Solid Modeling : representation of solid objects unambigiously. Represent only one object

Solid representation

Divide Euclidean space into two regions interior and exterior to it separated from each other by the boundary of the object

Properties of Solid models :

Bounded boundary limits and contain the interior of the solid

Homogenously 3D no dangling edges or faces presented boundary is always in contact with the interior of the solid

Finite solid is not infinite in size can be described by a limited amount of information

Basics of solid modeling theory

Geometry , topology,

(x,y,z) coordinates of vertices : geometry

Connectivity matrix: topology

Geometric closure,

Set theory and Operations ,

A set is a collection of objects , in the context of geometric representation the basic element of a set is a point . two sets are commonly represented

W   universal set containing all the elements of all sets

0   null set containing no elements.

   A⊏B, A is a subset of B

   Inequality equality

   Regularized Boolean set operations:

   Union difference intersection etc

Set membership classification

Given two sets x and s as being on its interior, exterior or on its boundaries

 x is partitioned into subsets xins , sons, souts inside on boundary or outside S

Boundary Representation

Idea: physical object is enclosed by a set of faces, which themselves belong to closed and orientable surfaces

Information on both geometric and topological elements is stored in the B- rep database

Euler's law gives a quantitative relationship among faces edges vertices faces etc
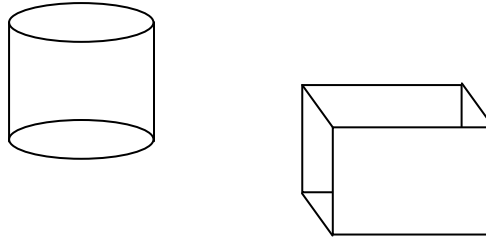
$F-E+V-L = 2(B-G)$

$F-E+V = 2$

Two vertices

Three edges

Three faces

$F -E + V = 2$

Sweep representation

Used for creating solids with uniform thickness in a particular direction and axisymtetric solids by translational and rotational sweeping

Sweeping requires

A surface to be moved and a trajectory (along which the movement should occur)

Recent Advancements In solid modeling

NURBS (Non Uniform Rational BSplines)

Solid modeler for handling free form surface definitions and not just polyhedral and quadric models