Georgia Tech - ME6754

Homework Assignments for
Constrained Objects and X-Analysis Integration Lectures (COBs & XAI)

Russell Peak
Guest Lecturer
March 14 & 16, 2000
Office Hours for HW: M 3/20 1-2, Tu 3/21 11-12

Due Date: Tue March 28, 2000

Assignment 1

Read the following (before class Thu 3/16):
3. X-Analysis Integration (XAI) Technology http://eislab.gatech.edu/pubs/reports/EL002/

Assignment 2

1) Given the spring examples from the Lecture 1 slides, develop the same type of COB information model views for a linear resistor model, linear_resistor. I.e., create these views for it (as in Slides 3-4).
   - Figure (with labeled parameters)
   - Relations (traditional math form)
   - Constraint schematic (schema form)
   - Subsystem view
   - Lexical COB schema template
   Use the notation and syntax per Slides 3-4. Hint: You should define the resistor object template with a voltage point at both ends, such that \( \Delta V = V_1 - V_2 \) and \( \Delta V = iR \).

2) Create constraint schematic instances and lexical COB instances showing a linear_resistor instance in two states (and the associated calculated outputs) (analogous to Slide 6):
   - State 1: use \( R=5 \) ohms, \( V_1 = 20 \) volts and \( V_2 = 10 \) volts as inputs
   - State 2: use \( i=3 \)amps, \( V_1 = 30 \) volts and \( V_2 = 30 \) volts as inputs

3) Create COB information model views (see Problem 1) for a resistor system with three resistors in parallel. This is similar to the spring_system concepts in Slides 9-10. Also include an Express-G diagram for this system (like Slide 15).

4) Create a constraint schematic instance view of this resistor system with these inputs (and the associated calculated outputs): resistor values of 3, 5, and 6 ohms (top to bottom), and \( V_{\text{start}} = 60 \) volts and \( V_{\text{end}} = 30 \) volts. Extra credit: Create another constraint schematic that adds other object(s) to this system in order to determine overall resistance without explicitly deriving that relation (see Slides 16-17).

5) Based on the above reading, describe the following concepts briefly in your own words and why they are needed (around 5 sentences each): a) ABB, b) SMM, c) APM, d) PBAM/CBAM, e) routine analysis, f) routinization, g) multi-fidelity idealizations.

6) Describe why multi-directionality is important for engineering design and analysis.

7) Draw a figure like Lecture 2 slides 25, 56, 62, 64 for an example part/assembly of your choice. Include names of several commercial CAD tools and CAE/solution tools, and include at least two modes (physical behaviors) that each have at least two analysis modules (CBAMs) of varying fidelity. For example, let your part be a ball bearing assembly where analysis modules are included for stress and torque modes.