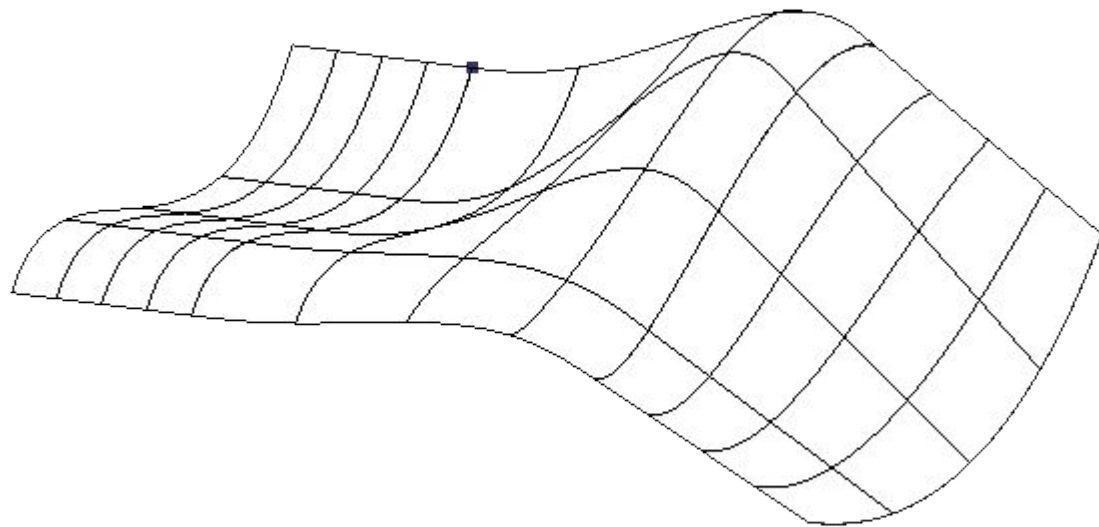


SURFACE GEOMETRY FOR CAD

FRANK MILL



SURFACE GEOMETRY

Bezier, basic B-spline and NURBS can all be used to create surfaces.

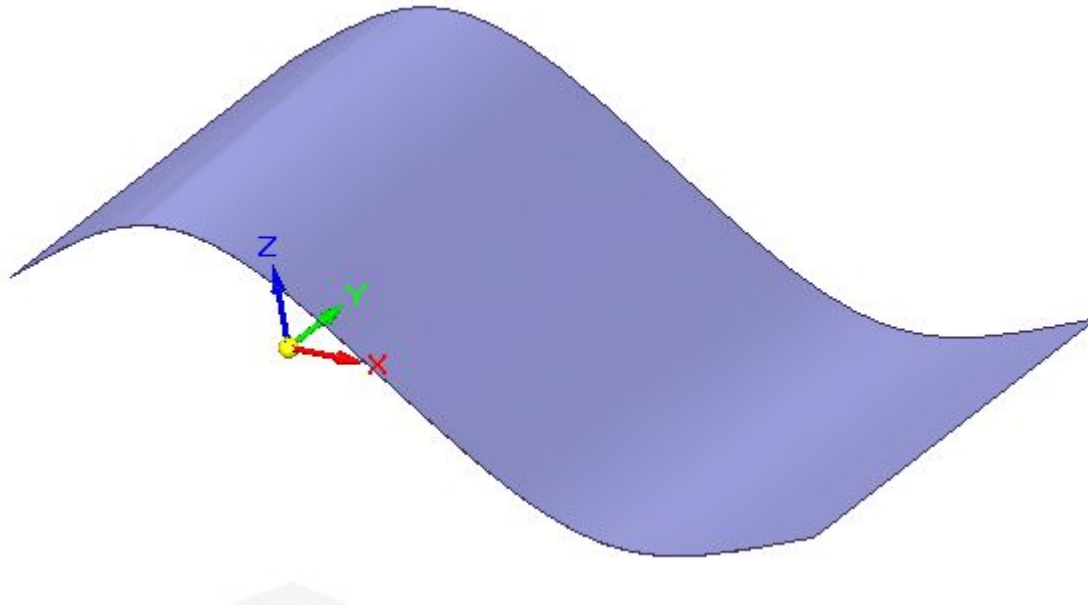
When surfaces are used to create solids a unit vector must be added that points away from the material side of the surface.

Solid surfaces are usually referred to as 'Faces'.

SURFACE GEOMETRY

Perhaps the simplest surface, from a construction point of view, is a curve extruded along a straight line in space.

Simple Extruded Surface:



SURFACE GEOMETRY

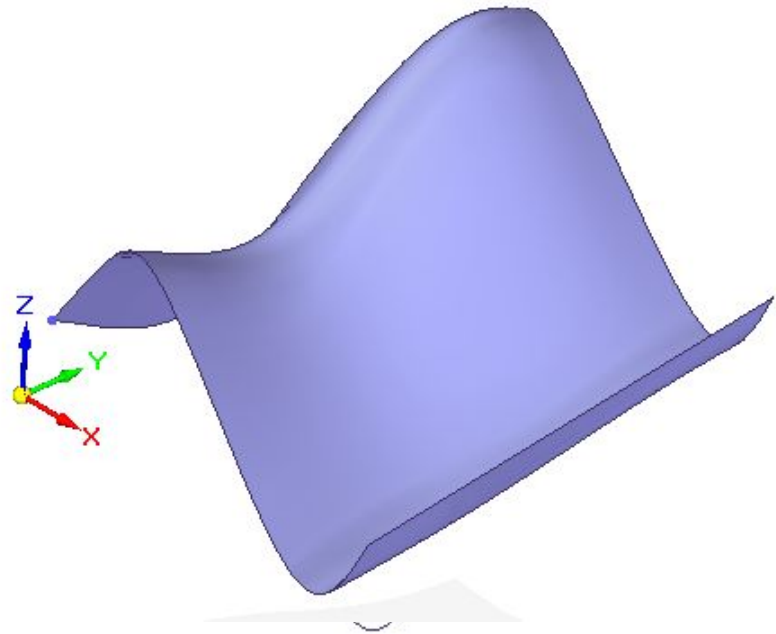
Extending this approach we can create surfaces by moving curves along other curves. Common surface types include those formed by:

- **Revolving**
- **Sweeping (along other curves)**
- **Lofting between profile curves**
- **Rounds and Blends**

SURFACE GEOMETRY

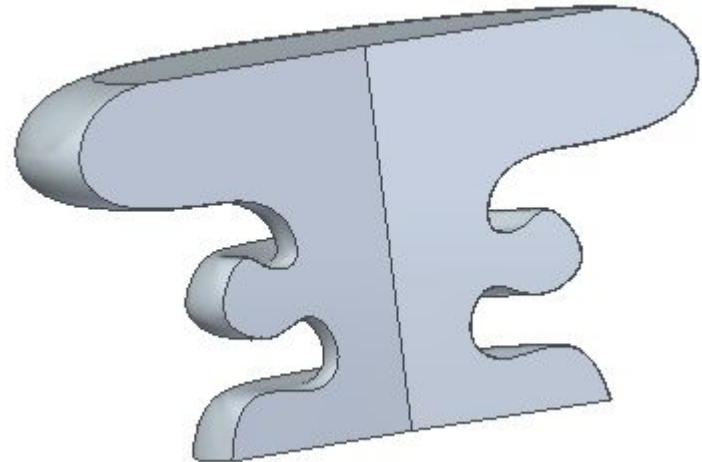
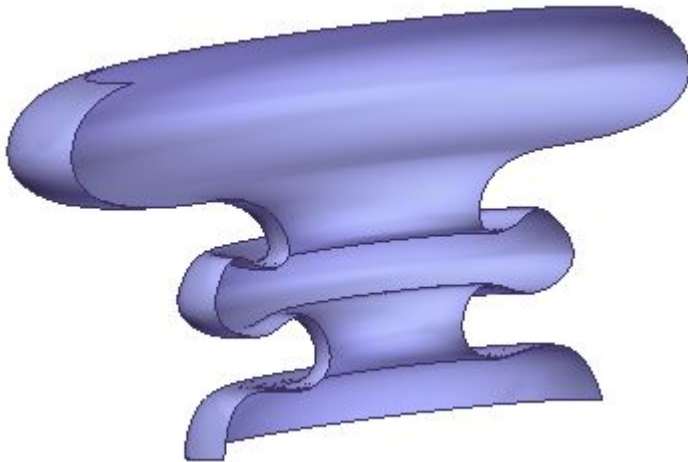
Normally we use surface patches formulated in NURBS and we usually refer to the surface parameters as u and v (not t)

Perhaps the simplest type of surface is created by sweeping one curve along another.



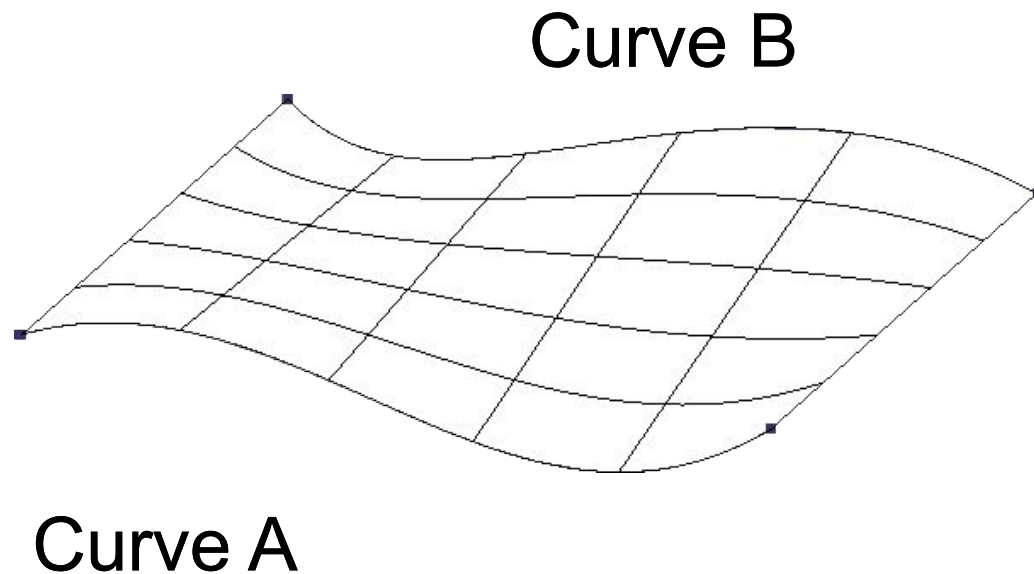
SURFACE GEOMETRY

Surfaces usually come in two forms ie as solids or construction surfaces.



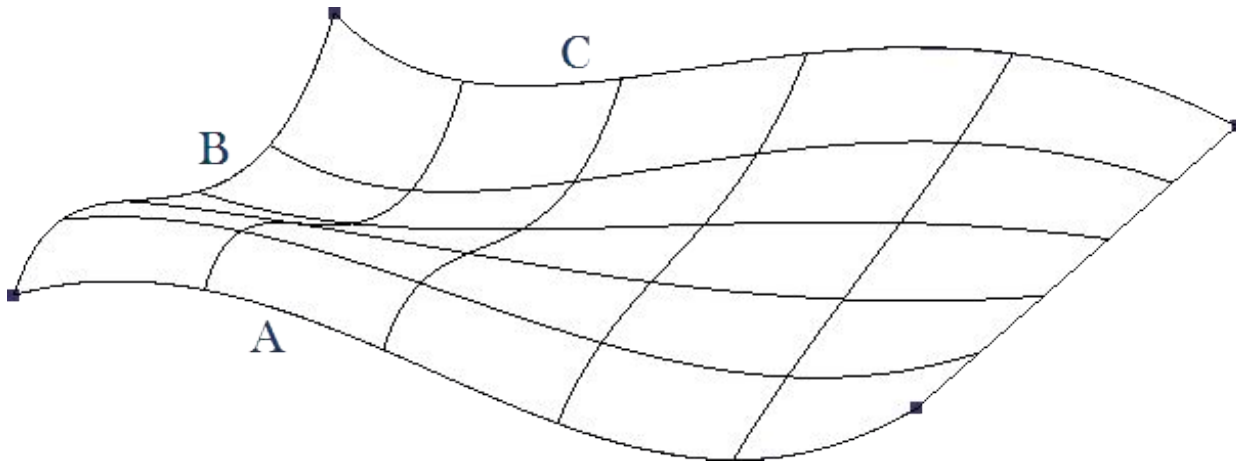
LOFTING

Lofting joins two or more curves to each other



COMPLEX SWEEPS

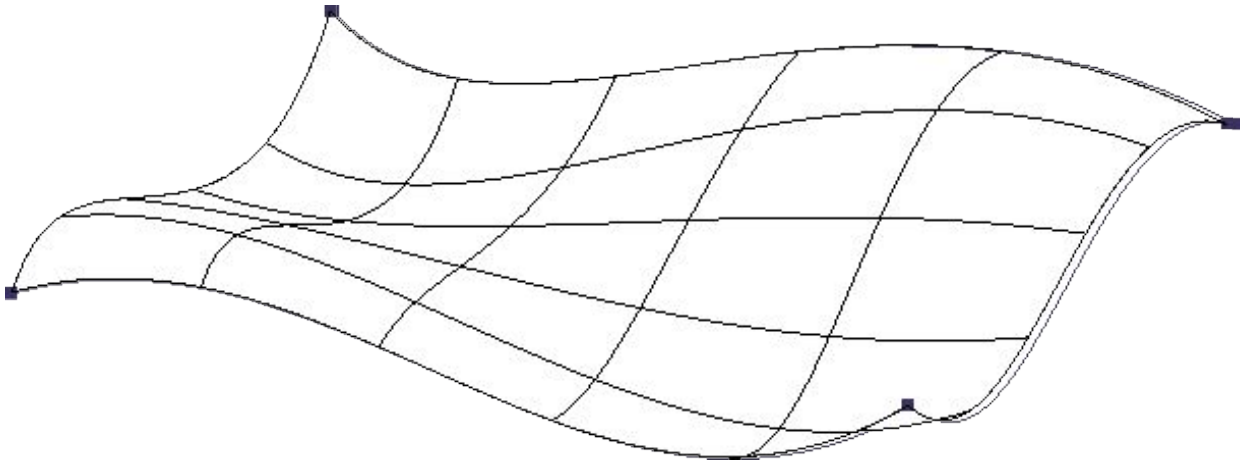
More complex sweeps can be formed by combining sweeps and lofts. Eg sweep curve A along curve B. Along the parametric dimension A transforms into the shape of curve C.



Complex sweep with multiple cross-sections.

BOUNDED SURFACES

Commonly we require to fit a surface patch into a bound region.

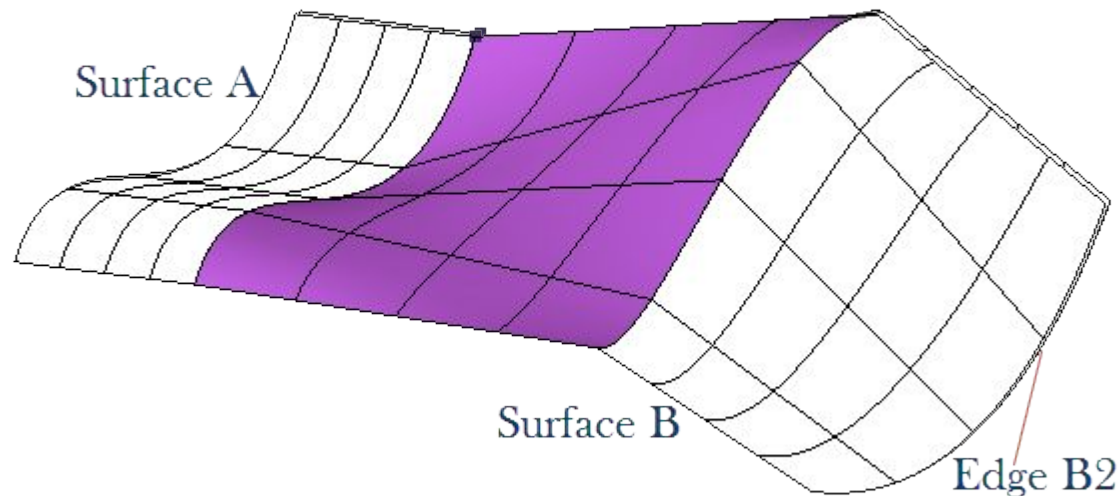


Bound surface defined by four curves.

PRACTICAL ASPECTS

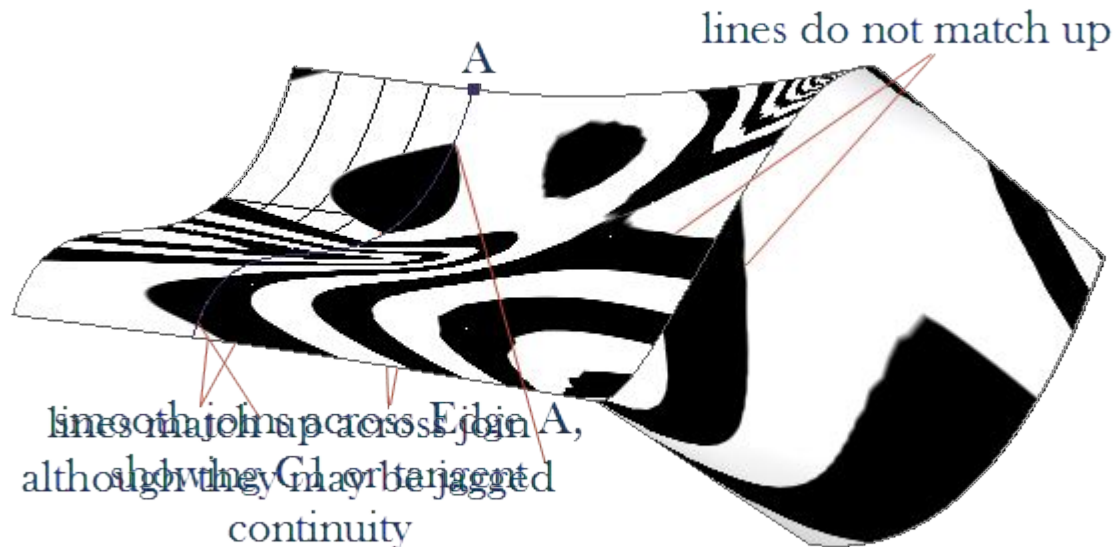
The sharp join at the surface boundary is a large percentage of all cases of continuity.

Reconsider the 'loft' but this time between two surfaces:



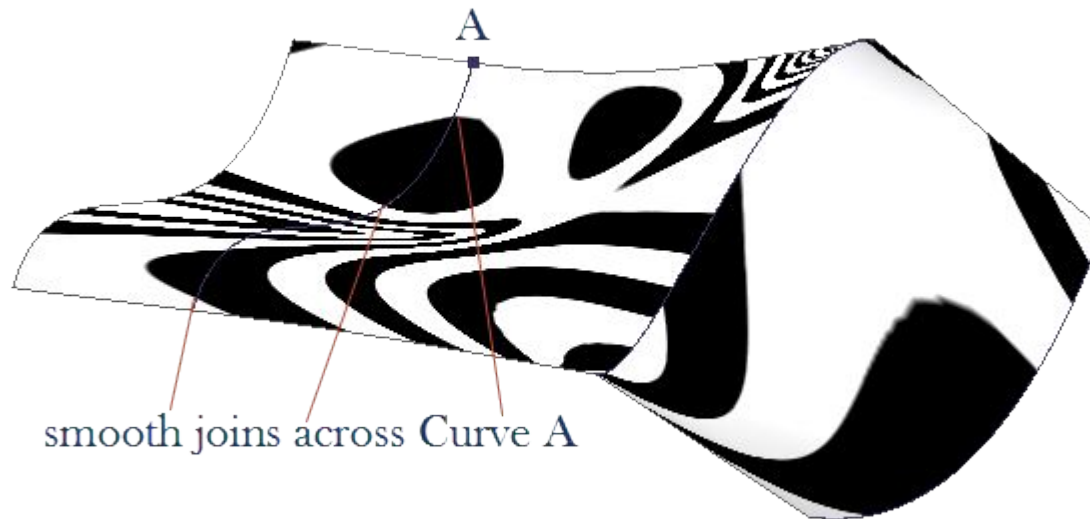
PRACTICAL ASPECTS

Consider this new surface using a common and very useful
We can specify end conditions and redraw the surface.....
visualisation tool known as zebra stripes.



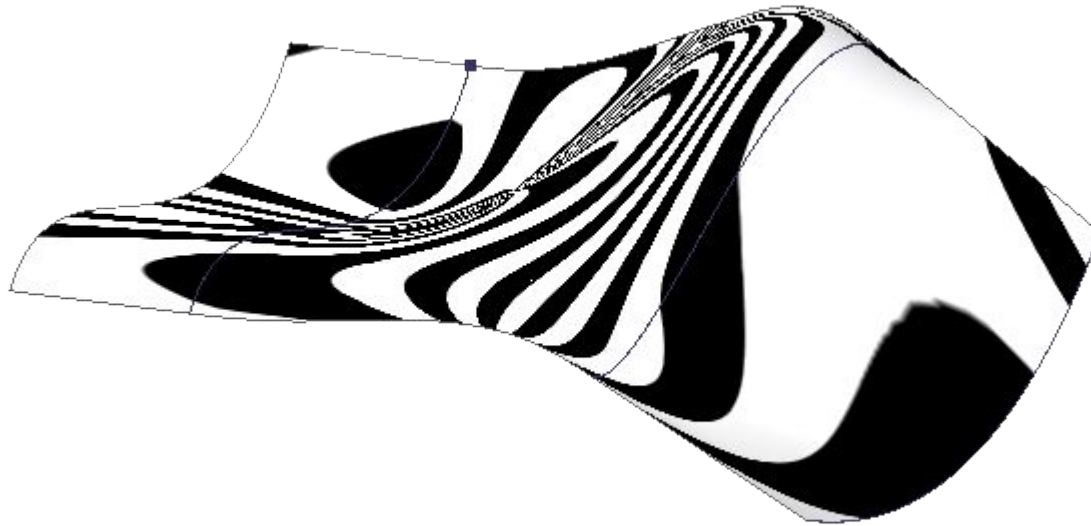
PRACTICAL ASPECTS

If we specify C2 continuity.....



PRACTICAL ASPECTS

Now let's specify C2 continuity across all three surfaces.....

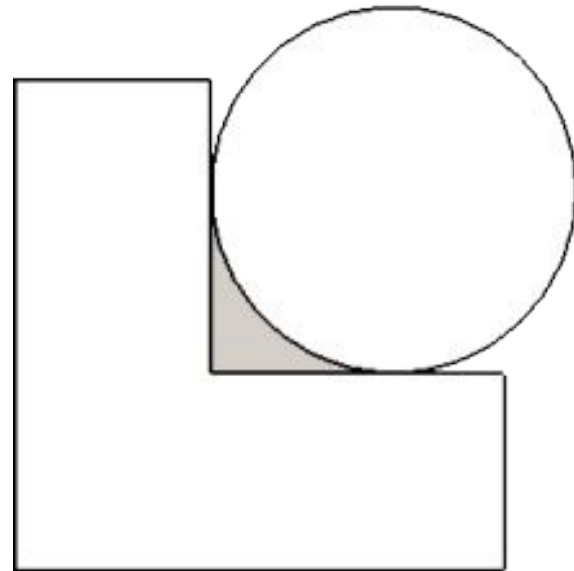


ROUNDS AND BLENDS

The most common rounds applied to normal parts can be conveniently thought of as 'rolling ball' rounds.

The effect is to 'fill' the (shaded) area between two faces.

Rounds work effectively across surface joins where these are at least tangent continuous (C1).



CURVES REVISITED

- Curves can be formed from surface intersections.
- They (curves) can be projected or wrapped on to surfaces.
- Or, they can be drawn directly on to them.