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FACULTY OF ENGINEERING & TECHNOLOGY

BCS -504 Computer Graphics & Multimedia

Lecture-18

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OUTLINE

- B-SPLINE
- PROPERTIES OF B-SPLINE
- HIDDEN SURFACE REMOVAL
- TYPES OF HIDDEN SURFACE DETECTION ALGORITHMS
- ALGORITHMS USED FOR HIDDEN LINE SURFACE DETECTION

B-Spline Curves

The Bezier-curve produced by the Bernstein basis function has limited flexibility.

First, the number of specified polygon vertices fixes the order of the resulting polynomial which defines the curve.

The second limiting characteristic is that the value of the blending function is nonzero for all parameter values over the entire curve.

The B-spline basis contains the Bernstein basis as the special case. The B-spline basis is non-global.

Properties of B-spline Curve

1. The sum of the B-spline basis functions for any parameter value is 1.
2. Each basis function is positive or zero for all parameter values.
3. Each basis function has precisely one maximum value, except for k=1.
4. The maximum order of the curve is equal to the number of vertices of defining polygon.
5. The degree of B-spline polynomial is independent on the number of vertices of defining polygon.

Properties of B-spline Curve

1. B-spline allows the local control over the curve surface because each vertex affects the shape of a curve only over a range of parameter values where its associated basis function is nonzero.
2. The curve exhibits the variation diminishing property.
3. The curve generally follows the shape of defining polygon.
4. Any affine transformation can be applied to the curve by applying it to the vertices of defining polygon.
5. The curve line within the convex hull of its defining polygon.

Hidden Surface Removal

1. One of the most challenging problems in computer graphics is the removal of hidden parts from images of solid objects.
2. In real life, the opaque material of these objects obstructs the light rays from hidden parts and prevents us from seeing them.
3. In the computer generation, no such automatic elimination takes place when objects are projected onto the screen coordinate system.
4. Instead, all parts of every object, including many parts that should be invisible are displayed.
5. To remove these parts to create a more realistic image, we must apply a hidden line or hidden surface algorithm to set of objects.
6. The algorithm operates on different kinds of scene models, generate various forms of output or cater to images of different complexities.
7. All use some form of geometric sorting to distinguish visible parts of objects from those that are hidden.
8. Just as alphabetical sorting is used to differentiate words near the beginning of the alphabet from those near the ends.

Hidden Surface Removal

1. Geometric sorting locates objects that lie near the observer and are therefore visible.
2. Hidden line and Hidden surface algorithms capitalize on various forms of coherence to reduce the computing required to generate an image.
3. Different types of coherence are related to different forms of order or regularity in the image.
4. Scan line coherence arises because the display of a scan line in a raster image is usually very similar to the display of the preceding scan line.
5. **Frame coherence** in a sequence of images designed to show motion recognizes that successive frames are very similar.
6. **Object coherence** results from relationships between different objects or between separate parts of the same objects.
7. A hidden surface algorithm is generally designed to exploit one or more of these coherence properties to increase efficiency.
8. Hidden surface algorithm bears a strong resemblance to two-dimensional scan conversions.

Types of hidden surface detection algorithms

1. Object space methods

2. Image space methods

Object space methods: In this method, various parts of objects are compared. After comparison visible, invisible or hardly visible surface is determined. These methods generally decide visible surface. In the wireframe model, these are used to determine a visible line. So these algorithms are line based instead of surface based. Method proceeds by determination of parts of an object whose view is obstructed by other object and draws these parts in the same color.

Image space methods: Here positions of various pixels are determined. It is used to locate the visible surface instead of a visible line. Each point is detected for its visibility. If a point is visible, then the pixel is on, otherwise off. So the object close to the viewer that is pierced by a projector through a pixel is determined. That pixel is drawn is appropriate color.
These methods are also called a **Visible Surface Determination**. The implementation of these methods on a computer requires a lot of processing time and processing power of the computer.

Algorithms used for hidden line surface detection

1. Back Face Removal Algorithm
2. Z-Buffer Algorithm
3. Painter Algorithm
4. Scan Line Algorithm
5. Subdivision Algorithm
6. Floating horizon Algorithm

Multiple Choice Question

MUTIPLE CHOICE QUESTIONS:

Sr no	Question	Option A	Option B	OptionC	OptionD
1	What is advantages of LCD display ?	Low cost	Low weight	Small size Low power consumption	All of these
2	The graphics monitor which are display three dimensional scenes are devised using a technique that reflects a…..image	CRT	transformsation	2D objects	LCD
3	Which one vibrating mirror is used in GENISCO SPACE GRAPH system?	2D objects	3D objects	1D objects	All of these
4	Application of 3D viewing devices In ……...to analyze data from ultra-sonography.	medical	surveying	transformsation	none of these
5	Application of 3D viewing devices ,In geological to analyze……..	topological	seismic data	both a & b	none of these

REFERENCES

- http://www.engppt.com/search/label/Computer%20Graphics