Assemblies

24-370 - Spring 2011

Professor Steve Collins

Syllabus and Grading Questions

- Grading scheme reminder:
  - Homeworks: 25% of total grade
    - About 9 HWs total, for about 3% of final grade each
  - Project 1: 25% of total grade
  - Project 2: 25% of total grade (Due ~ Mar. 21)
  - Project 3: 25% of total grade (Due ~ May 5)
- Project 1 Grading:
  - Working through reports now
  - Will receive final graded reports after revision

Project 1 Rev 1 Debriefing

- Explore the high-level design space more
  - Keep it simple, elegant
- Free Body Diagrams
  - Use early and often
  - Use germane loading (forces vs. moments)
- Specialized analyses
  - Ring analysis
  - Buckling
  - Overconstraint

Project 1 Debriefing

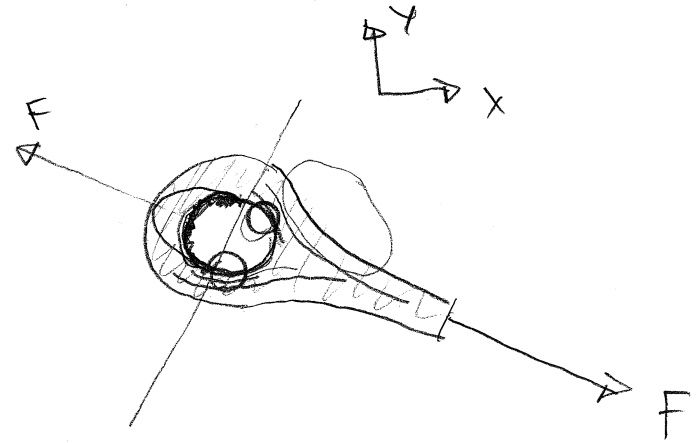
- SolidWorks refinement issues
  - Under-optimizing stress concentrations
  - Implications of fixing holes
  - Over-optimizing on mis-constrained models
- Von Mises equivalent and (tensile) yield strength
- Manufacturing issues
  - Very small features
  - Tolerances…
  - Pockets - sorry!
- Tolerances in Engineering Drawings

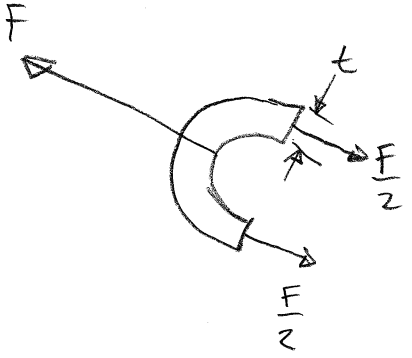
CIRCLE?

PROPERTIES?

H-ADAPTIVE

$F_{CRIT} = \frac{CE}{IL}$



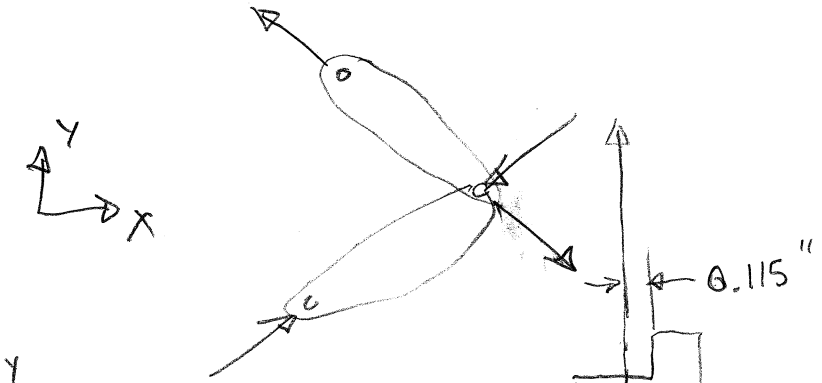


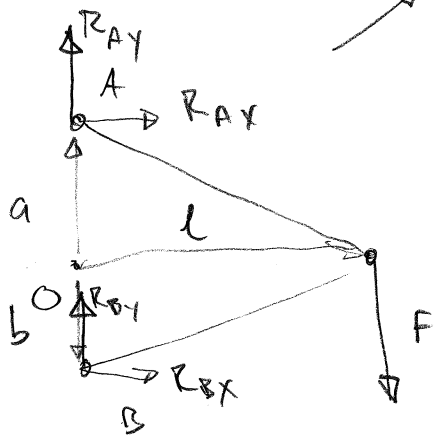
$\sigma = \frac{\frac{F}{2}}{t \cdot depth_Z}$

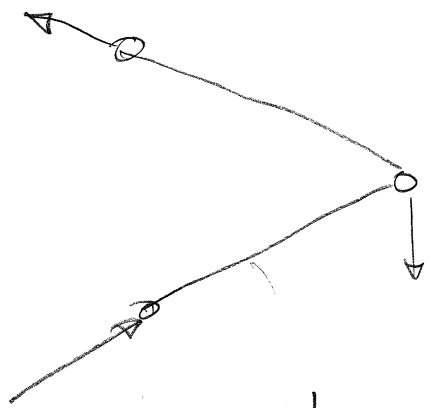
SEND MASSES

* BOXES

INDEPENDENT FIXING

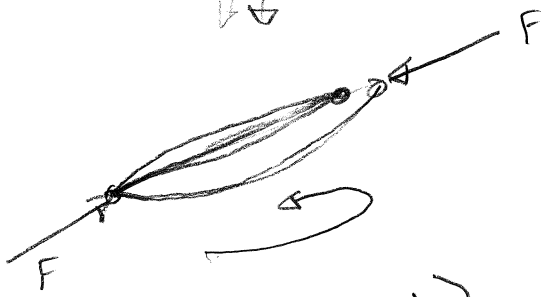






$$\sum F_y = 0 = F + R_A + R_B$$

$$R_{A_y} = R_{B_y} = \frac{1}{2}F$$

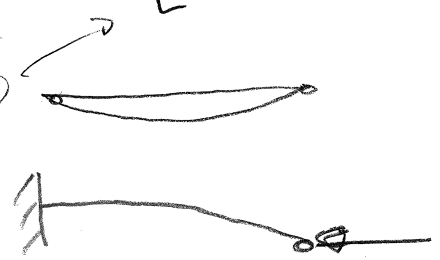


$$\sum M_{/O} = 0 = Fl + a \cdot R_{AX} - b \cdot R_{BX}$$

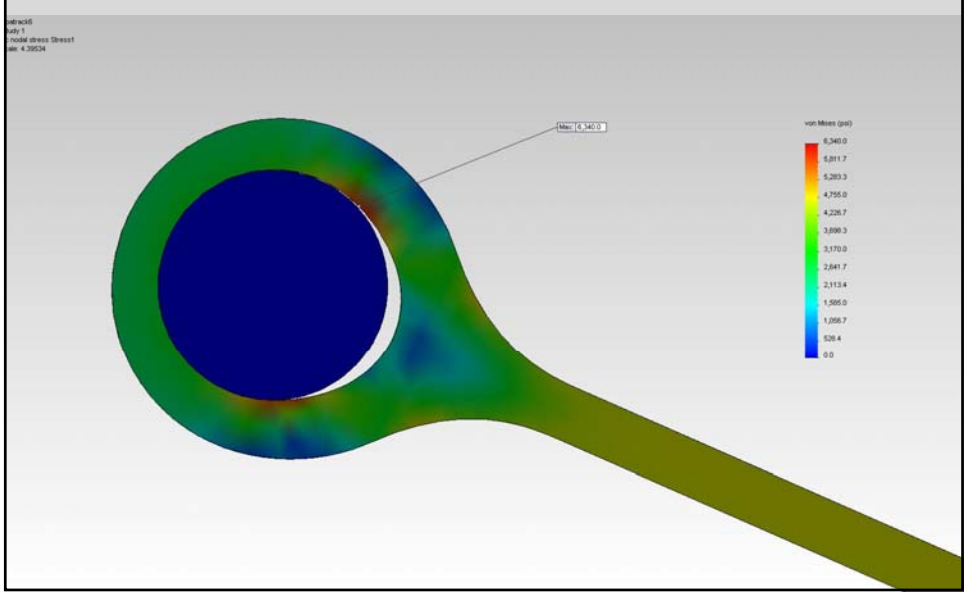
$$\sum F_x = 0 = -R_{AX} + R_{BX} \Rightarrow R_{AX} = -R_{BX}$$

$$Fl = -(a+b) R_{AX} \Rightarrow R_{AX} = \frac{-fl}{a+b}$$

$$\frac{EI}{cL} \rightarrow L = f(a,b)$$

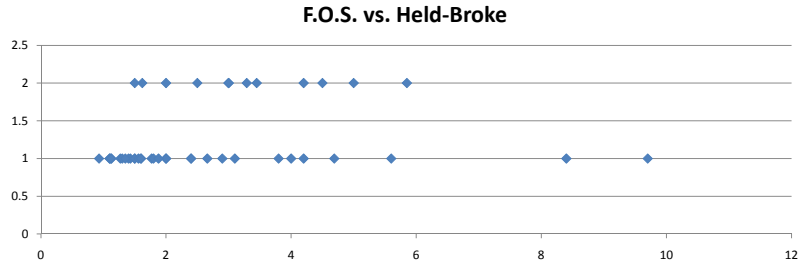


Project 1 Debriefing



Project 1 Debriefing

- Overview of data and designs
  - What trends did we see?



- The winner is: Jon Boerner: 4.08 g

Reminders and Announcements

- Rev 2 and Addendum Due Wednesday
  - Another chance to hold the load
  - Lower mass requirement: 7.5 g
  - No pockets
  - Due at beginning of class, for realsies
- Machine shop practice, anyone?
- AutoDesk info session Wednesday 4:30 SH 224
  - Free pizza and drinks…

Assemblies

- Why use assemblies?
- Loading implications
- Tolerances
- Constraints
- Fastening, Nonpermanent Joints

Why use assemblies?

- Making things move
  - Separate pieces to move independently
  - E.g., articulations using bearings
- Manufacturability
  - Impractical to do some things with just one part
  - E.g., internal spherical pocket
- Impermanence and portability
  - E.g., scaffold or tent

Why not use assemblies?

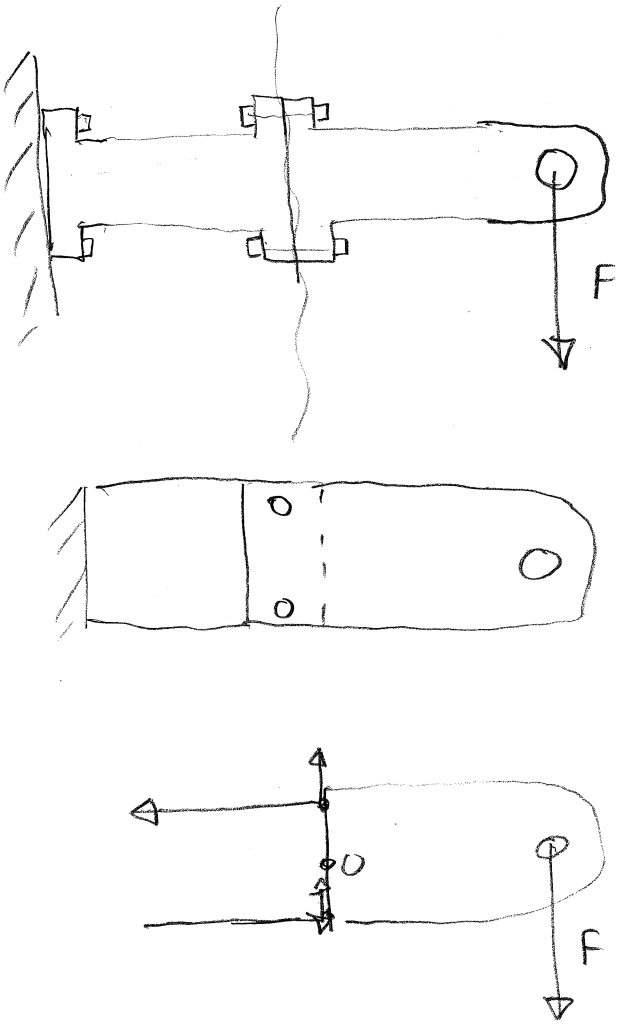
- Complexity
  - More parts, more things to go wrong
- Assemble-ability
  - Hard to put some things together
  - Time and cost
- Connection points are weak points
  - Generally much less material (fastener)
  - Or much weaker material (weld, glue)
- Connection points are less precise
  - Stacking of tolerances

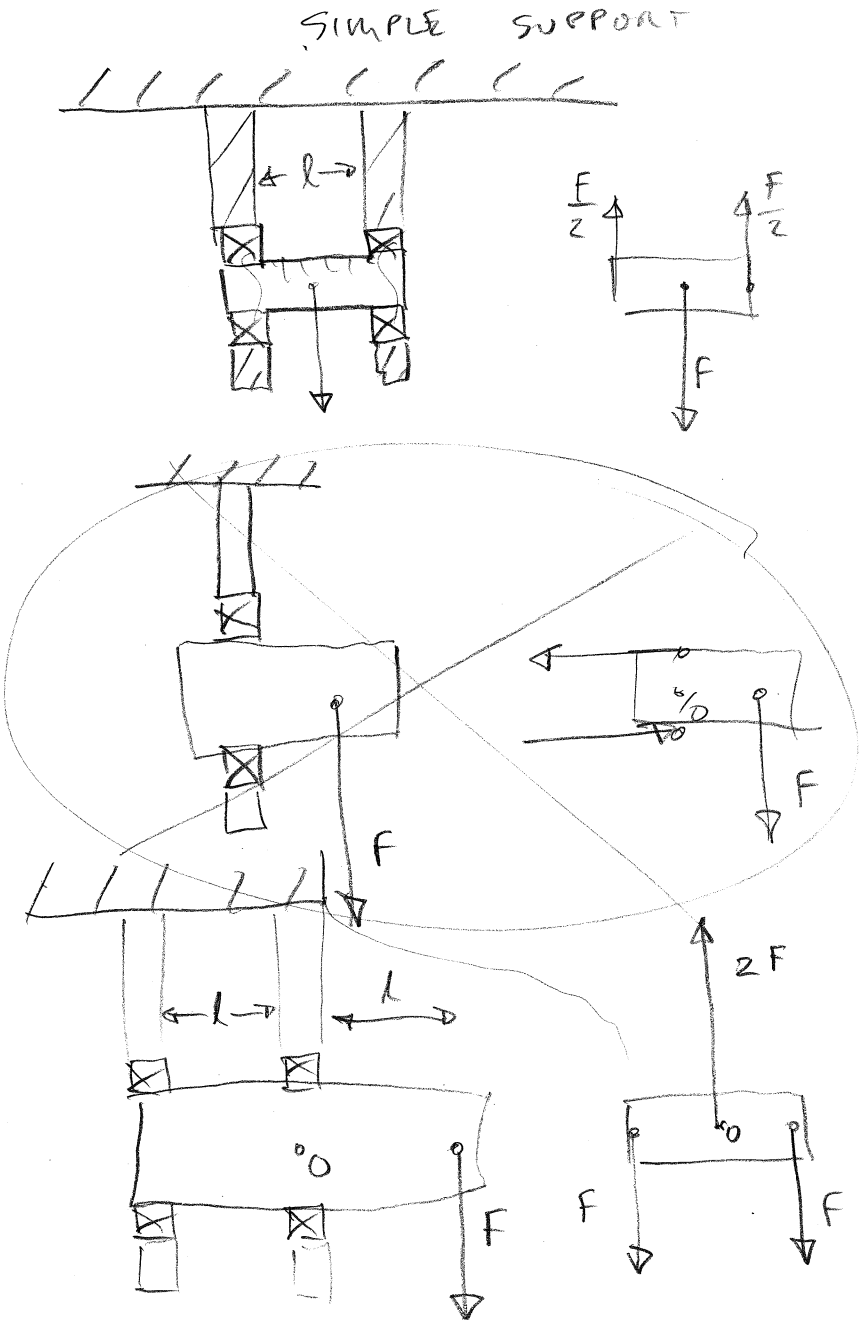
Assemblies and Loading

- Geometry of attachments very important
  - Very different loads possible at connections
  - Stiffness also affected
- Some examples and exercises
  - A two-part beam
  - Mounting a shaft

Assemblies and Tolerances

- What are tolerances?
  - From possible errors in parts
  - From uncertainty in connections
  - Other types of “slop”
- Stacking
- Geometry of attachments very important
  - Displacement errors affected by geometry, stacking
- Some examples and exercises
  - Mounting a shaft
  - A high-precision gear-box frame





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