issues can compromise a systems kinematics.

Understanding where to apply tollerances.

We start with a ball valve as an easy example.

Contact between bodies provides centering,
contact with more of than one surface is to much since



The axis of both parts in theory are alligned but in reality they are not alligned, so we either apply tollerances, or chose one to be the one which centers, whereas the other is redundant. To make sure the other is redundant we can increase the dimension of it so it doesn't accidentaly impose centering on our stem.

The flange on the stem shouldn't be tooh thick as to induce issues where to body and cover grip it, reducing it's ability to rotate.

We can to make sure the flange is able to rotate without pressure from the follower.

We could apply tollerances, but we could just reduce the size.

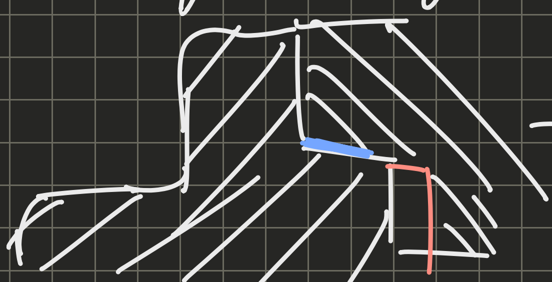
Whenever possible we try to not use tollerances to reduce cost and render our models error proof.

The flanges are more difficult to center, as they have many cylindrical surfaces which can all have center axis. We need the centering of the flange to make the ball can fit between the flanges and so that there is no pressure on them.

The allignment of the flanges is permitted by the interaction with the cylindrical surface interaction with the body.

To allign the flange with ball we need to guarantee allignment between the two which is hard.

Axially (axial allignment) we don't want to press to much but also not too little on the ball.
In this case there are redundant contacts, it is good enough to impose one.



→ we reduce the body so we don't reduce the centering surface we have chosen.

Whenever we have an assembly we need to question whether we need any alligment between parts. We need to make sure we impose to much force or too little. We also need to reduce the redundancy.

While we design with nominal values, real values can be different, and while we can use tollerances they cost so if we can we just remove material.

To reduce leakages we can introduce seals.

Seals
Considrations:

non-static

- static seal, contact seal or non-contact seal
- Horizontal or vertical arrangement.
- Purpose:
  - Grease and lubricant retention (what we don't want to leave)
  - Contaminant Exclusion (what we don't want to enter)
  - Retention or exclusion
  - Separating Liquids.
- counterface hardness (what surface are we in contact)
  - we don't want to wear the surface or seal (to quickly)
- speed of sealing lip.
- other requirements

Non-rubbing seals (not in contact)

- small gap (dry / dust free)
- grooves improve effective of seal, since they create a sequence of pressure drops.
- one helical groove, works if the shaft only goes in one direction.
- labyrinth with multiple chambers
  - can be radial or axial
    - radials have issues when there are temperature changes as the shaft will lengthen, reducing the space between.
    - axials can have issues due to vibrations.

Rubbing Seals (contact between static and rotating)

- felt washers (used for grease, not oil), suitable with speeds up to 4 m/s
  - can be combined with labyrinth more fluid grease
- lip seal → worm gear had it (look for direction whether)
  - different designs: for retention or against contaminants
    - adds a elastic ring to provide more seal

When we do not have motion, either we used a soft material gripped by bolts, or we use an o-ring.