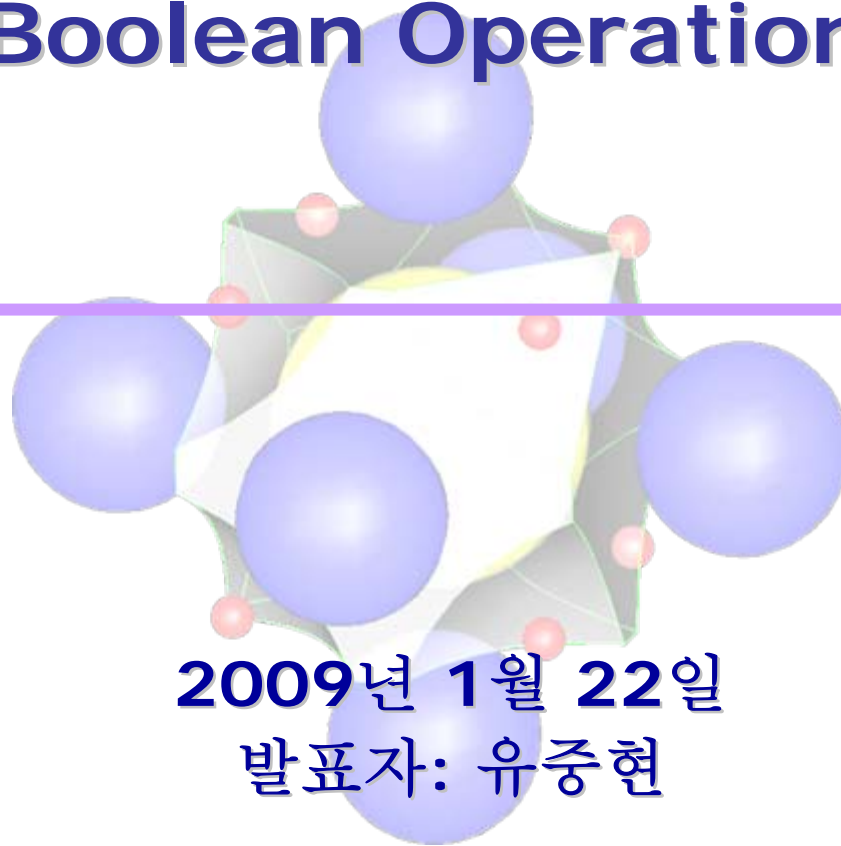
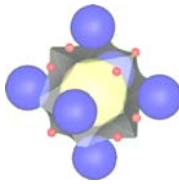


Architectural geometry: Boolean Operations

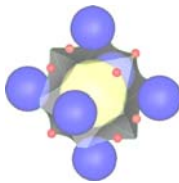


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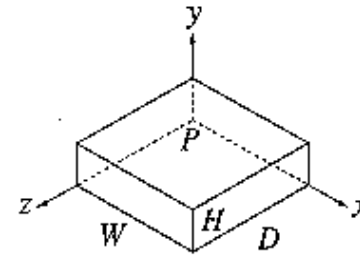
Typical modeling functions

- Creation by **simple shapes**
 - primitive creation function and Boolean operation
- Creation by **moving surfaces**
 - sweeping, skinning
- **Modification** of existing shapes
 - rounding (blending), lifting, filleting etc.
- **Manipulation of the low level entities** of a solid, such as vertices, edges and faces
 - boundary modeling
- Modeling by using **familiar shapes**
 - feature-based modeling

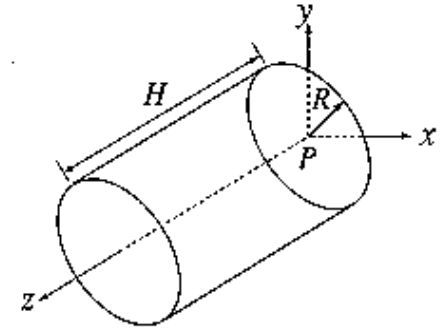


Primitive creation function

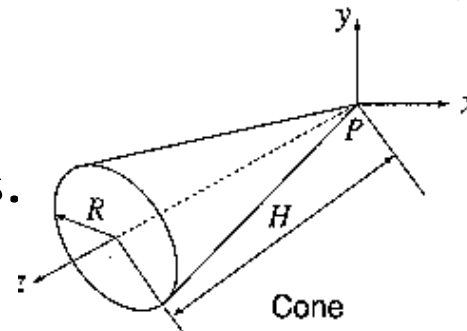
- Retrieve a solid from the primitive solids stored in CAD system.
- User specifies the parameters for primitives.



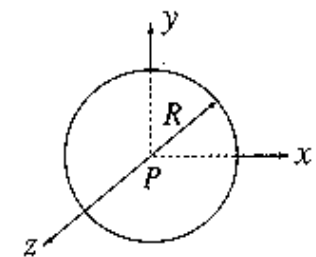
Block



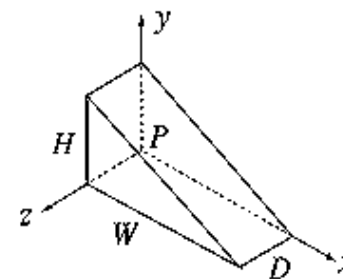
Cylinder



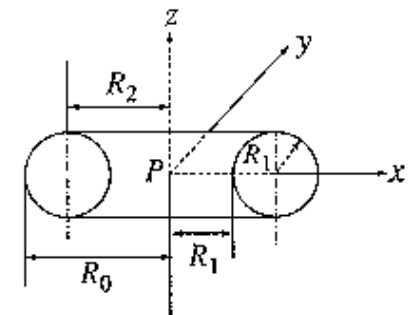
Cone



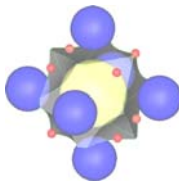
Sphere



Wedge

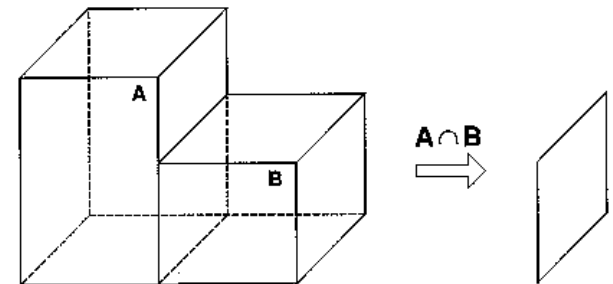
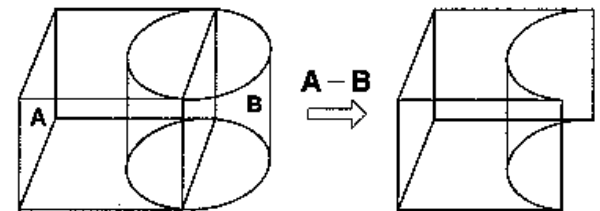
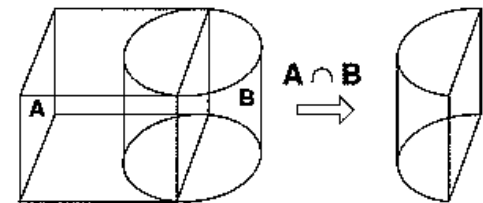
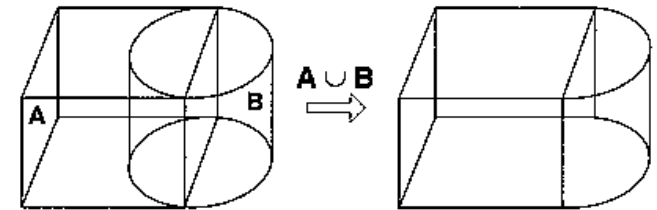


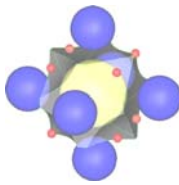
Torus



Boolean operations

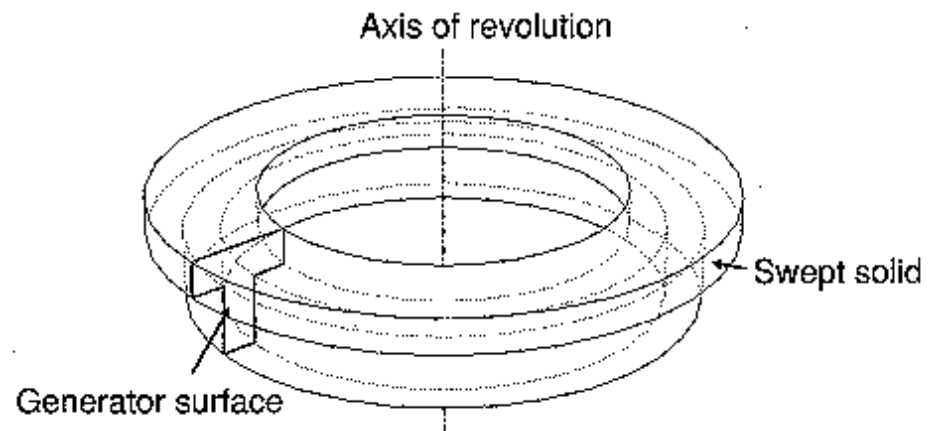
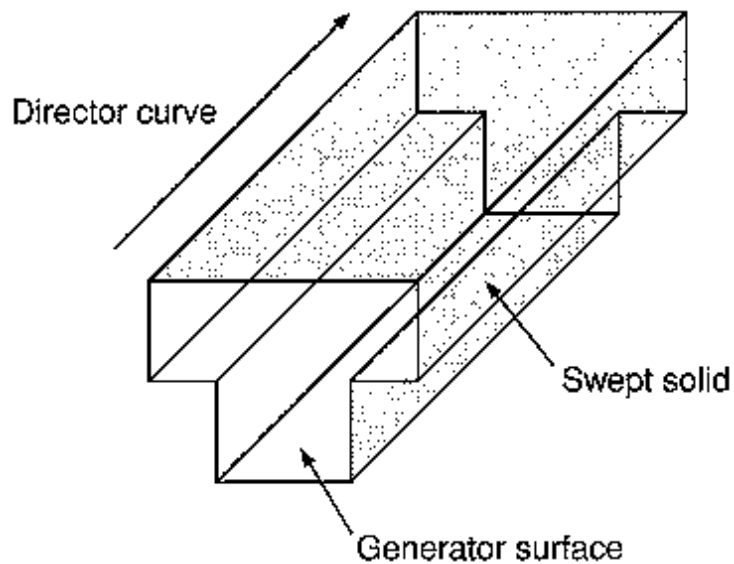
- Tools for modeling solid by **combining** the primitives or existing shapes.
- **Union, intersection and difference**
 - **Trimming + joining**
 - **Split**
- Be careful that **invalid solids** should not appear.

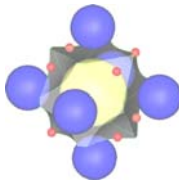




Sweeping

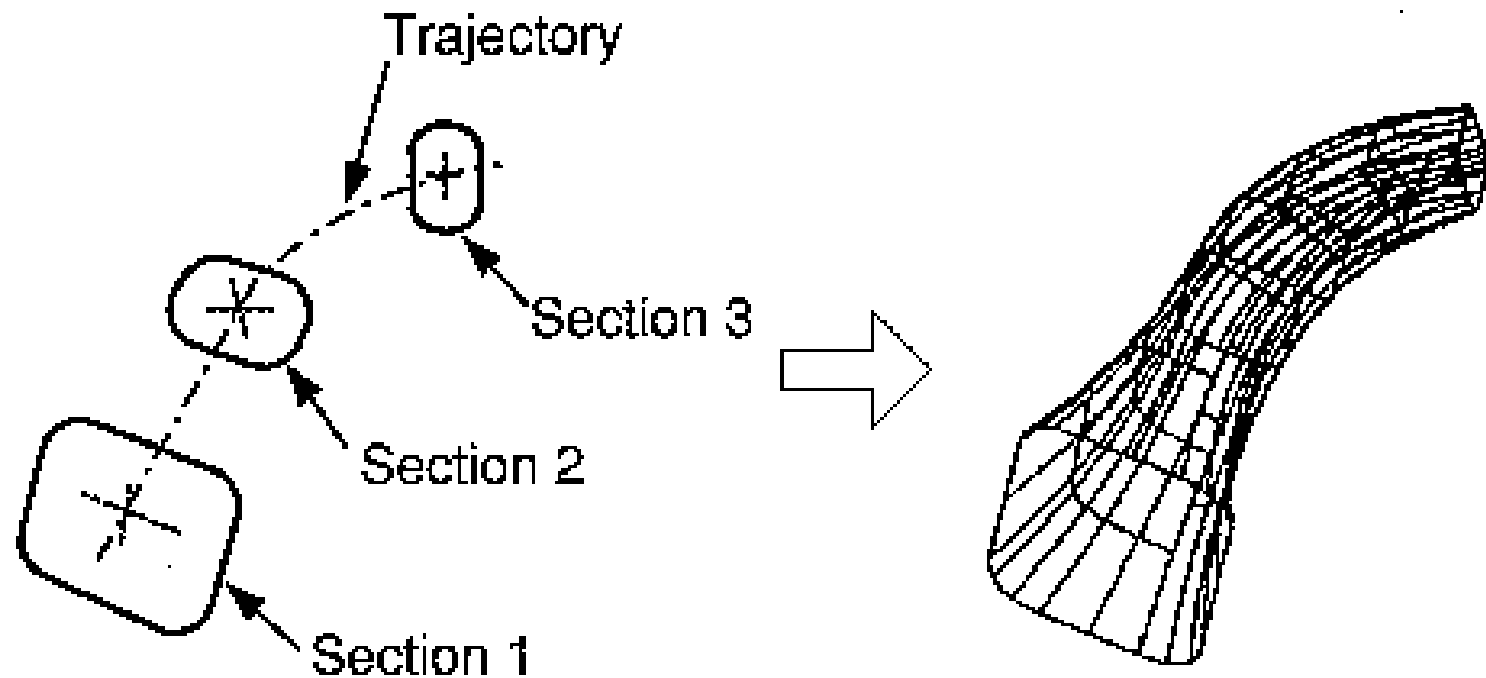
- Translational sweeping
- Rotational sweeping (Swinging)

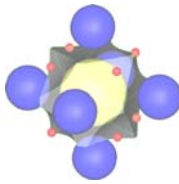




Skinning

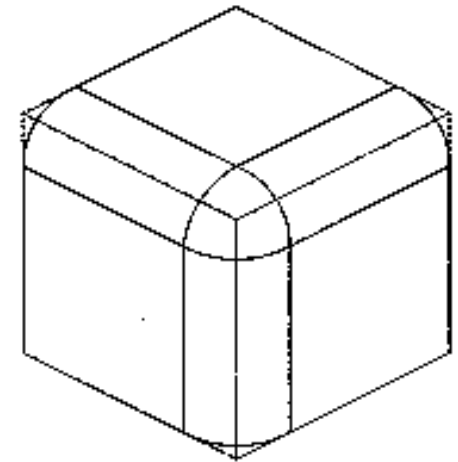
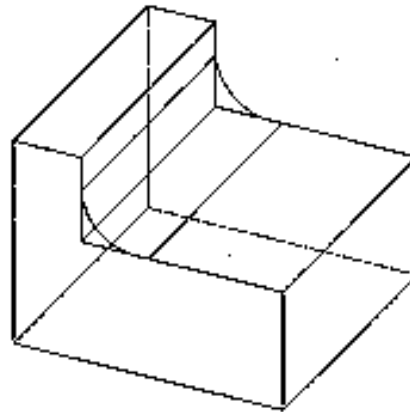
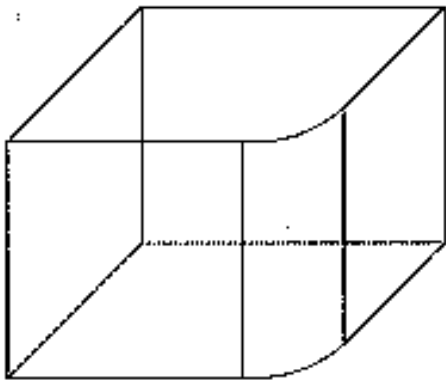
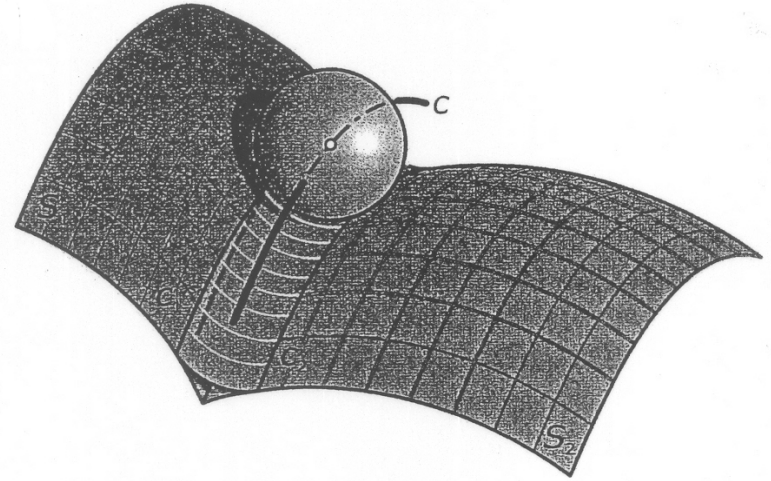
- (Lofting)
- Trajectory
- Cross-section



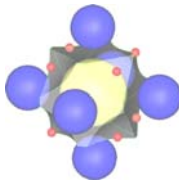


Rounding

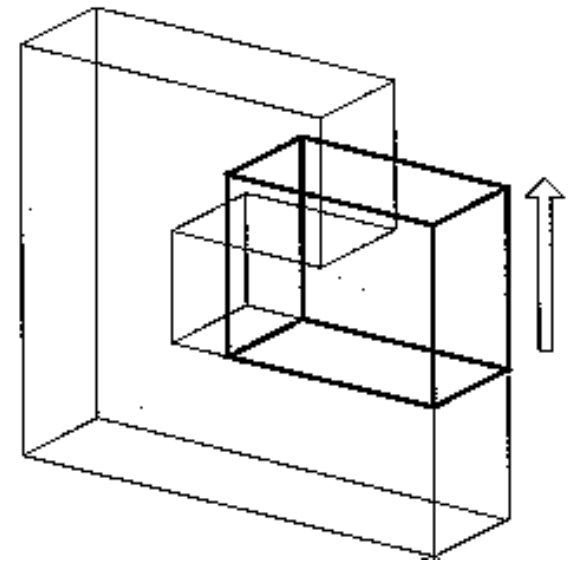
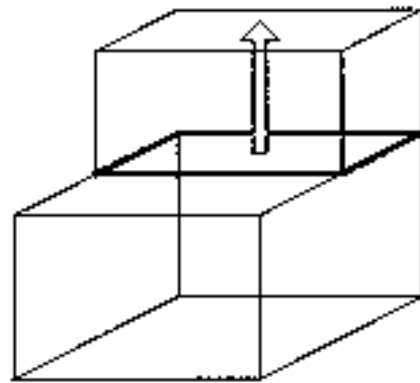
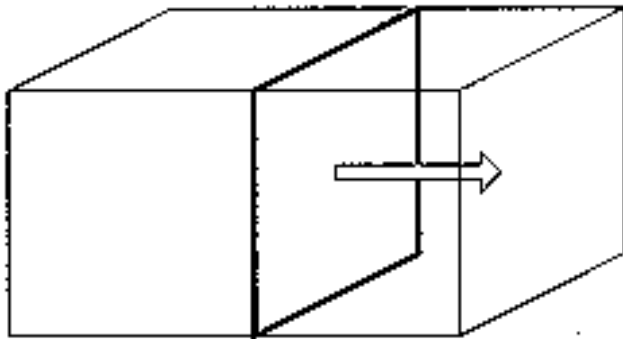
- Rounding (Blending)
- Filleting

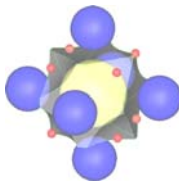


Lifting



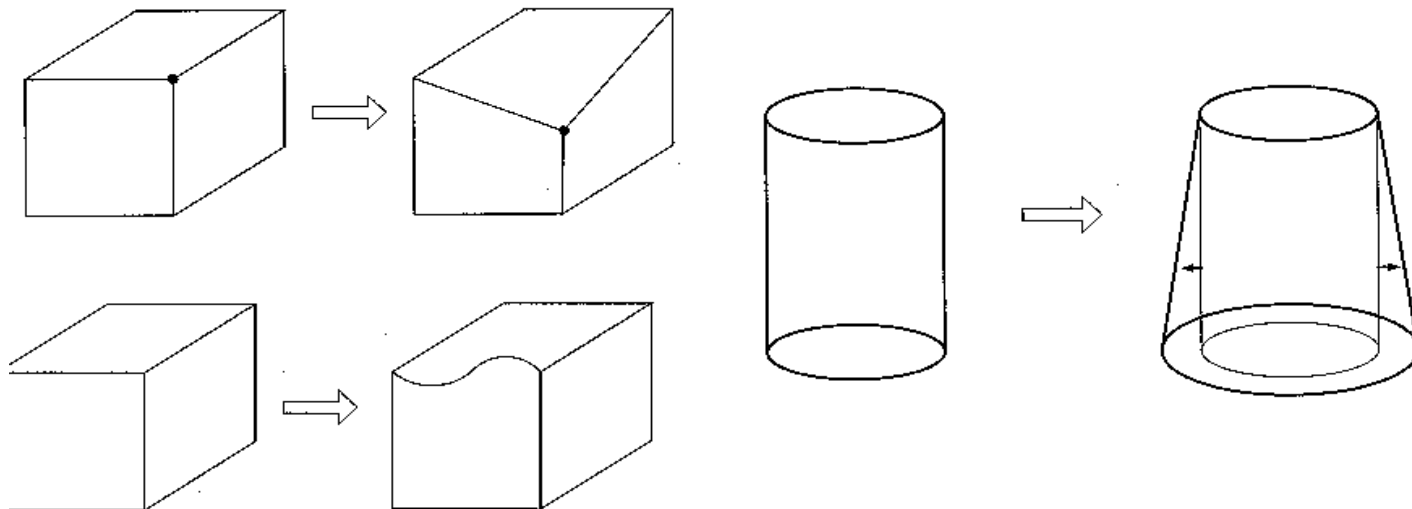
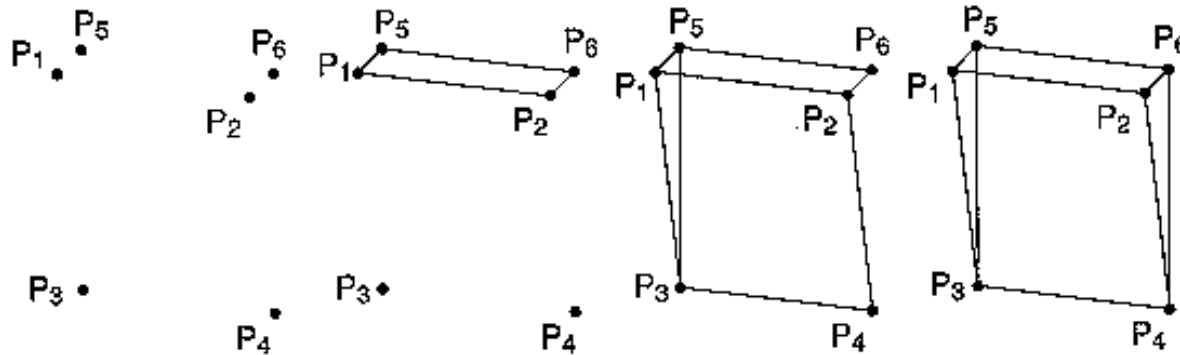
- Extrusion
- Protrusion (Boss)

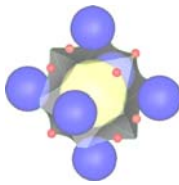




Boundary modeling

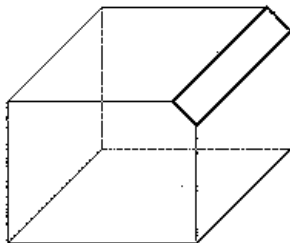
■ Tweaking



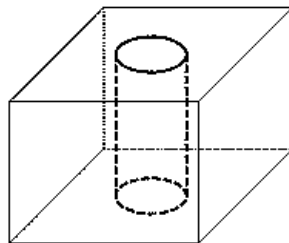


Feature-based modeling

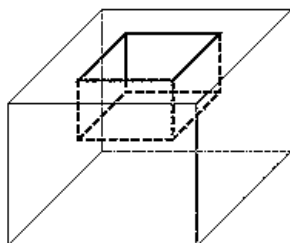
- Feature = geometric information + functional information (**design history**)
 - Body feature, form feature, operation feature
 - Ex) hole = positioning of cylinder + Boolean difference



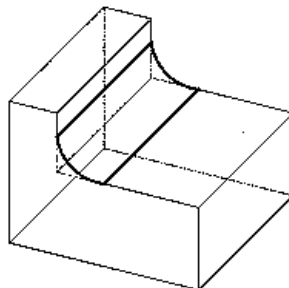
(a)



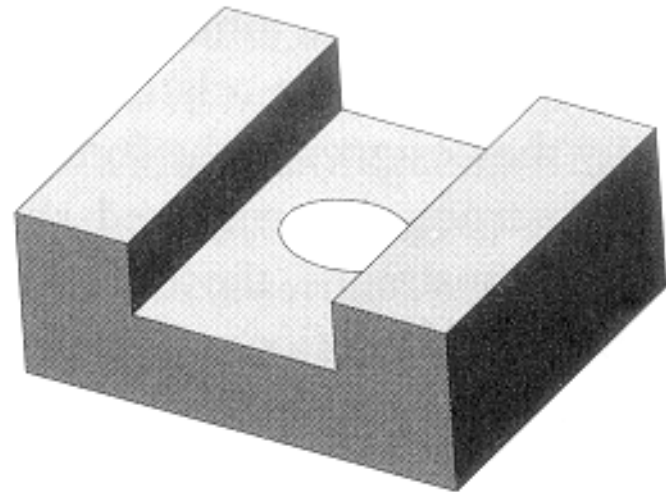
(b)

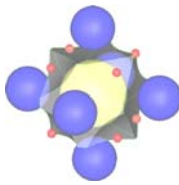


(c)



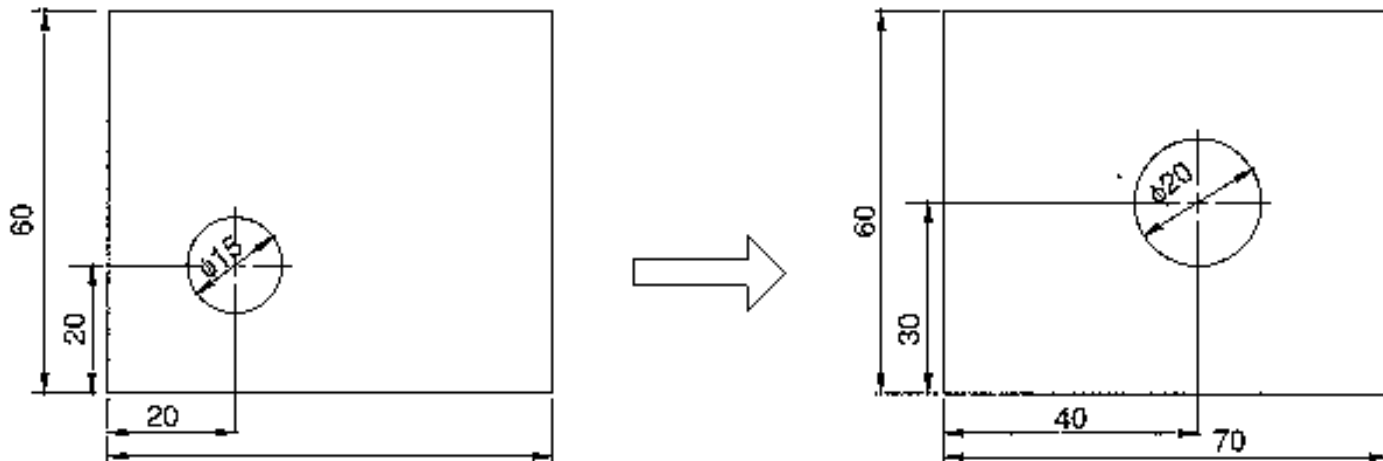
(d)



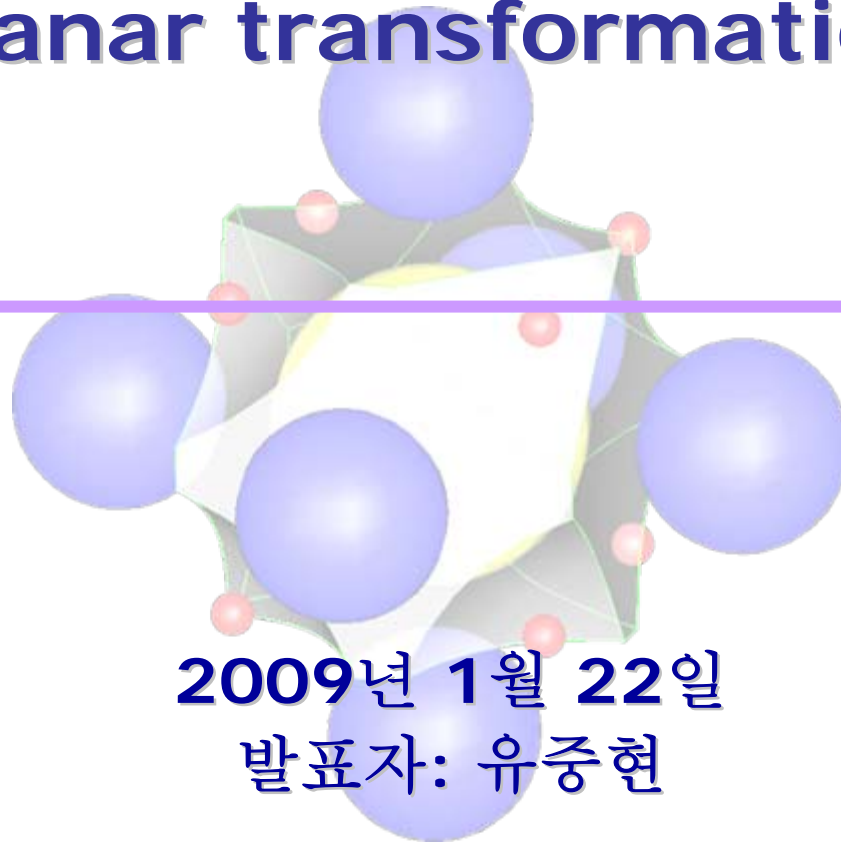


Parametric modeling

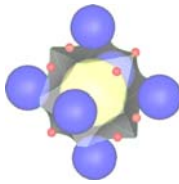
- Modeling based on geometric **constraint** and dimension data
 - Constraint
 - Two edges lie in a plane.
 - Two faces are parallel.
 - Dimension
 - **Relationship** among dimensions as well



Architectural geometry: Planar transformations



2009년 1월 22일
발표자: 유중현

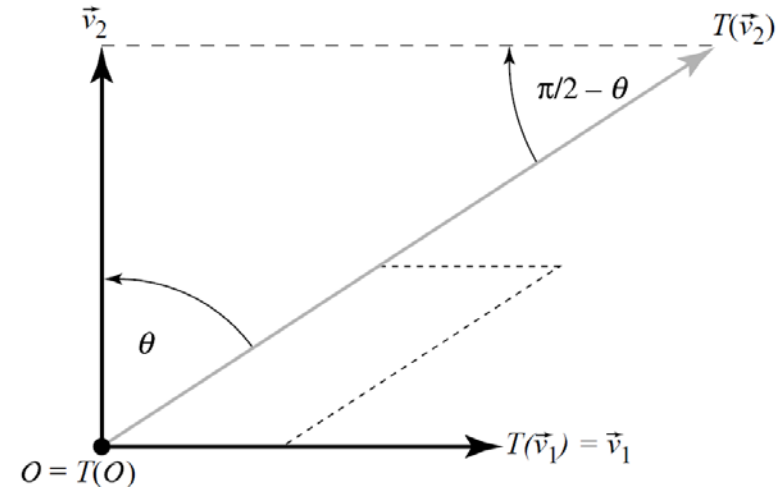
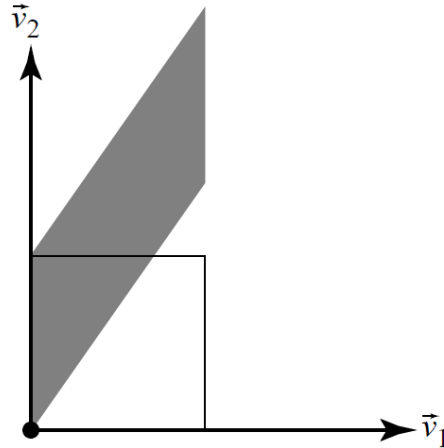
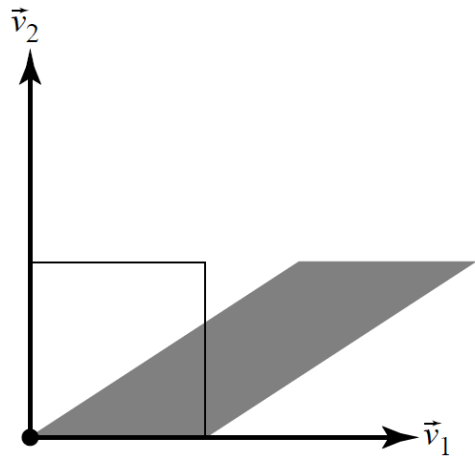
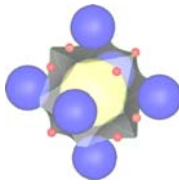


2D transformation

■ Affine transformation

- Congruent transformation: preserve **length** and **angle**
 - Translation, rotation, reflection
 - (Isometries)
- Similarity transformation: preserve **angle**
- Shear transformation: preserve **area**

Shearing



$$x_1 = x + y \tan \theta$$

$$y_1 = y$$

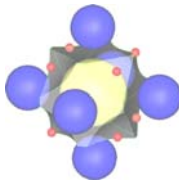
$$x_1 = x$$

$$y_1 = x \tan \theta + y$$

fixed line: x-axis

fixed line: y-axis

Composition of transformations

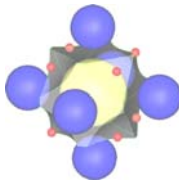


- **Composition of two reflections**
 - Intersecting reflection lines: a **rotation**
 - Parallel reflection lines: a **translation**

- **Composition of two opposite or two direct congruence transformation**
 - A direct congruence transformation

- **Composition of a direct and an opposite congruence transformation**
 - An opposite congruence transformation

Tilings



- Regular and semi-regular tessellation (tiling)
 - Regular: triangle, square and hexagon
 - Semi-regular: eight tessellation in a plane (3, 3, 4, 4) ...
- Crystallographic groups
 - The groups of congruence transformations which make a tiling invariant under the transformations
 - 17 groups (28 different types of tiles)