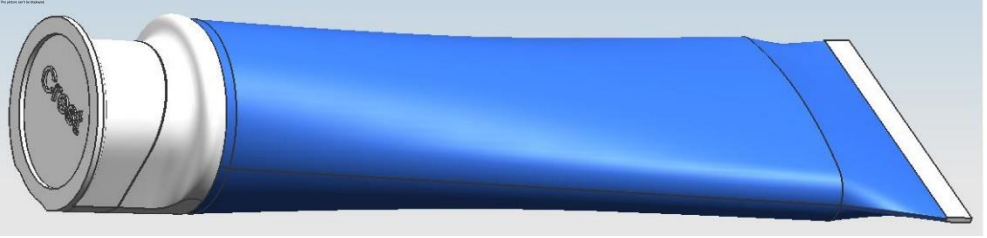


Image from Chad Dickman

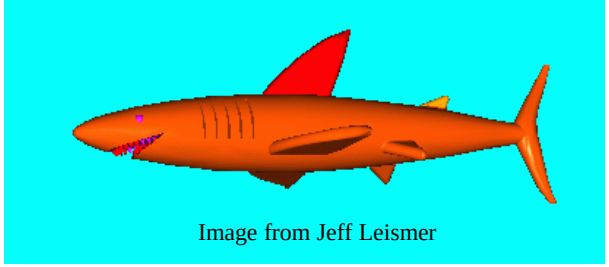


Image from Jeff Leismer

Freeform Surface Modeling

Image from Michael Biery

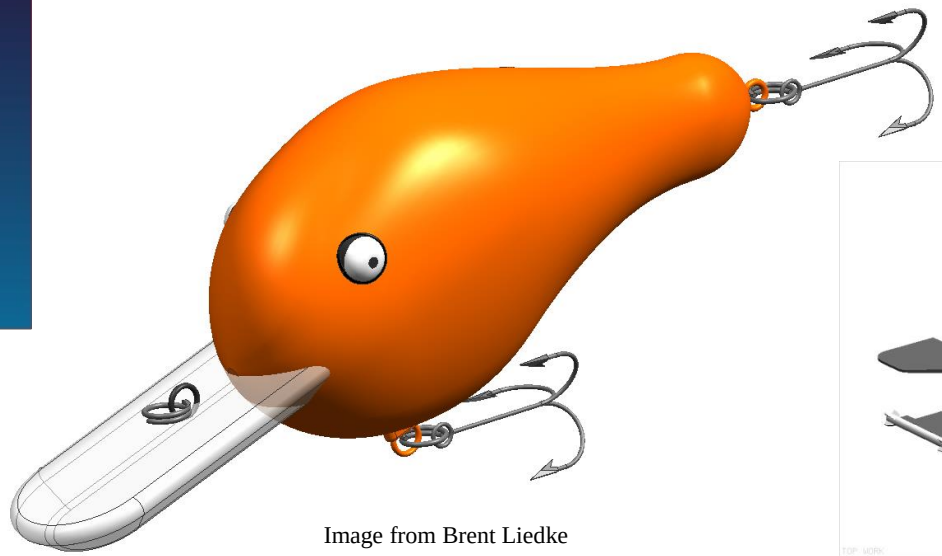


Image from Brent Liedke

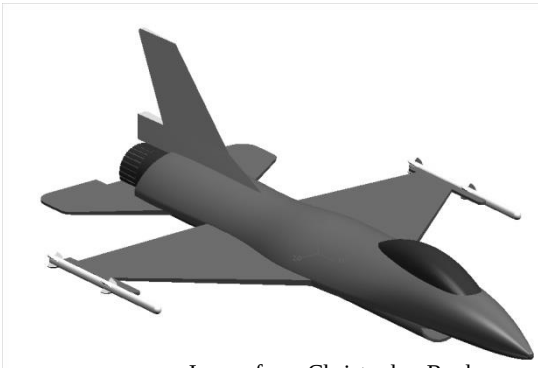


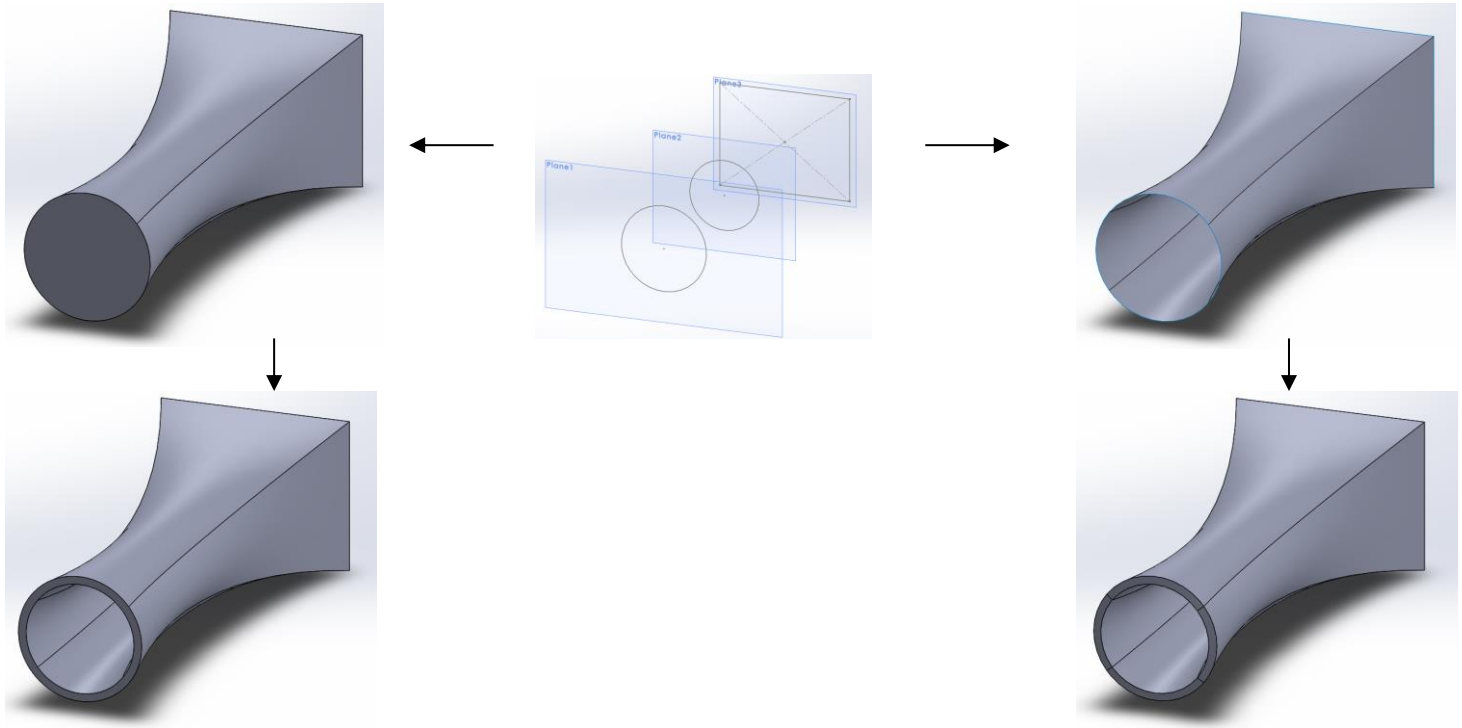
Image from Christopher Rock

Review of Sweep Operations

- Types of “sweep” operations are:
  - Extrude
  - Revolve
  - Sweep along path
- Elements of sweep operations are:
  - Profile
  - Sweep path (may be implied)

Solid vs. Surface Models

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



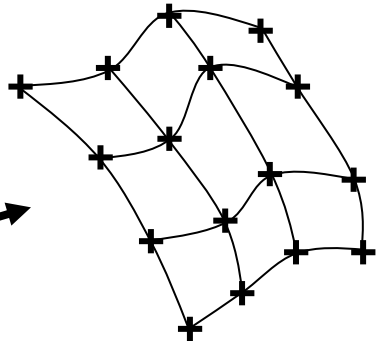
(a) Solid Modelling Approach

(b) Surface Modelling Approach

Types of Freeform Surfaces

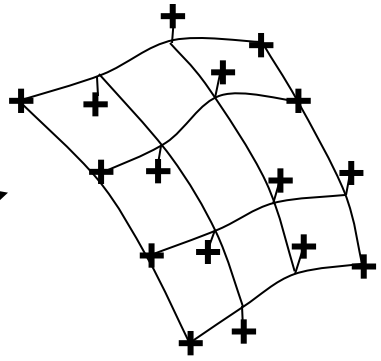
1. Surfaces from points
   - Point interpolation

     Surface is incident with a grid of points



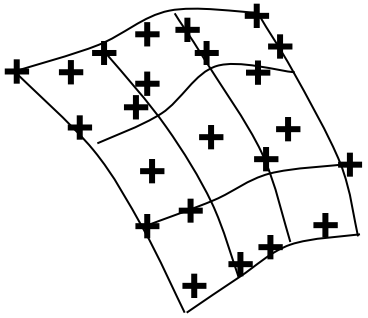
   - Control points

     Grid of points “pull” surface



   - Point cloud

     Best fit to jumble of points

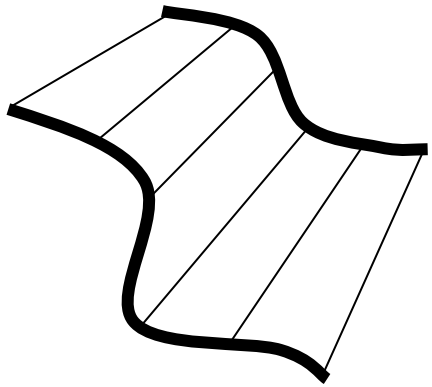


Types of Freeform Surfaces

2. Surfaces from multiple sections

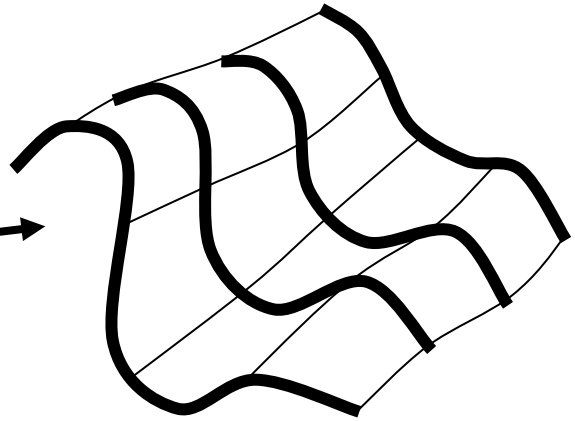
- Ruled surface

Matching points on each curve are joined by straight lines



- Lofted surface

Best fit of surface to curves

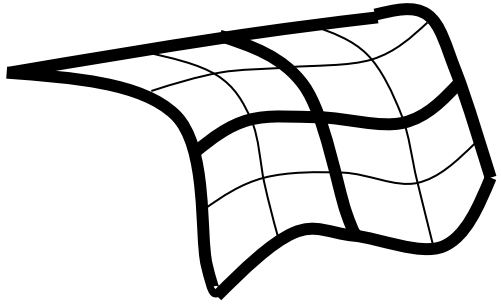


Types of Freeform Surfaces

2. Surfaces from multiple sections

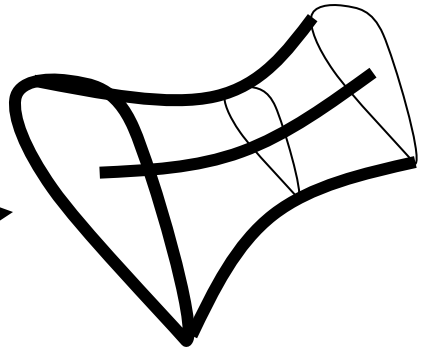
- Through curve mesh

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.

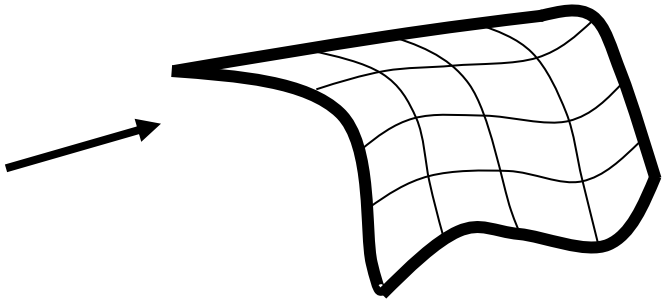


Types of Freeform Surfaces

2. Surfaces from multiple sections

- Bounded plane or surface

Best fit to bounding curves



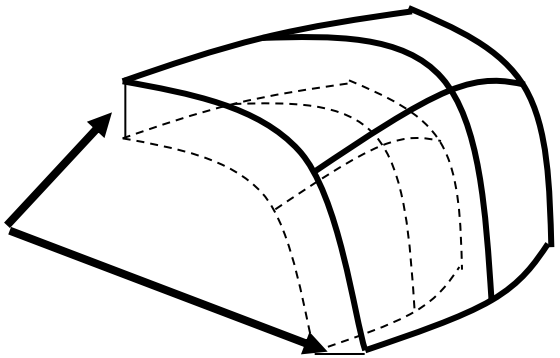
Can sometimes also control edge tangency/curvature to match adjacent face.

Types of Freeform Surfaces

3. Surface construction from existing surfaces

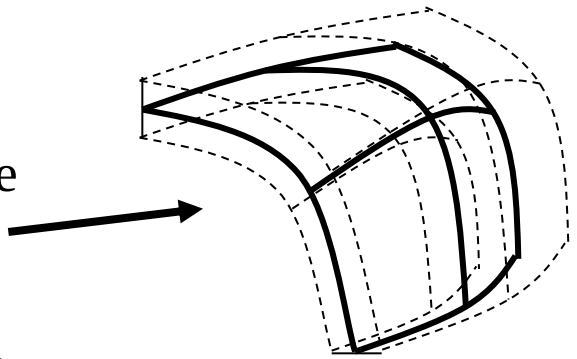
- Offset surface

  Offset surface is same perpendicular distance from original surface at every point.



- Midsurface

  Midsurface is same perpendicular distance from both original surfaces at each point.



- Both of these surfaces are associative.

Types of Freeform Surfaces

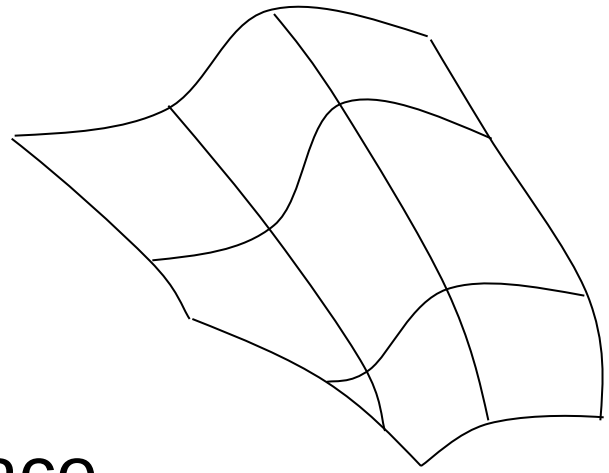
3. Surface construction from existing surfaces

Others we already use:

- Face blends
- Taper
- Shell/thicken
- Direct modeling operations

Types of Freeform Surfaces

4. Operations on sheets and faces
   - Trim sheet



   - Split face
   - Sew face

Practical Hints

- Choosing loft direction:
- Rounding ends:
- Fixing twist:
- Difference between sweep and loft: