17. 3D Object Representations

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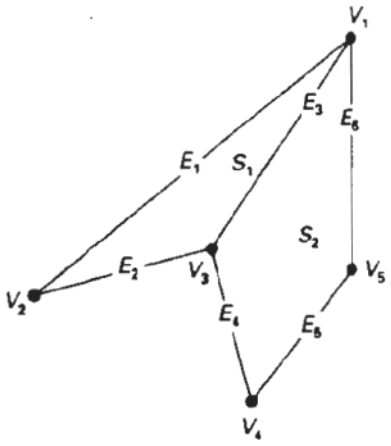
→ No single method can be used to describe objects that includes all characteristics of their different materials.

Representing Polygon Surfaces :-

① Polygon Tables

Storing geometric data using three 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

EDGE TABLE	
E_1:	V_1, V_2
E_2:	V_2, V_3
E_3:	V_3, V_1
E_4:	V_3, V_4
E_5:	V_4, V_5
E_6:	V_5, V_1

POLYGON-SURFACE TABLE	
S_1:	E_1, E_2, E_3
S_2:	E_3, E_4, E_5, E_6

② Plane Equations

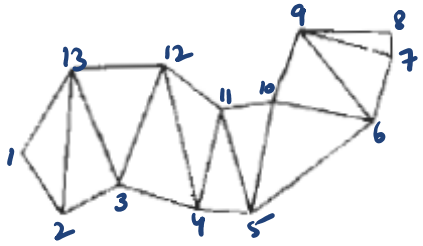
The equation for a plane surface,

$$Ax + By + C_2 + D = 0$$

(x, y, z) is any point on the plane.
A, B, C, D are constants describing the spatial properties of the plane.

③ Polygon Meshes

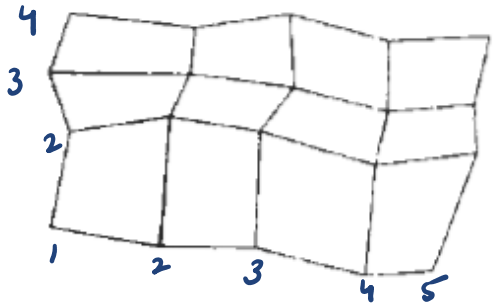
Triangle Mesh:—



A triangle strip formed with 11 triangles connecting 13 vertices.

⇒ produces (n-2) connected triangles.

Quadrilateral Mesh:—



12 quadrilaterals constructed from a 5 by 4 input vertex array.

⇒ A mesh of (n-1) by (m-1) quadrilaterals.

Spline Representation :-

Spline :- a flexible strip used to produce a smooth curve through a designated set of points.

Interpolation and Approximation Splines :-

Control Points :- Set of coordinate positions which indicates the general shape of a curve.

⇒ Fitting the polynomial so that the curve passes through each control point.

⇒ Polynomials are fitted to the control point path without necessarily passing through any control point.

Interpolated

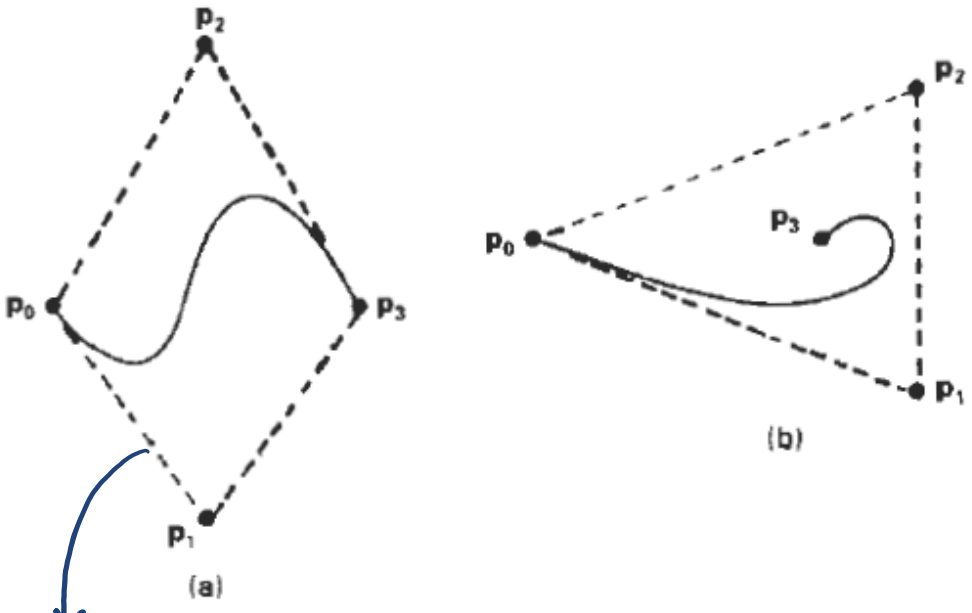
Approximated control points

Interpolated control points

Approximated control points

CONVEX HULL :-

The convex polygon boundary that encloses a set of control points is called convex hull.



Convex hull shape