CS488 Computer Graphics

Section 1 (Craig Kaplin)

Assignment 4

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Extra Features

Stochastic Supersampling:

When activated, a 3x3 grid is sampled over to obtain each pixel's worth of colour. The positions of intersection with the sampling ray and the grid area is jittered by random factors.

Activate with gr.set_supersample(1), deactivate with gr.set_supersample(0)

Additional Primitives:

Cylinders and Cones can be created as hierarchical objects.

- gr.cylinder('name') creates a geometry node with a cylinder, with the major axis aligned with the z axis, of unit radius, and extending in height from z = (-1,1)
- gr.cone('name') creates a geometry node with a cone, major axis along z, unit size.

Extra Material Properties:

Reflection

Enabled through an optional parameter in the material declaration in Lua:

```
matobj = gr.material({kd}, {ks}, shine, reflect)
```

The new parameter, reflect, is a coefficient of reflectance from 0.0 (no reflection) to 1.0 (totally reflective). Defaults to 0.

Refraction

Enabled through two optional parameters in the material declaration

```
matobj = gr.material({kd}, {ks}, shine, reflect, refract, ior)
```

The refract parameter is a coefficient of refraction, 0.0 for no refraction, 1.0 for completely refractive. Defaults to 0

The second parameter, ior, is the index of refraction for the material. Defaults to 1.

Texture Mapping

Enabled through four optional parameters in material declaration

```
matobj = gr.material({kd}, {ks}, shine, reflect, refract, ior, texturename, uScale,
                     vScale, uOffset, vOffset)
```

texturename is a string containing the name of the texture file, requires PNG format. Defaults to empty string (no texture)

uScale is a double which is a measure of scaling along the U texture coordinate, for a single copy across entire surface, use image width. Defaults to 1.

vScale is similar to uScale, but for the V texture coordinate.
uOffset and vOffset are offsets to shift the texture around on the surface. Defaults to 0.

Note: U and V coordinates are generated from the intersection points with various primitives, and varies for each type of shape. Sphere's use latitude and longitude, planes (mesh faces) use projection, cylinders and cones use a mixture of the two (for sides, and caps)

Extra Lua Commands

- gr.set_supersample(int m) activates supersampling if m is 1, deactivates if m is 0. Setting is off by default.
- gr.set_display_bound(int m) activates visibility of bounding boxes if m is 1, deactivates when m is 0. Off by default.
- gr.set_recursion_depth(int d) alters the recursion depth cutoff for secondary rays spawned by reflective or refractive material. The default value is 4. Note that internally there is a reflection and refraction contribution threshold that must be met to spawn additional rays, regardless of the depth.

Command Line Arguments

Some command line arguments have been implemented beyond the single one specifying the scene lua filename. They are all optional, and have effects lasting the entire run of the program, that is, across multiple render calls in the same lua file.

The new command form is ./rt [luaname] [width] [height] [outputname]
Where:

- luaname is the name of the lua scene defifnition file
- width and height override the specified sizes in the lua render call
- outputname overrides the PNG file to be written by the lua render call

When ommited, values fall back on those specified in the lua file.

Acknowledgements:

Owen, Scott
Ray Object Intersections
http://www.siggraph.org/education/materials/HyperGraph/raytrace/rtinter0.htm
For Intersection algorithms

Bikker, Jacco
Raytracing Topics and Techniques
http://www.flipcode.com/articles/article_raytrace01.shtml
Refraction and texture mapping techniques

Texture Sources:
woodTexture.png : 3dcafe.com, free texture
earthTexture.png : http://visibleearth.nasa.gov/view_rec.php?vev1id=11622
brioTexture : Ian Henderson

Mystery Science Theatre 3000, from which these characters were based.