Sec B2

Surface is specified by eqn having two independent variables like curve surface are specified by equation in Parametric & Non Parametric form

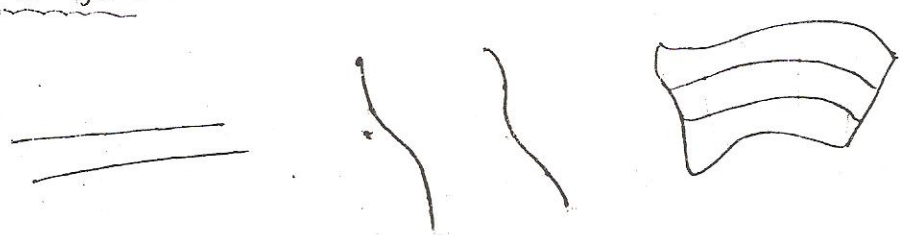
explicit implicit

$z = f(x, y)$

$x = f(s, t)$
$y = f(s, t)$
$z = f(s, t)$

where $a \leq s \leq b$
$c \leq f \leq d$

- A surface formed by transitioning b/w two or more curve by using linear blending b/w each section of surface is called ruled surface.

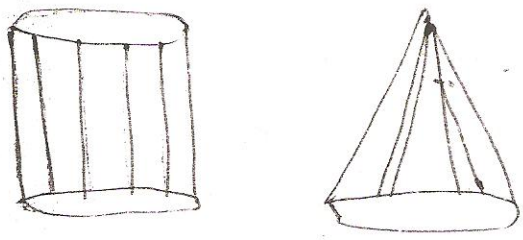


Polygon Surfaces

- It comprises of a set of surface polygons that enclose the object interior
- for 3-D graphics objects, it is most commonly used boundary representation techniques. Boundary representation technique is also called B-rep technique describe a 3-D object as a set of surfaces that separate the object interior from its environment.
- Polygon surfaces are defined using linear equations.
- This simplify the display of objects.
- Polygon surfaces when used in 3-D CAD packages efficiently define objects with plane surfaces compared to the objects with curved surfaces.

Polygon surfaces are defined using a set of vertex co-ordinates and associated with attribute parameters.

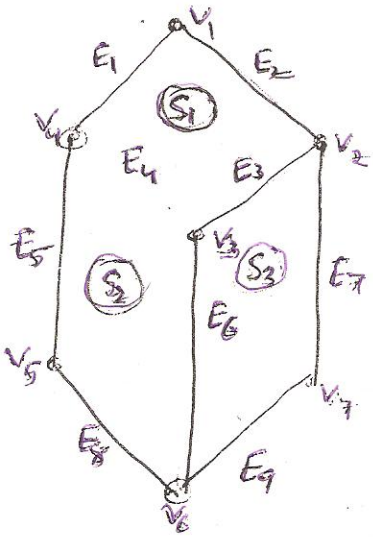
While using a CAD Package, as information for each object is made to be as I/p. The data for each ~~object~~ Polygon is organised into tables. The useful data is subsequently taken from these tables and modifications of solid models



⇒ Polygon data tables can be categorised into two groups

① Geometric tables

② Attribute tables



Vertex table
$V_1 : x_1 y_1 z_1$
$V_2 : x_2 y_2 z_2$
$V_3 : x_3 y_3 z_3$
$V_4 : x_4 y_4 z_4$
$V_5 : x_5 y_5 z_5$
$V_6 : x_6 y_6 z_6$
$V_7 : x_7 y_7 z_7$

Edge table	
E_1	V_1, V_4
E_2	V_1, V_2
E_3	V_3, V_2
E_4	V_3, V_4
E_5	V_4, V_5
E_6	V_3, V_6
E_7	V_2, V_7
E_8	$V_5 V_6$
E_9	V_6, V_7

Polygon Surface table
$S_1 : E_1, E_2, E_3, E_4$
$S_2 : E_4, E_5, E_8, E_6$
$S_3 : E_3, E_6, E_9, E_7$

The equation of plane is given by following expression

$$Px + Qy + Rz + S = 0$$

point (x_1, y_1, z_1) lies on the plane and the surface of the model if

$$Px_1 + By_1 + Rz_1 + S < 0$$

and, if $Px_1 + By_1 + Rz_1 + S > 0$, the point doesnot lie on the surface of the model.

Bezier Surface 3m/b

→ Bezier curves are easily extended into three-D to create Bezier surface. Two orthogonal sets of Bezier space curves defines a Bezier surface. The surface appear as a set of quadrilateral patches

Control pts that define Bezier surface can be manipulated so as to give the surface some aesthetic or engg. properties.

- Bezier surface can be plotted by using two orthogonal Bezier curves and specifying the input mesh of control points

$$P(s,t) = \sum_{i=0}^{m} \sum_{i=0}^{n} B_{ij}\, J_{i,m}(u)\, J_{i,n}(v)$$

$$= \sum_{i=0}^{m} \sum_{i=0}^{n} B_{ij} \cdot {}^{m}C_i\, u^i (1-u)^{m-i}\, {}^{n}C_j\, v^j (1-v)^{n-j}$$

when $0 \le u \le 1$ & $0 \le v \le 1$