Shading Objects

This presentation was not given during the meeting, but serves as a useful reference for shader examples and information.
What is a shader?

- A shader is effectively a way to assign visual material properties to geometry
- They describe how something should look
Applying Shaders to Geometry

- Shaders are applied to regions
- Default shader for unspecified geometry is “plastic” (Phong shader)
- Multiple shaders may be specified with the “stack” shader
Quick Example

• The default shader is called “plastic”, which is a particular set of parameters to the Phong shader.
Existing Shaders

There are more than a few...

air, brdf, bump, bwtexture, camo, checker, cloud, cook, envmap, fakestar, fbmbump, fbmcolor, fire, flat, grass, gravel, grunge, light, marble, null, phong, projection, rtrans, scloud, stack, tcl, texture, toyota, turbump, turcolor, wood, ...
Now for some examples

The following image is a collection of a variety of shaders all stacked with the plastic shader.

Each individual shader is then shown by name with a closeup of the corresponding shader. The list is in alphabetical order.
Air Shader Example
Bidirectional Reflectance Distribution Function (brdf)

- Simple Isotropic Gaussian model with just one parameter (RMS slope)
- Preset Values: brdf

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>specular</td>
<td>sp</td>
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<tr>
<td>diffuse</td>
<td>di</td>
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<tr>
<td>rough</td>
<td>rms</td>
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<td>transmit</td>
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<td>reflect</td>
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<tr>
<td>extinction_per_meter</td>
<td>extinction</td>
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BRDF Shader Example
Bump Map Shader Example
Camouflage Shader Example
Cloud Shader

- Two-dimensional Geoffrey Gardner style cloud texture map
- Name: cloud

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<th>Description</th>
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<tbody>
<tr>
<td>thresh</td>
<td>threshold below which it is completely translucent</td>
</tr>
<tr>
<td>range</td>
<td>range on intensities over which translucency varies from 0 to 1</td>
</tr>
</tbody>
</table>

thresh=0.35, range=0.3 for decent clouds
Cloud Shader Example
Cook-Torrence Direct
Illumination Shader

• Implementation of the Cook-Torrence direct illumination of surfaces by light sources shading model (good for metals and shiny objects)

• Early attempts were made at making this a replacement for the Phong shader

• Preset values: cook

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<td>specular</td>
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<td>diffuse</td>
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BRL-CAD Users Group Meeting 2002
Cook-Torrence Shader Example

Good for metals and shiny objects
Fbmcolor Shader Example
Fire Shader Example
Blue sphere in front of red sphere with 50% transparency
Grass Shader Example
Grass Shader Example
Gravel Shader Example
Grunge Shader Example
Lights

- Lights in BRL-CAD are actually also a special shader type that emits a spectrum of energy.
- Other shaders use objects shaded with the light shader as light sources.
- Lights may be made visible, but are usually invisible (you see the objects that they illuminate).
Light Parameters
Marble Shader Example
Null Shader

- Is the most simple shader
- Effectively makes an object disappear visually from a display, while still returning segments within the raytracer for analysis
- Is a good starting point for writing new shaders
Phong Shader

- Is the default shader, using a default set of parameters that appear similar to plastic
- Is references with a variety of names to access preset values: plastic, glass, mirror,...
- diffuse + specular = 1.0
Phong: Plastic Example
Phong: Glass Example
Phong: Mirror Example
Diffuse/Specular

Specular component increases -->

Diffuse component increases -->
Projection Shader Example
Rtrans Shader Example
S-Cloud Shader Example
Stack Shader

- Is the mechanism for combining several shaders to get a more complex effect

- The example images shown are all stacked with the Phong shader using the default plastic values, with the exception of the Flat shader example.
TclShaders

- Enables you to use any Tcl procedure as a shader
- Not a good idea where performance matters
- Should only be considered acceptable to use only when access to the source code is not possible
Texture Shader Example
Turbump Shader Example
Turcolor Shader Example
Wood Shader Example
Other Information

- All shaders are in the source distribution in `liboptical/`
- They are grouped according to functionality and parameters into the `sh_*\.c` files
- See `liboptical/sh_\xxx.c` for details on how to write a new shader from scratch
- See `liboptical/sh_null.c` for a rather simple example of a shader
End