Lecture-26
AH

classmate
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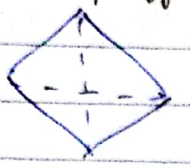
Page

Polygon

A close figure with more than 2 sides

Convex polygon



line b/w any two vertices is inside the polygon area completely.

Concave polygon

Polygon surface equation

$Ax + By + Cz + D = 0$

If $Ax + By + Cz + D < 0$, point inside the area.

3D object representation

~~i) Boundary representation~~

- Broadly representation schemes for solid schemes are divided into two categories:

i) Boundary representation

Describe 3D objects as a set of surfaces that separate the object interior from the environment.

ii) Space partioning representation (SPR)

They are used with interior properties, by partioning the spatial region containing an object into a set of small, non-overlapping contiguous solids (usually cubes).

Vertex table

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Geometric data representation for two adjacent polygon surfaces:

Vertex table
$V_1 : x_1, y_1, z_1$
$V_2 : x_2, y_2, z_2$
.
.
$V_5 : x_5, y_5, z_5$

Edge table	(if using surface)
$E_1 : V_1, V_2$,	S_1
$E_2 : V_2, V_3$	S_1
$E_3 : V_1, V_3$	S_1, S_2
$E_4 : V_3, V_4$	
$E_5 : V_4, V_5$	
$E_6 : V_1, V_5$	

Polygon surface table
$S_1 : E_1, E_2, E_3$
$S_2 : E_3, E_4, E_5, E_6$

Quadric surface

surface with surface equation of degree 2

→ surface eqn of sphere

eg- $x^2 + y^2 + z^2 = r^2$

sphere's cartesian eq²

→ circle not a surface

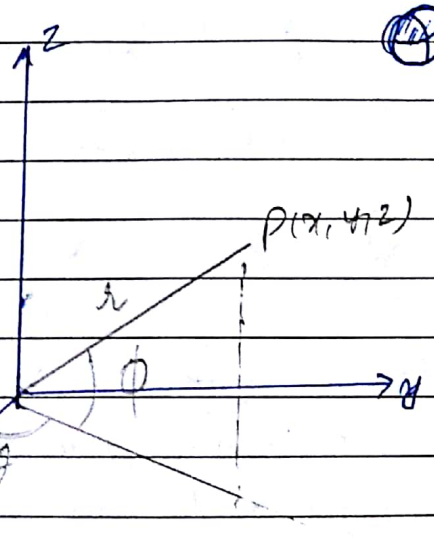
→ sphere has a volume

Parametric eq² for sphere

$x = r\cos\phi\sin\theta$

$y = r\sin\phi\cos\theta$

$z = r\sin\phi$



We can represent a ~~sphere~~ surface using parametric equation in terms of longitude & latitude. (angle)

$-\frac{\pi}{2} \leq \phi \leq \frac{\pi}{2}$

$-\pi \leq \theta \leq \pi$

Ellipsoid

$\left(\frac{x}{r_x}\right)^2 + \left(\frac{y}{r_y}\right)^2 + \left(\frac{z}{r_z}\right)^2 = 1$

→ Cartesian form eq²

Superquadric

Superellipse

$\left(\frac{x}{r_x}\right)^{2/s} + \left(\frac{y}{r_y}\right)^{2/s} = 1$

→ we change more by varying s

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Super ellipsoid

$$\left[\left(\frac{x}{r_x}\right)^{2/s_2} + \left(\frac{y}{r_y}\right)^{2/s_2}\right]^{s_2/s_1} + \left(\frac{z}{r_z}\right)^{2/s_1} = 1$$

Blobby object → 3D object with no fixed shape
Shape changes with time.
Eg - water droplets, clay, muscle etc.

line drawing → 3 algos
Circle drawing → 4 algos
ellipse drawing → 4 algos → Xiaolin Wu's algorithm

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