Geometry Strength Mass Design Loop

24-370 - Spring 2011

Professor Steve Collins

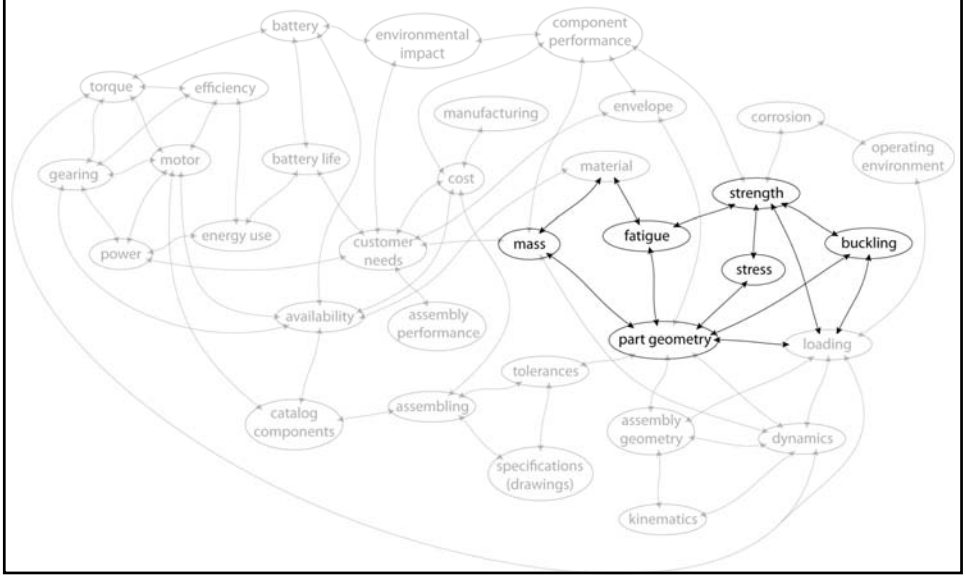
Announcements

- Questions on HW2?
  - HW timing
- Questions about the project?
- Wednesday: Drawings and technical writing
- Early feedback forms
  - 5 minutes

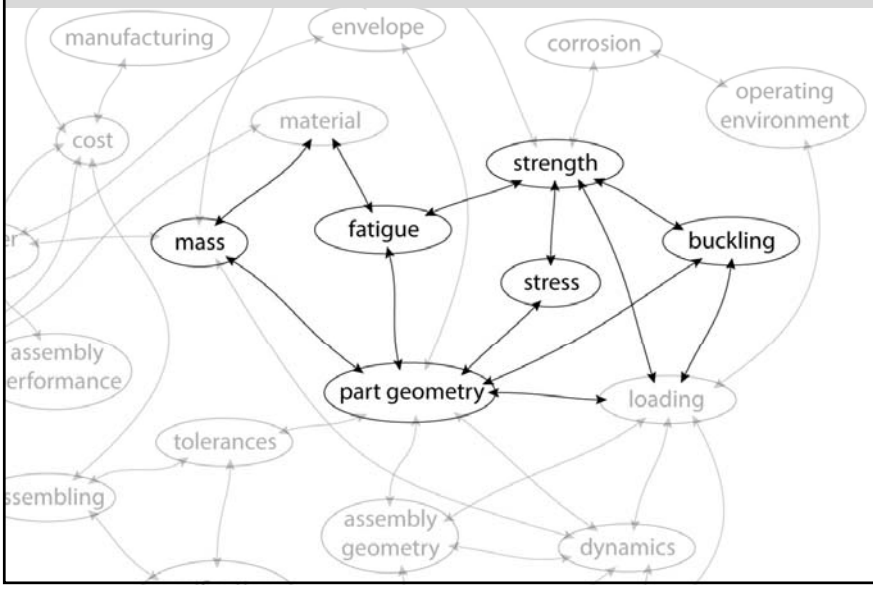
Geometry, Strength, and Mass

- Design optimization problem
  - Constraints: loading, material, manufacturing, *fos*
  - Free parameters: geometry (∞ possible vars)
  - Outcomes: volume/mass
- Sub-loop in overall design problem
  - Learn base levels well to navigate higher spaces
  - Next variations
    - Material as free parameter
    - Loading as free parameter

Design Sub-Loops



Design Sub-Loops



Geometry, Strength, and Mass

- Some general ideas
  - Avoid bending moments
  - Triangles good, rectangles bad
- Some approaches
  - Intuition
  - Inverse analysis formulations
  - SolidWorks refinement
- Learning and improving skills
  - Practice
  - Knowing simple models & analyses

Intuitive Design Exercises

- Given loading
  - Make up as we go
- Sketch overall part geometry
  - Use intuition about strength and mass
- Share conceptual ideas
  - Discuss implications

Inverse Analysis Approach

- Given loading and overall geometry
  - One or two cases
- Develop simple model
- Symbolic derivation and inversion
- Solve for optimal values

Iterative Refinement

- Given detailed part geometry
  - One or two examples
- FEA evaluation
  - Look for unutilized material
  - Assess implications of removal
- Modify parameters
- Re-evaluate
- Repeat

Homework #3

- By email this afternoon
- Practicing each approach
- A note about precision…
- Due Wednesday, February 9th in class
  - Same day as final project report
  - Recommendation: tonight while it's fresh