

ENG 004 Lecture 8, Oct 23, 2012

Announcements

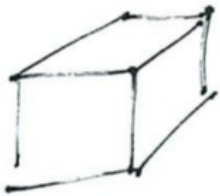
- Homework #3 due now
- Homework #4 will be posted after class
- Midterm coming up on Thursday, November 1
- Read Chapter 4

Topics

3D primitives and model types

Constructive Solid Geometric Modeling

3D Primitives



Parallelepiped



sphere
(Double-Curved Surface)

3D Primitives



Cylinder
(single-curved surface)



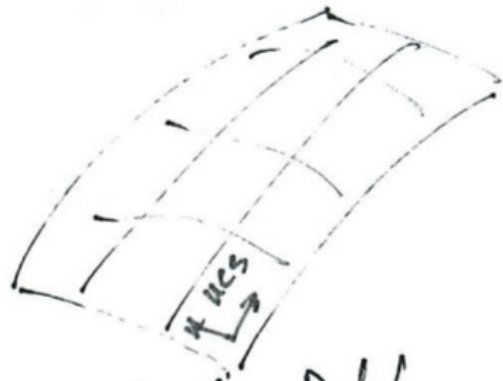
Cone
(single-curved surface)

3D Primitives



Space Curve

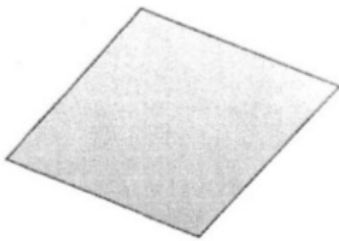
(1-D object embedded in 3-D space)



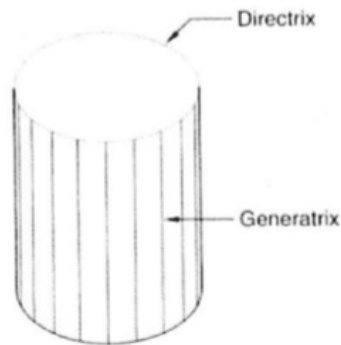
Surface Patch

(2-D object embedded in 3-D space)

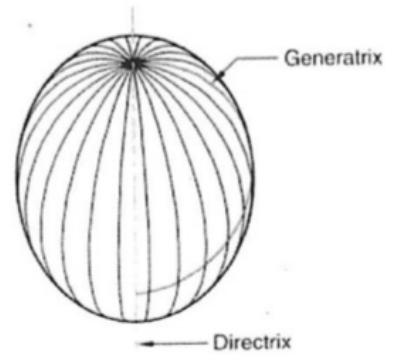
3D Primitives



Plane
2-D bounded surface

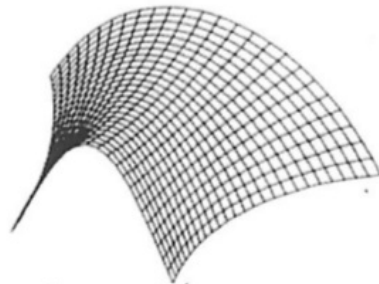
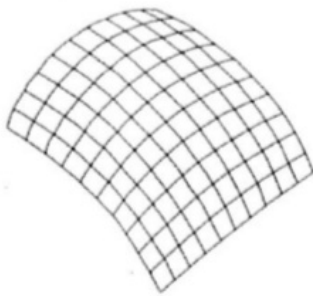


Cylinder
(single-curved)
(developable)
(special ruled surface)

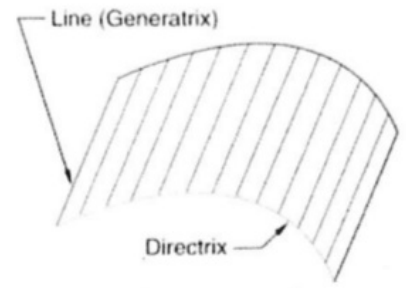


Sphere
(double curved)

3D Primitives



general surface patches
(double-curved)

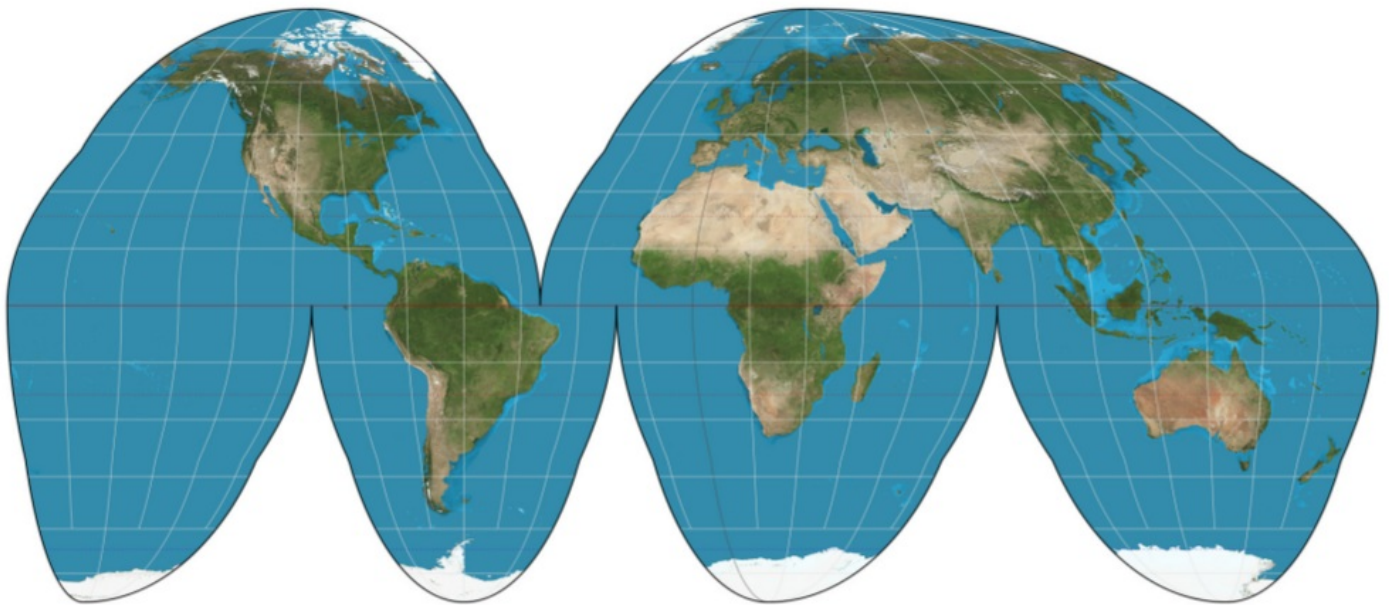


ruled surface

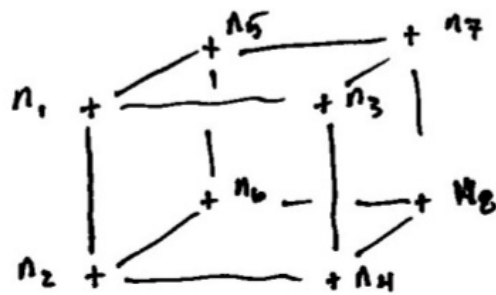
Ruled Surfaces



Undeveloped Surface

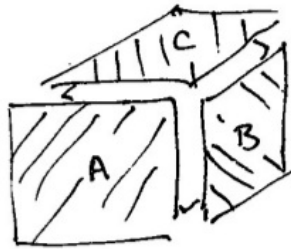


3D Modeling: Node Model



- Node Model
- Wire-frame Model
 - only nodes & their relationship to other nodes.
 - Computational Fluid Dynamics
 - Finite Element analysis (F.E.A.)

3D Modeling: Surface Model

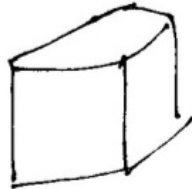


Surface Models

- only surfaces
& the edges between
surfaces.

Computer Rendering
Computer Animation.

3D Modeling: Solid Model



Solid Model

- complete 3-D geometry
& physical properties.

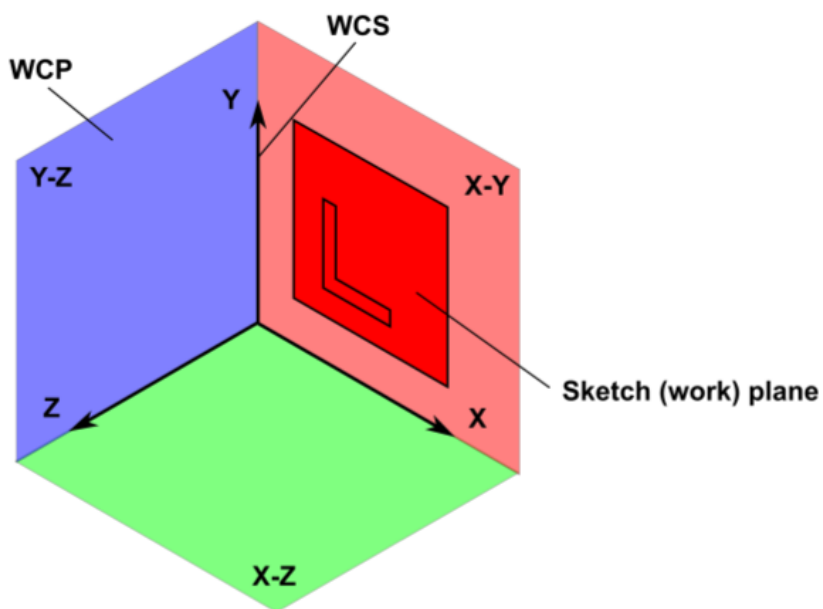
Design .

F.E.A.

Computer Simulation

Computer Animation

Sketch Planes



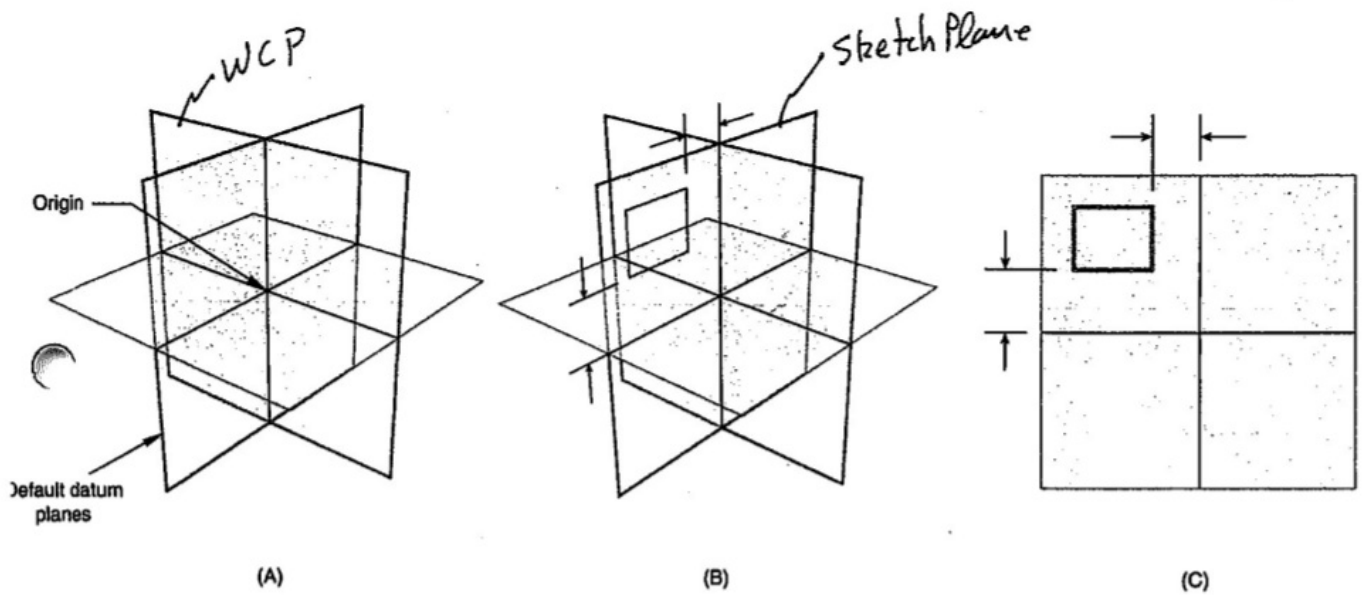
World coordinate planes (WCP) are associated with the world coordinate system (WCS)

Sketch (Work) Plane

Coincident or relative to a WCP

Can be a plane or projected plane that already is in the model

Sketch Plane Creation



Solid Model Boolean Operations

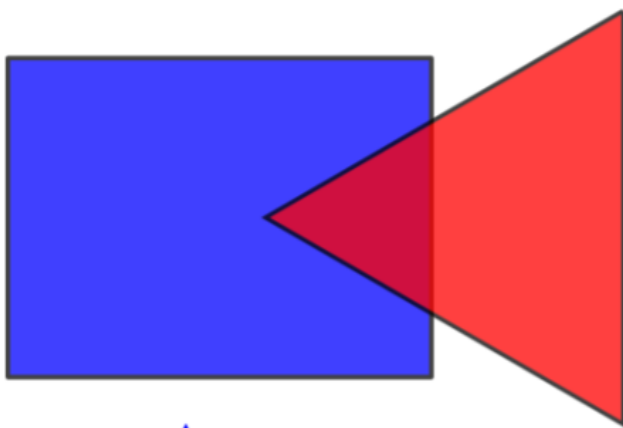
Constructive solid geometric modeling (CSG) uses Boolean operations and constructive operations to create a solid model.

Boolean operations

- Join (Union, Add): \cup
- Difference (Cut, Subtract): $-$
- Intersection: \cap

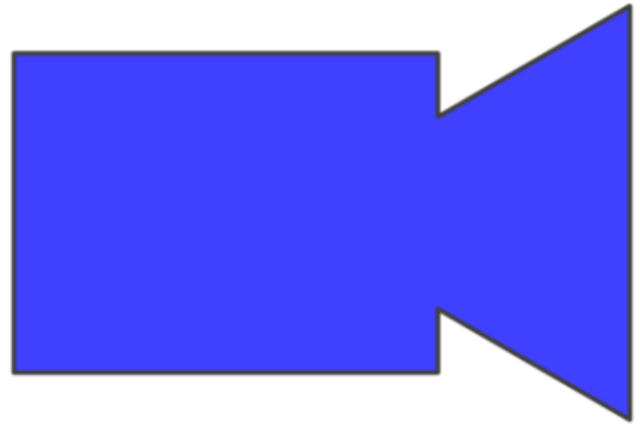
In order for Boolean operations to be logical, the features must be either overlapping or touching.

Boolean Operations: Union



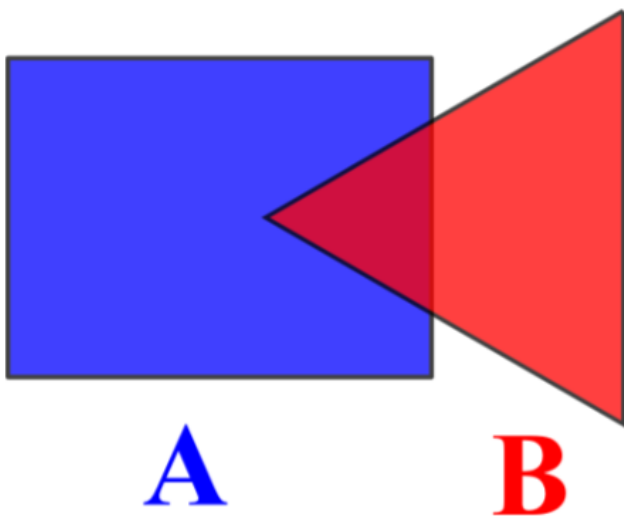
A

B



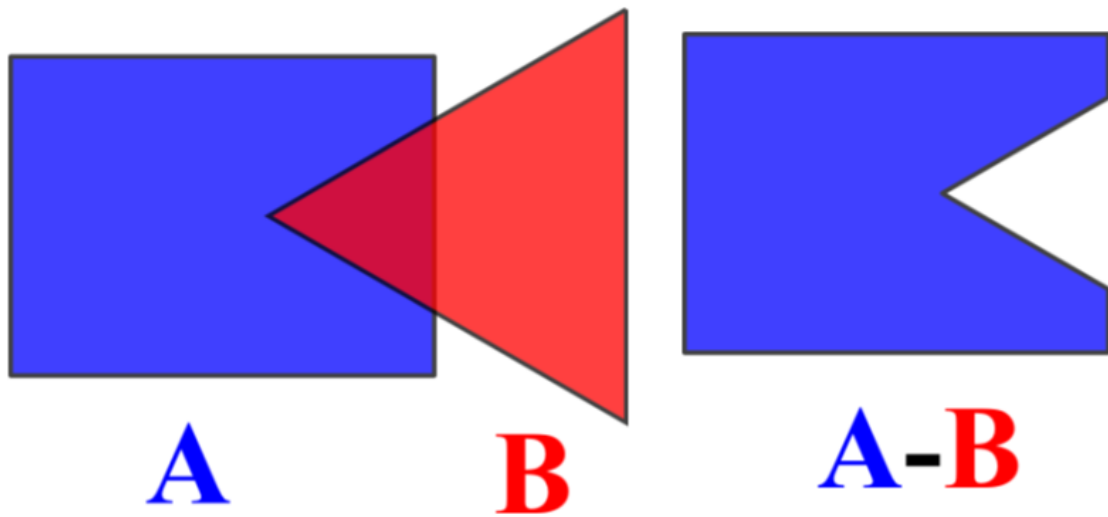
A \cup **B** = **B** \cup **A**

Boolean Operations: Intersection

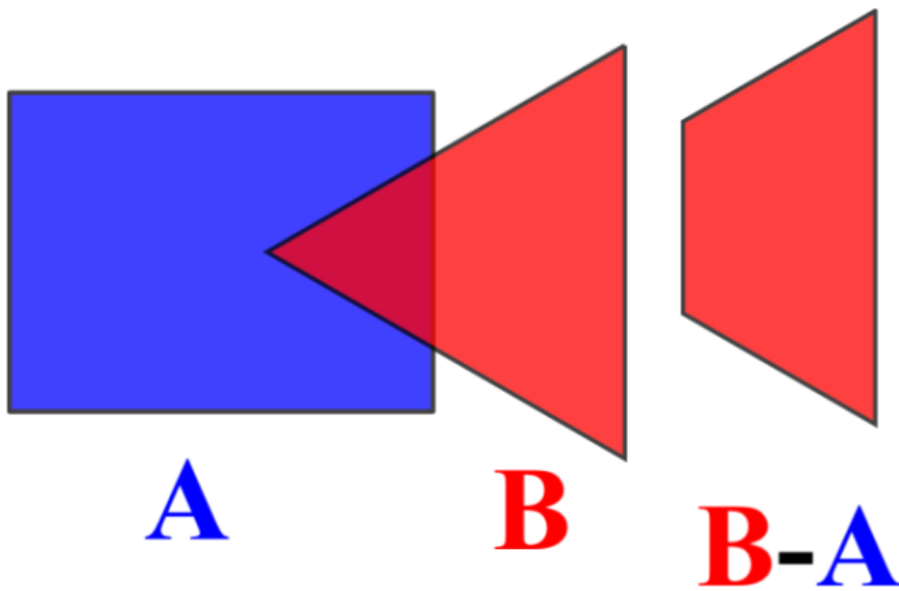


$$A \cap B = B \cap A$$

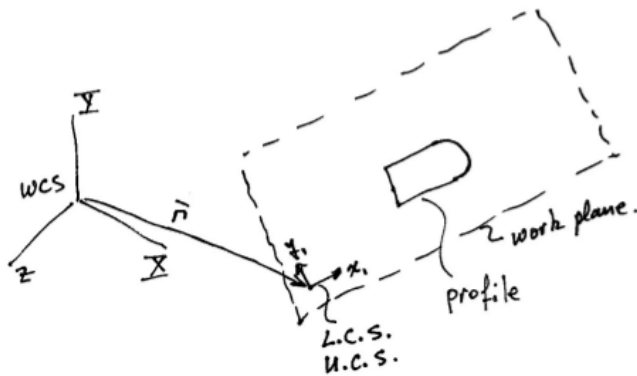
Boolean Operations: Difference



Boolean Operations: Difference

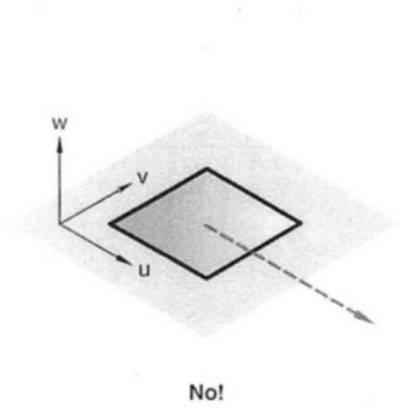
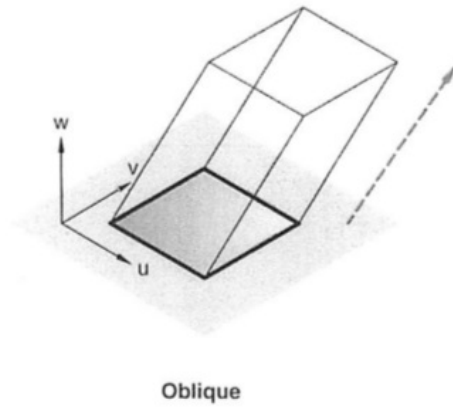
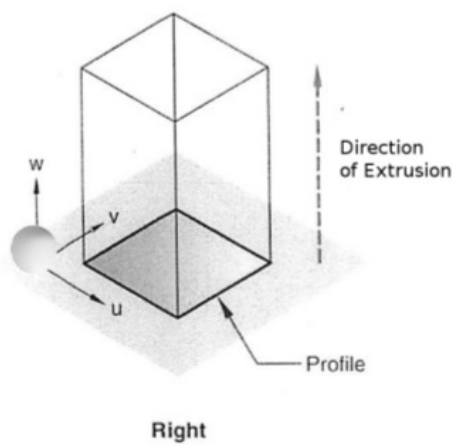


Solid Model Constructive Operations

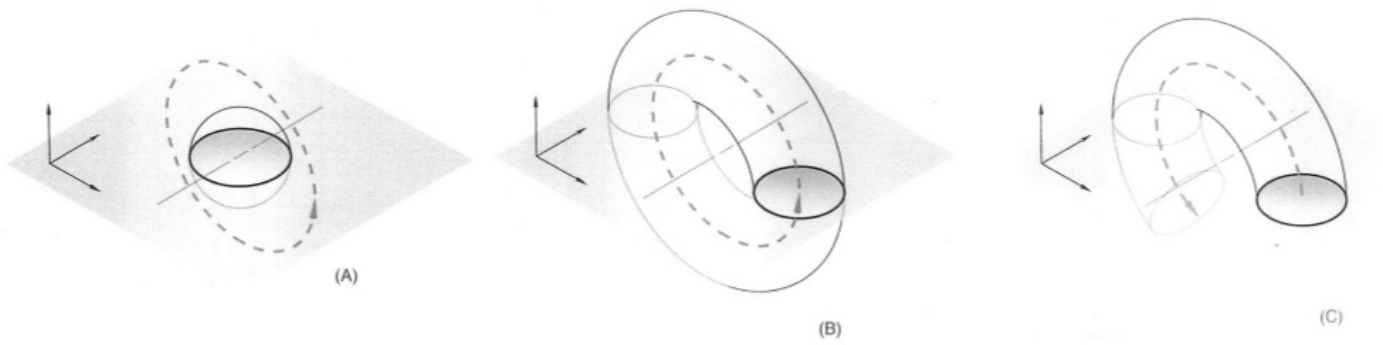


- Define a work plane
- Define a closed profile (sketch) using 2D primitives
- Infinite, unbounded 2D plane placed and oriented anywhere in the 3D domain of the model
- A local coordinate system (LCS) or user coordinate system (UCS) is associated with the World Coordinate System (WCS)
- A 2D profile is defined

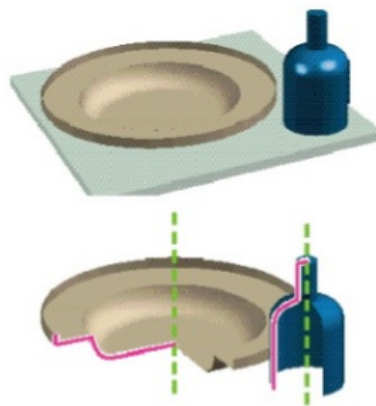
Extrusion



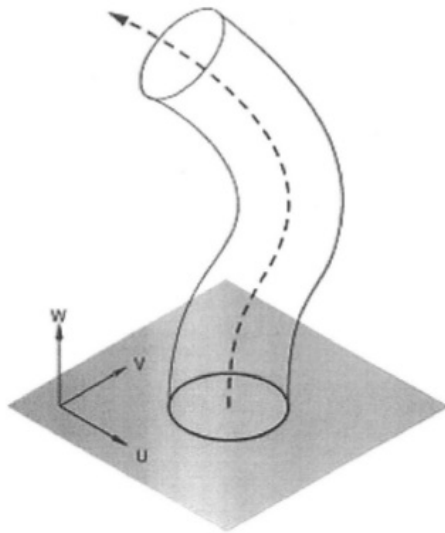
Revolution



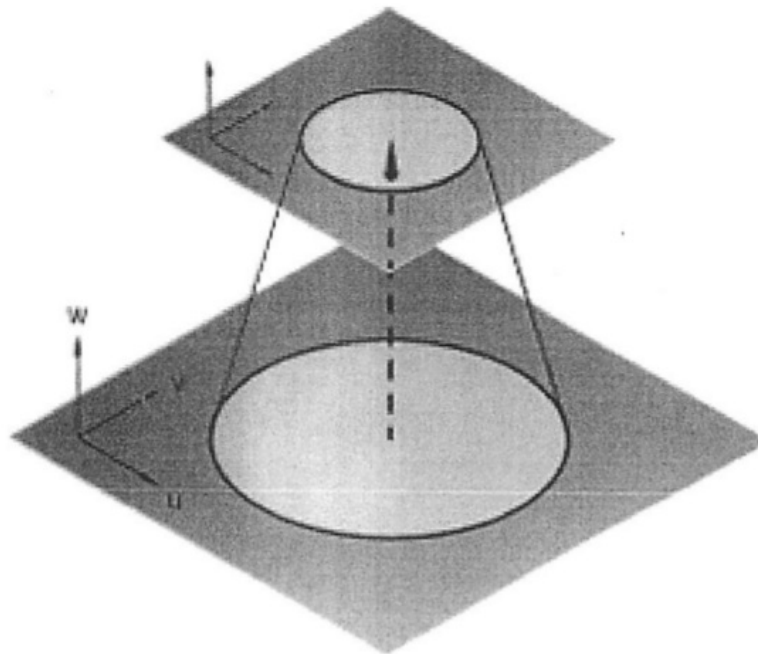
Revolution



Sweep



Loft



Constructive Operations

Extrude (linear sweep)

Define length and direction of the extrusion. The direction cannot be parallel to the work plane.

Revolve

Define the axis and amount of rotation

Sweep (path based sweep)

Define a space curve along which the sweep occurs

Loft

Define a space curve and intermediate profiles along the curve.

Feature Planning

- History tree
- Logical sequence of procedures used to create a solid model
- There is no unique history tree for a particular part being modeled

Sketch Constraint Quiz

pg 117 for constraint types, groups of 3-5, all names on one paper

