

Graphics Systems and Models

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1 Administrivia

Announcements

Assignment

Read 2.1–5.

From Last Time

Outline

1. CG Applications.
2. Graphics Systems Components.
3. Objects and Images.
4. Event Processing
5. Pinhole and Synthetic Cameras.
6. Graphics Pipeline.

Coming Up

OpenGL introduction lab.

2 CG Applications

1. Entertainment: Lord of the Rings, Star Wars.
 - (a) Not real-time: can use model-render paradigm.
 - (b) *Lots* of off-line compute cycles. Good physics.
 - (c) High quality results.
2. Games: Quake, etc.
 - (a) Real-time, interactive.
 - (b) Lots of on-line compute cycles.
 - (c) Procedural physics: fast, not too accurate.
Real physics: lots of compute cycles (slow), accurate.
3. Simulation: Well, a surgical simulation is “like” a game.

3 Graphics System Components

Frame buffer attributes:

1. Unit: picture element (pixel).
2. Discretization process (rasterization): geometry info to raster (array or line of pixels).

3. Depth: 1, 8, 16, 24, 32 bits.
4. Resolution: 640×480 , 800×600 , 1280×1024 , etc.
Aspect ratio.

4 Objects and Images

1. In any visualization process, painting, photography, etc., there are two key elements: object and viewer.

Object exists independently.

Its image is dependent upon view and other things such as light.

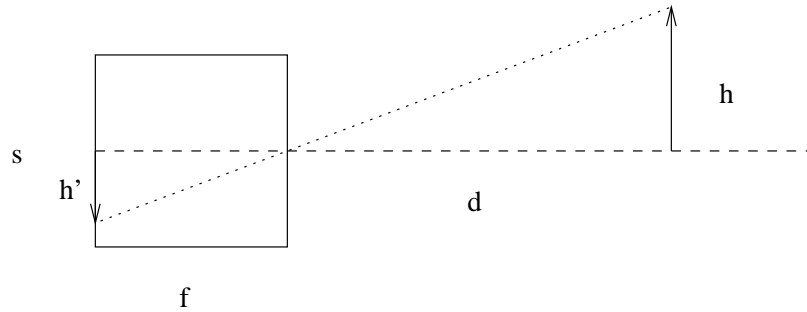
2. In CG, an image is composed of “polys” — usually triangles.

5 Event Processing

1. Examples of events: measures, etc. from input devices. Window resize, restore. Program-generated redisplay posting.
2. Callback registration (Java listeners).
3. Event loop — infinite.

6 Pinhole and Synthetic Cameras

Consider the projection of an object of height h onto the focal plane of a pinhole camera:



1. What's the height of the image (h')?
2. What's the angle of the field of view?
3. Depth of field.
4. CG's synthetic camera adds a clipping rectangle to this basic set-up.
What affects clipping? (Distance f and size of the projection plane).
Graphics APIs also add clipping along the z -axis (think depth of field).
5. Independence of objects and camera.

7 Graphics Pipeline

1. 3-D points represented by four element vectors.
2. Transformations applied by multiplications by series of 4×4 matrices.
3. Stages:
 - (a) Vertex processor.
 - (b) Clipper and primitive assembler.
 - (c) Rasterization.
"Potential" pixels — z -buffering, lighting, alpha blending.

(d) Fragment processing.

CPU only, or CPU/GPU. GPU programmability.

GPUs as supercomputers and controlled munitions.