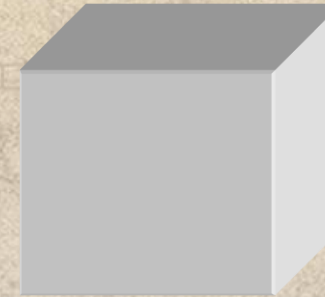
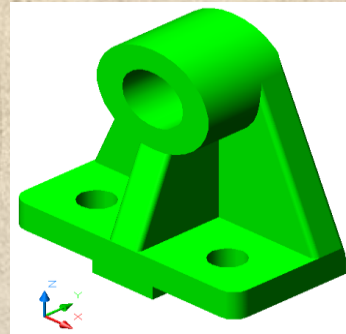




UNIT I-TOPIC 4
GEOMETRIC MODELING



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TYPES OF GEOMETRIC MODELING METHODS

- Wireframe modeling
- Surface modeling
- Solid modeling



WHY GEOMETRIC MODELING IS NEEDED

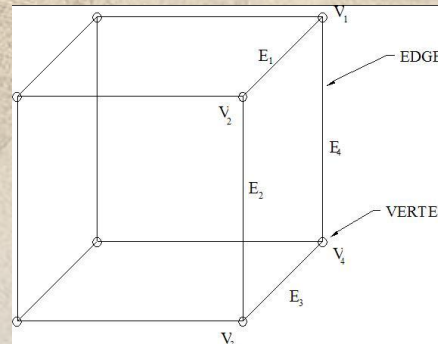
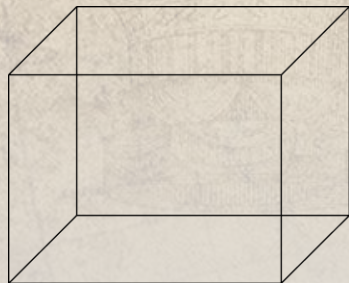
- Geometric (3D) models are easier to interpret
- Simulation under real-life conditions
- Less expensive than building a physical model
- 3D models can be used to perform finite element analysis (stress, deflection, thermal)
- 3D models can be used directly in manufacturing, Computer Numerical Control (CNC)
- Can be used for presentations and marketing



WIREFRAME MODELING

- Wire-frame modelling uses points and curves (i.e. lines, circles, arcs) to define objects
- The user uses edges and vertices of the part to form a 3-D object

Wireframe model



Part



Figure resource : Introduction to CAD/CAM/CIM Book



WIREFRAME MODELING – ADVANTAGES

- Can quickly and efficiently convey information than multi view drawings
- Can be used for finite element analysis
- Can be used as input for CNC machines to generate simple parts
- Contain most of the information needed to create surface, solid and higher order models

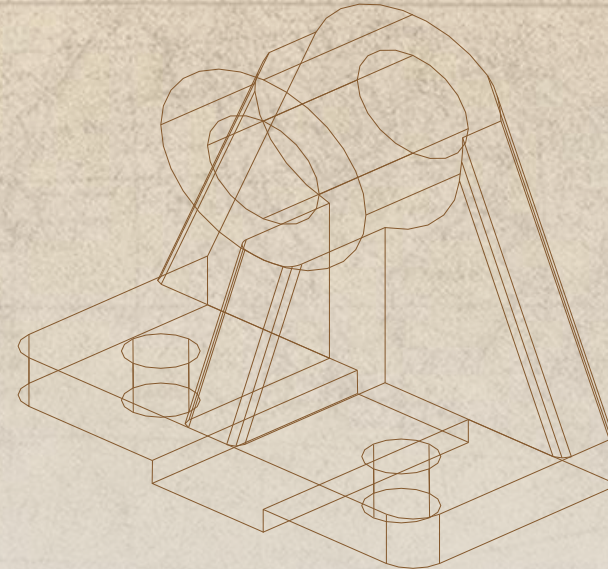
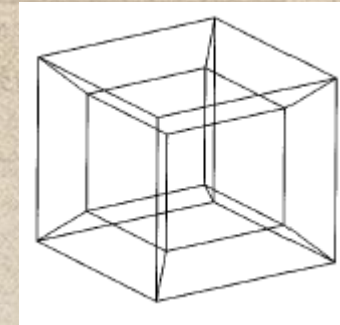


Figure resource :
<https://tinyurl.com/y8angbbh>

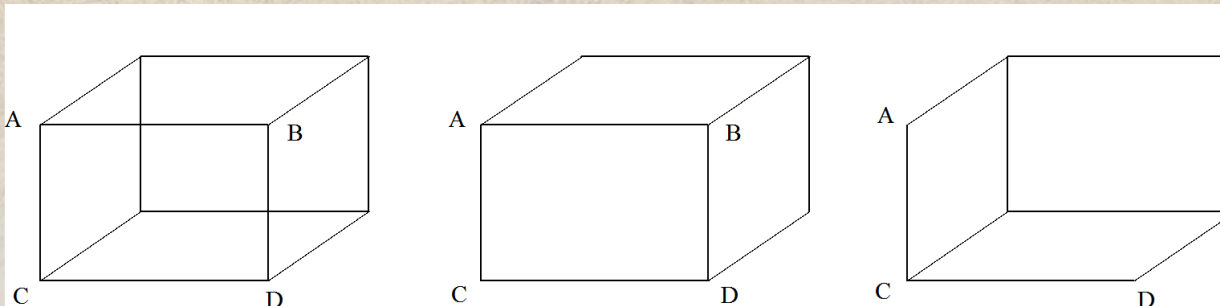


WIREFRAME MODELING - DISADVANTAGES

- Tend to be not realistic
- Do not represent an actual solids (no surface and volume)
- Cannot model complex curved surfaces
- Cannot be used to calculate dynamic properties
- Ambiguity
- complex model difficult to interpret



Ambiguous views



What does this object look like?

Figure resource : Introduction to CAD/CAM/CIM Book



SURFACE MODELING

“ A surface model represents the skin of an object, these skins have no thickness or material type ”

- Surface modeling is more sophisticated than wireframe modeling in that it defines not only the edges of a 3D object, but also its surfaces
- In surface modeling, objects are defined by their bounding faces



SURFACE MODELING - ADVANTAGES

- Eliminates ambiguity and non-uniqueness present in wireframe models by hiding lines not seen
- Renders the model for better visualization and presentation, objects appear more realistic
- Provides the surface geometry for CNC machining
- Provides the geometry needed for mold and die design
- Can be used to design and analyze complex free-formed surfaces (car bodies)
- Surface properties such as roughness, color and reflectivity can be assigned and demonstrated



SURFACE MODELING - DISADVANTAGES

- Surface models provide no information about the inside of an object
- Cannot be used to calculate dynamic properties

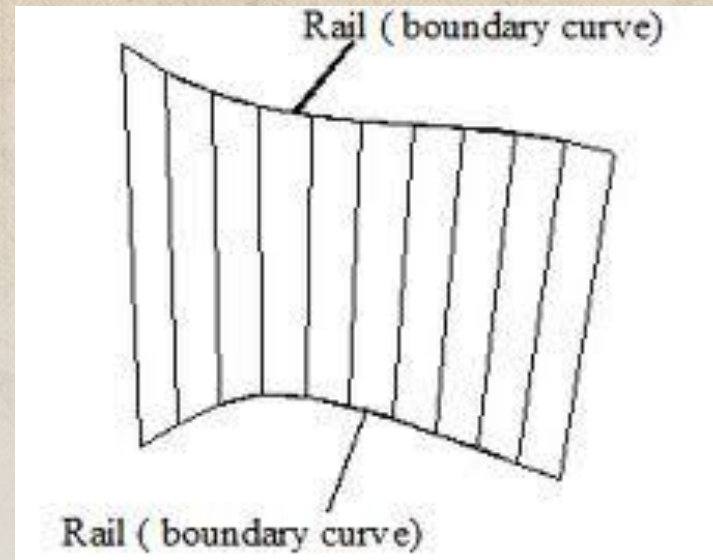
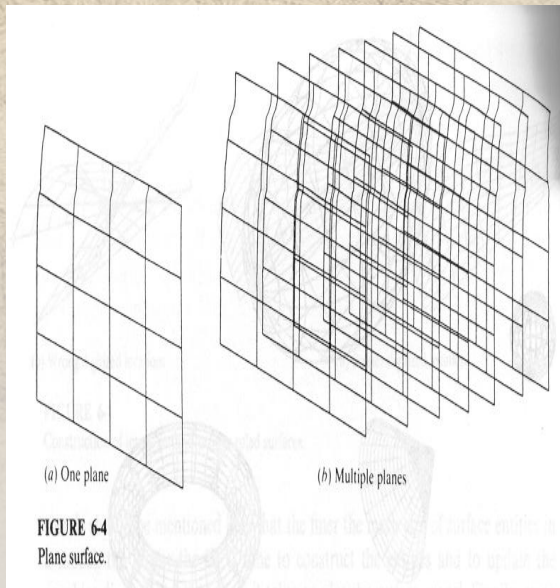


Figure resource : Introduction to CAD/CAM/CIM Book



SURFACE ENTITIES

- **Analytic entities include :**
 - Plane surface
 - Ruled surface
 - Surface of revolution and
 - Tabulated cylinder
- **Synthetic entities include**
 - Hermite Cubic spline surface
 - B-spline surface
 - Bezier surface and
 - Coons patches



SOLID MODELING

- In the solid modeling, the solid definitions include vertices (nodes), edges, surfaces, weight, and volume. The model is a complete and unambiguous representation of a precisely enclosed and filled volume

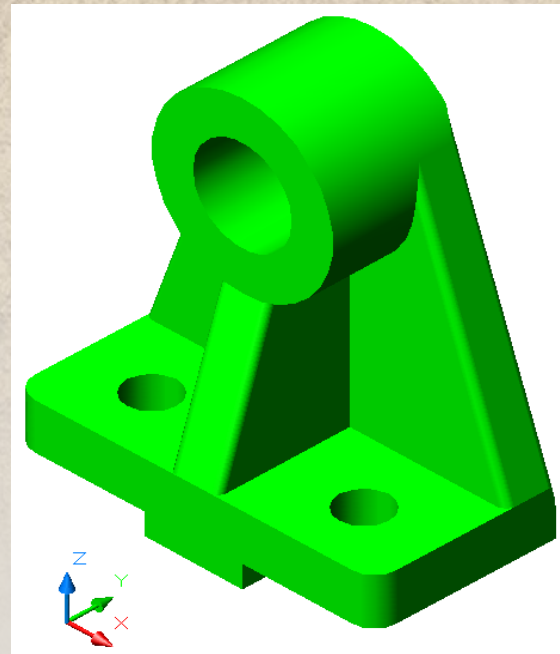
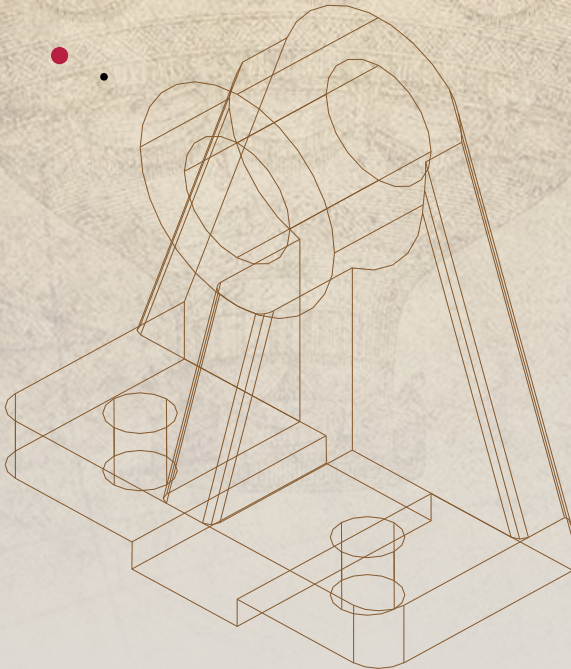


Figure resource :<https://tinyurl.com/y8angbbh>



METHODS OF CREATING SOLID MODELS

- Constructive Solid Geometry (CSG), CAD packages; Unigraphics, AutoCAD – 3D modeler
- Boundary Representation (B-rep), mostly used in finite element programs
- Parametric Modeling, CAD packages: SolidWorks, Pro/Engineer



PRIMITIVE SOLIDS

Primitive creation functions:

- These functions retrieve a solid of a simple shape from among the primitive solids stored in the program in advance and create a solid of the same shape but of the size specified by the user

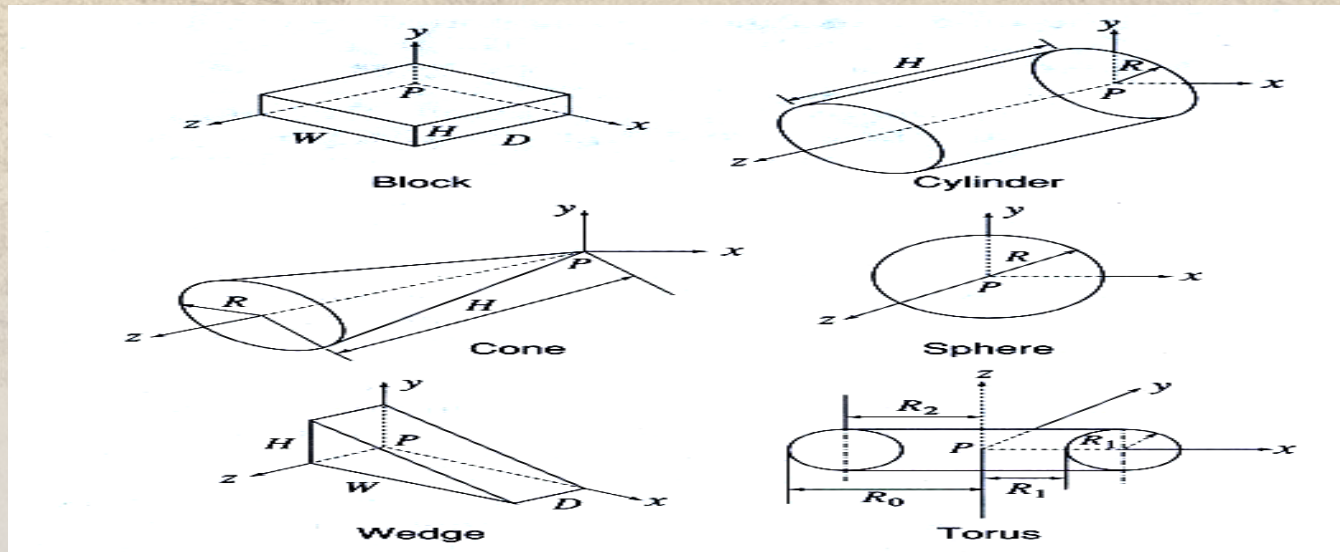


Figure resource : <https://tinyurl.com/y8angbbh>



ONE MARKS

In the following geometric modelling techniques which are not three-dimensional modelling?

- (a) Wireframe modelling
- (b) Drafting**
- (c) Surface modelling
- (d) solid modelling

In the following three-dimensional modelling techniques. Which do not require much computer time and memory?

- (a) Surface modelling
- (b) Solid modelling
- (c) Wireframe modelling**
- (d) All of the above



Thank You