Constraint Based Modeling
Geometric and Dimensional

ENGR 1182
SolidWorks 03
Today’s Objectives

- Using two different types of constraints in SolidWorks:
  - Geometric
  - Dimensional

- SW03 Activity
  - List Geometric Constraints
  - Apply Geometric and Dimensional Constraints

- SW03 Application
Constraints

Two different types of constraints:

1. Geometric
   - Constraining geometry based on normal orientations or relative to other parts of the geometry

2. Dimensional
   - Numerical values that constrain the size and location of geometry
Geometric Constraints
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Geometric Constraints
2 Options

Constraints relative to the normal conventions for direction. Examples: vertical, horizontal

Constraints relative to other sketch entities. Examples: perpendicular, parallel
Advanced Geometric Constraints

- Accurate Models
- Tangent Constraints
  - Arcs or Circles
- Equality Constraints
  - Equal sizes
- Concentric constraints
  - Align Center Points
Automatic Constraints

While sketching SolidWorks will automatically guess at the constraints that the user implies.

Dotted lines show alignment and icons show the constraints applied.

Unwanted constraints can be selected (left click) and deleted (delete key).
SolidWorks: Selecting

Lines or points can be selected by holding Ctrl and left clicking on each.

At the left of the screen, relations can be added by selecting the appropriate icon.

The lines will snap to the applied constraint and icons will display the current constraints.
How Could We Create This?
(with uniform thickness and aligned?)
SolidWorks: Applying Constraints

Step 1: Horizontal and Vertical Constraints

Step 2: Make Slants Parallel

This edge can be selected and moved manually
SolidWorks: Applying Constraints

This profile is not fully constrained but the shape is generally constrained by using only Geometric Constraints.

Step 3: Equality Constraints on all similar members
Geometric Constraints

Wrap Up

Relationships:
- Vertical
- Horizontal
- Parallel
- Perpendicular
- Equal
- Coincident

Circular Relationships:
- Tangent
- Concentric

Application SW03 - GEO:
Draw the following object and constrain with geometric constraints only. The shape will not be fully defined but should maintain shape if selected and dragged.
Activity (SW03)

List all the necessary constraints to go from the initial shape to the final, then apply the constraints on the SolidWorks part file to confirm.
Dimensional Constraints

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Dimensional Constraints

- Linear Dimensions
- Radial Dimensions
- Angular Dimensions
Once constrained with geometric constraints how do we make this accurate?
Effective robust designs start with shape and geometry constraints, and then dimensional constraints are added.
Algebraic Constraints

- Simple Algebraic Expressions
  - i.e. (type) = 20/3
- Related to Other Dimensions
- Driving vs. Driven
SolidWorks: Dimensions

Dimensional Constraints can be added using the **Smart Dimension Button**

1. Click on the entity
2. Move cursor off object
3. Click once more to place dimension

When Constraints are applied the following dialog box will appear displaying
- Dimension Name
- Editable Dimension Value
- Options (direction, etc.)
SolidWorks: Dimension Options

Dimensions can be added between 2 lines by selecting the lines sequentially.

Between a point and a line.

Or even 2 points as long as the correct direction is chosen (the Smart Dimension tool shows options when moving the mouse).
Circles or Arcs can be dimensioned by the diameter (Ø) or radius (R)

A circle can be located by its center point by constraining both the x and y directions
SolidWorks: Angular Dimensions

Angular Constraints can be added by clicking one line and then the other line. SolidWorks will automatically assume angular constraint.
SolidWorks: Algebraic Constraints

Constraints can be added in the form of equations by:
1. Entering “=“
2. Entering a value or by left clicking on a dimension
3. Using operations +, -, *, /
Dimensional Constraints

Wrap Up

Dimensional Constraints

- Linear
- Radial
- Angular
- Coupled with Geometric Constraints

Algebraic

- Relations between dimensions

Application SW03 - DIM:

Problem 6.4 (r)
In-Class Activity

Open the seed file in the course drive. Adjust the shape using geometric constraints and then add dimensional constraints to finalize the model.
Important Takeaways

- Using different geometric constraints to constrain geometry based on normal orientations or relative to other parts of the geometry.

- Using dimensional constraints to constrain the size and location of geometry.

- Algebraic dimensions create relations between dimensions.
What’s Next?

- Due Next Class: SW03 Out of Class HW
- Before next class, you will read about design intent with fully defined drawings
- Also you will learn about solid modeling’s design analysis tools
- Take SolidWorks 4 Quiz on readings