Freeform Surface Modeling
Review of Sweep Operations

• Types of sweep operations are:
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• Elements of sweep operations are:
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Solid vs. Surface Models

- Freeform surfaces can be created on surface or solid models.

(a) Solid Modelling Approach  (b) Surface Modelling Approach
Types of Freeform Surfaces

1. **Surfaces from points**
   - **Point interpolation**
     
     Surface is incident with a grid of points.
   
   - **Control points**
     Grid of points “pull” surface.
     
     (Not necessarily incident.)
   
   - **Point cloud**
     
     Best fit to jumble of points.
     
     (E.g., laser scanned data)
Types of Freeform Surfaces

2. Surfaces from multiple sections
   - Ruled surface
     Matching points on each curve are joined by straight lines.
   - Through curves (loft)
     Best fit of surface to curves.
     (If only two curves, same as ruled.)
Types of Freeform Surfaces

2. Surfaces from multiple sections
   - Through curve mesh
     Best fit to two sets of curves, one set for each direction.

   - Advanced/variational sweep
     Similar to basic sweep, but “guide rails” can be used to change size and orientation of cross-section. Sketch constraints may also be used for control of swept profile.
Types of Freeform Surfaces

2. **Surfaces from multiple sections**
   - Bounded plane or surface

     - Best fit to bounding curves.
     - Can sometimes also control edge tangency/curvature to match adjacent face.
Types of Freeform Surfaces

3. Surface construction from existing surfaces
   • Offset surface
     Offset surface is same perpendicular distance from original surface at every point.
     Can also offset in specific directions.
   • Midsurface
     Midsurface is same perpendicular distance from both original surfaces at each point.
   • Both of these surfaces are associative.
Types of Freeform Surfaces

3. **Surface construction from existing surfaces**

Others we already use:

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Types of Freeform Surfaces

4. Operations on sheets and faces
   - Trim sheet
   - Split face
   - Sew face
Practical Hints

• Choosing loft direction:

• Fixing twist:

• Difference between sweep and loft:

• Rounding ends: