Unit- III

Shading Models

Page Subhash
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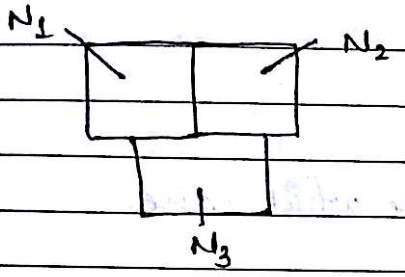
27/09/17

→ Gouard Shading Model -

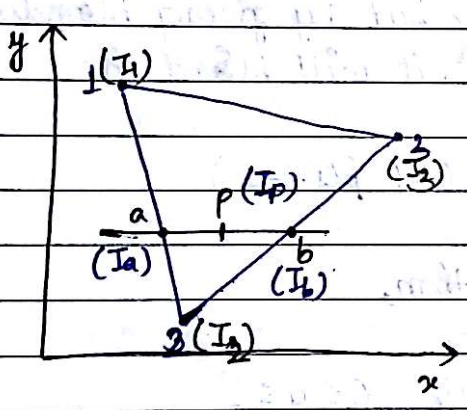
i) Calculate avg. normal vector of given polygon surface
ii) Apply Illumination Model
iii) Calculate linear interpolated intensities of surface polygon vertex



$$N_V = \frac{N_1 + N_2 + N_3}{|N_1 + N_2 + N_3|}$$

In general form,

$$N_V = \frac{\sum_{i=0}^{n} N_i}{\left|\sum_{i=0}^{n} N_i\right|}$$



for vertex 1 & 2, intensities are I_1 & I_2

So, for any point 'a' on the vertex 1 to 2, intensity at 'a' is

$$I_a = \frac{y_a - y_2}{y_1 - y_2}(I_1) + \frac{y_1 - y_a}{y_1 - y_2}(I_2)$$

Similarly,

$$I_b = \frac{y_b - y_2}{y_3 - y_2}(I_3) + \frac{y_3 - y_b}{y_3 - y_2}(I_2)$$

and, $$I_p = \frac{x_b - x_p}{x_b - x_a}(I_a) + \frac{x_p - x_a}{x_b - x_a}(I_b)$$

Now, for the next line (ie. y-1), the intensity I' will be calculated as

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$$I' = I + \frac{I_2 - I}{y_1 - y_2}$$

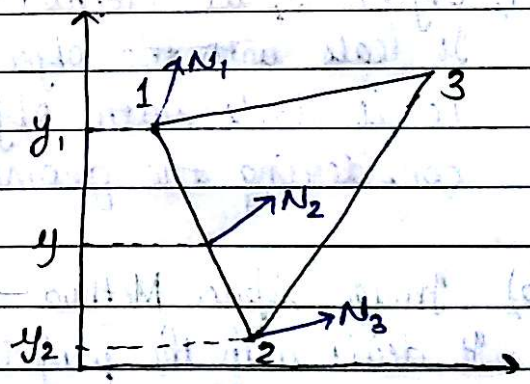
at Horizontal projection position,

$$I' = I + \frac{I_b - I_a}{x_b - x_a}$$

Disadvantages -
The linear intensity interpolation can result in bright or dark intensity stress or patches appearing on the surface.
These patches are called Mach-bands.

→ Phong Shading Model-
i) Determine unit normal vector for every polygon surface
ii) Linearly interpolates the vertex normal over polygon surface
iii) Apply Illumination Model

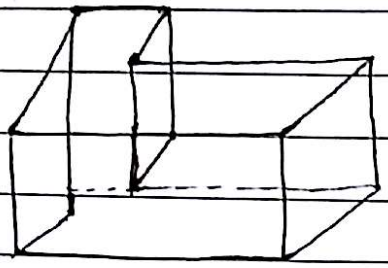
$$N = \left[\frac{y - y_2}{y_1 - y_2} \cdot N_1\right] + \left[\frac{y_1 - y}{y_1 - y_2} \cdot N_3\right]$$



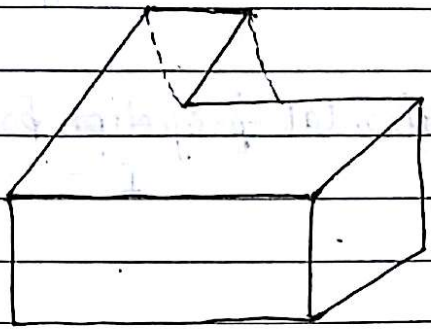
→ Flat Shading Model-

→ Polygon mesh

→ Visible Surface Detection -



(Hidden Surface Display)



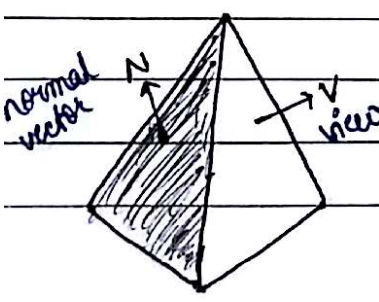
(Hidden Surface Removal)

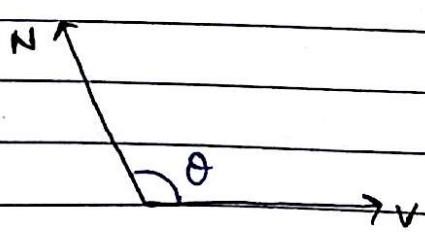
- The surfaces that are drawn or hidden from view must be removed in order to construct a realistic view of the 3-D scene.
- The identification and removal of these surfaces is called 'Hidden Surface Problem'.
- This problem is solved by applying Hidden Surface Algorithms which are categorized into two methods -

1) Object Space Method -
It deals with the object definition directly
i.e. it deals with object in world co-ordinate system considering the geometrical relationship b/w the actual objects.

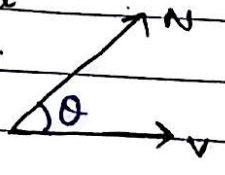
2) Image Space Method -
It deals with the projected image with screen co-ordinate system by considering pixel position on the view plane.

→ Object Space Method
Back Face Detection Method -





$N \cdot V > 0$
dot product



i) This algorithm is based upon 'Inside-Outside Test' for identifying the back face of a polygon.

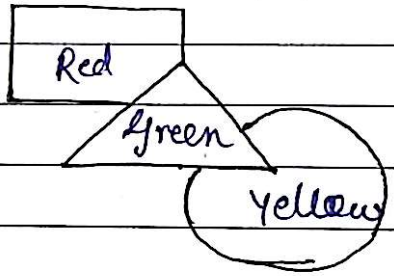
ii) The dir^{n} of the light can be identified by examining the result $N \cdot V > 0$, where $N \rightarrow$ normal vector to the polygon surface
$V \rightarrow$ vector in the view direction

ii) When both the vectors are in the same direction, then cosine will be +ve (>0). It means ~~N & V~~ that the polygon is visible.

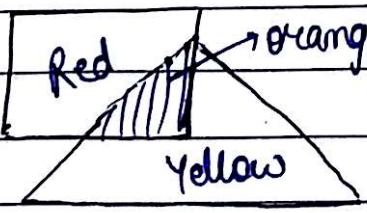
v) If N & V are in opp. direction, then $\cos\theta < 0$
⇒ polygon is back-faced

Image Space Method mainly consists of -

1) Z Buffer / Depth Buffer Method
- deals with overlapping solid shapes where one shape/colour completely overlaps another shape



2) A Buffer
- Overlapping of two surfaces is partial
eg. a transparent glass window over a background scenery
- Colour are mixed to give a third colour rather than one colour completely domination over other

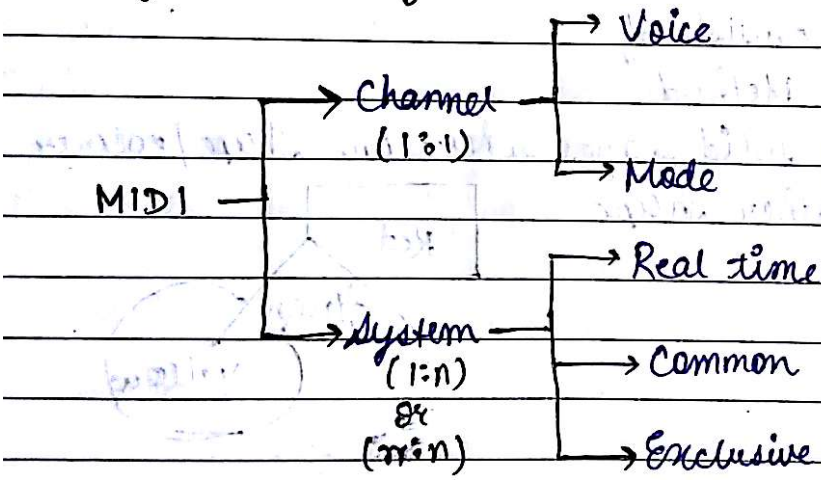


→ Multimedia :- → Interactive (Non-linear)
→ Non-interative (Linear)

1) What do you mean by Multimedia?
2) Diff. b/w interactive / non-interactive
3) Diff. b/w hypertext & hypermedia
4) Applications of multimedia
5) What do you mean by virtual reality?

MIDI - Musical Instrument Digital Interface

Type of MIDI Messages -



→ Animation -

→ Cell animation - Key frames; Tweening
→ Computer "
→ Morphing Tech.
→ Wrapping Tech.
→ Interpolation Technique