

3D Modeling Basics

Reasons for 3D Modeling

| | |
|----------------------|-----------------|
| Realistic renderings | Animation |
| Rapid prototype | Virtual reality |
| Production/CNC? | Video |
| Engineering analysis | 2D drawings |

Background Knowledge

| Three types of 3D models | | |
|--------------------------|---------|-------|
| Wireframe | Surface | Solid |

Wireframe: using each *wire* represents an edge of the actual object. The surfaces of the object are not defined.

Characteristics:

| |
|---|
| Transparency-see-through, |
| No volume, |
| Constructed by creating 2D objects in 3D space -3D coordinates needed |
| Good for computerized replicas, |
| Dimensionally complete, |
| Can be viewed from any position, |
| Test and analyze the object three dimensionally. |

Surface Models: using *surfaces* as well as edges represent an actual object.

Characteristics:

| |
|--------------------|
| Can't see through, |
|--------------------|

| |
|-------------------------|
| Has volume but no mass, |
|-------------------------|

| |
|--|
| Each surface must be constructed individually, |
|--|

| |
|--|
| Capable of either wireframe or hidden display, |
|--|

| |
|-----|
| ... |
|-----|

Solid Models: contain the complete surface and edge definition, as well as description of the interior features of an object. Material characteristics can be assigned and it is considered to have mass.

| |
|--------------------|
| Can't see through, |
|--------------------|

| |
|----------------------|
| Has volume and mass, |
|----------------------|

| |
|--|
| Constructed by ACIS-AutoCAD's solid modeler (CSG+B-Rep), |
|--|

| |
|--|
| Capable of either wireframe or hidden display. |
|--|

| |
|-----|
| ... |
|-----|

3D Coordinate System

The XY plane is parallel with the screen and the Z-axis is perpendicular to, and out of, the screen.

Data Entry Methods (pp.707-708)

| |
|-----------------------|
| PICK |
| X,Y,Z |
| @X,Y,Z |
| @distance<angle,Z |
| @distance<angle<angle |
| Distance,direction |

| WCS | UCS |
|-------------------------|------------------------|
| World Coordinate System | User Coordinate System |
| WCS Icon | UCS Icon |

UCS: allows a user to change from one coordinate system to another.

Command: ucs

Origin/ZAxis/3point/OBject/View/X/Y/Z/Prev/Restore/Save/Del/?/<World>:

Origin - identifies a new user coordinate system at origin 0,0,0.

Zaxis - identifies a user coordinate system from two points defining the Z-axis.

3point - identifies a user coordinate system by 3 points.

Entity - identifies a user coordinate system in relation to an entity selected.

View - identifies a user coordinate system by the current display.

X/Y/Z - identifies a user coordinate system by rotation along the X, Y, or Z-axis.

Prev - sets the user coordinate system icon to the previously defined user coordinate system.

Restore - restores a previously saved user coordinate system.

- Save** - save the position of a user coordinate system from under a unique name given by the user.
- Del** - deletes a user coordinate system from the database of the current drawing.
- ?** - lists all previously saved user coordinate systems.
- <world>** - switches to the world coordinate system.

3D Viewing and Display Commands

| Viewing | | | | | |
|---------|------|-------|------|------|--------|
| Vpoint | Plan | Dview | Zoom | View | Vports |

Vpoint: allows a user to change his/her viewpoint of a 3D model.

Plan: generates a top view of the object.

Dview: dynamically rotates the object.

View: can be used with 3D viewing to Save and Restore 3D viewpoints.

Vports: allows a user to display several viewpoints or sizes of the object on one screen (set **TILEMODE** variable =1).

| Display | | |
|---------|-------|--------|
| Hide | Shade | Render |

Hide: removes edges and surfaces that are hidden from the viewpoint from a solid or surface model.

Shade: fills the surfaces with the object's color and calculate light reflection by applying gradient shading to the surfaces.

Render: allows a user to create and place lights in 3D space, adjust the light intensity, and assign materials to the surfaces.