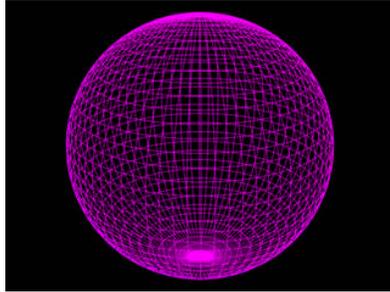
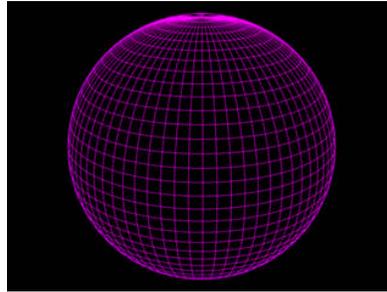


HIDDEN LINE RENDERING *by Lee Croft*

In this tutorial we're going to look at hidden line rendering. This is a really great tip taught to me by Electric Image partner and programmer Mark Granger. The wireframe render setting in EI renders an object as a simple mesh. Since only the wire mesh is rendered, you can see both the front and back side of the object. What a hidden wireframe rendering shows is only the visible area of the object in wireframe with the back obscured. The images below show a sphere in both regular and hidden wireframe modes.



Regular Wireframe

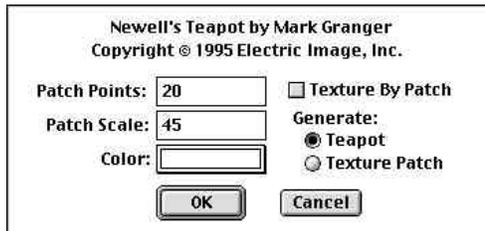


Hidden Wireframe

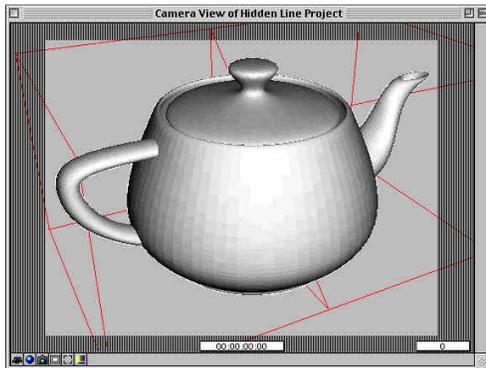
In this tutorial we are going to use a standard Teapot as our object. We'll also look at different alpha channel options for various compositing and post-processing effects.

STEPS

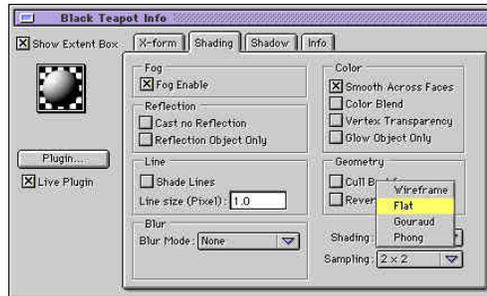
1. Create a new project. Click "Done" when asked to add a model. Add a teapot object by selecting **File>Add>Socket>Teapot**. Give your teapot a Patch Scale of 45.



2. Rotate your camera using the orbit tool (Command-Spacebar in the Camera window) until your scene looks something like the one below. Position your light accordingly.

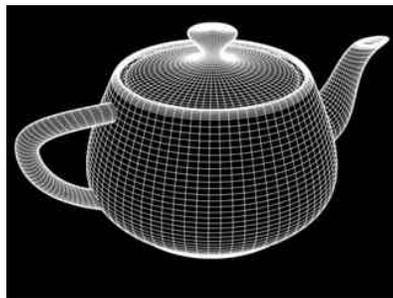


3. In order to fake the look of a hidden wireframe we need to have an object obscuring the lines on the far side of the teapot. To do this, duplicate your teapot by selecting it in either the Project Window or one of the world view windows, then type *Command-D*. If it isn't already, open your Project Window. You'll now see two objects called "Teapot Group". Rename the first one *Wire Teapot* and the second *Black Teapot*. Double-click on the Black Teapot group to open its Group Info Window and click on the Shading tab.
4. From the Shading popup menu in the bottom corner of the window, select Flat. This will enable Flat shading rendering for this object. (The entire project will be rendered using the standard Phong setting in the Render Control Window – this setting will render this particular object in Flat mode.)

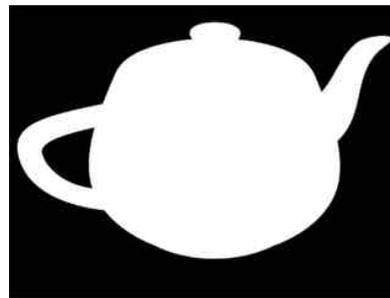


Click on the filter ball to open the Material Editor window. From under the Diffuse tab set the Diffuse Color to 100% black. Click on the Specular tab, and drag the Falloff slider to the left to set it to 0. Our teapot is now what is called "matte black." If you like, save this material setting, as there are many times you will want to make an object matte black while using EI.

5. Open the Group Info Window for the Wire Teapot group. From the Shading popup menu select Wireframe. Close the window. Do a snapshot render of the image. Congratulations! You've just done a hidden wireframe! The images below show both the RGB and Alpha Channels from the rendered image. Let's take a look at how this technique works



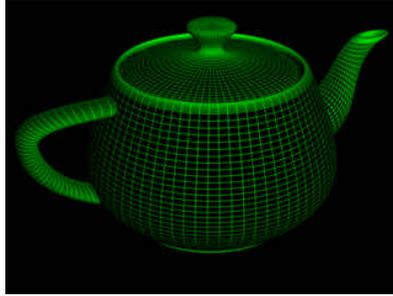
The RGB Channel



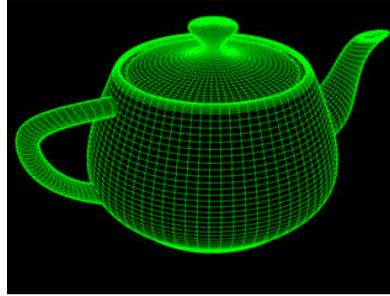
The Alpha Channel

You might expect our wireframe object to have a wireframe alpha channel. Well, you're right: when an object is rendered in wireframe mode it does produce a wireframe alpha. However, what we are seeing in the Alpha Channel is the solid white alpha values produced by the matte black teapot. Since its color is matte black, it matches perfectly with the default black background, giving the illusion of a hidden line render. It's as simple as that! Now let's look at other rendering options.

6. Obviously most times you will want to color your wireframe. To do so, open the Material Editor window for the wireframe group, and set its color to whatever you like. In my example, I have used bright green, with HSV values of 121, 100, and 100, respectively. Do another snapshot render and look at your results.



Standard Settings



Full Luminance

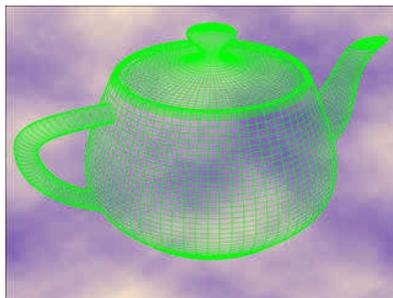
Your wireframe is now colored appropriately! Notice the natural shading of the wireframe – the settings of your lights will determine this, just like it would if it was rendered normally. However, you may wish to have a more illuminated wireframe for a different look. To do this simply go to the Luminance/Glow tab and adjust the Luminance Color values to be the same as your Diffuse settings.

TIP *A cool new feature of EI 2.8 is the ability to drag color tiles from one palette to another. Go to your Diffuse tab and drag the color swatch up onto the Luminance/Glow tab. This will now become the active tab. Drag the tile onto the Luminance Color swatch. Voila! Your color values are now identical! This feature works throughout the application.*

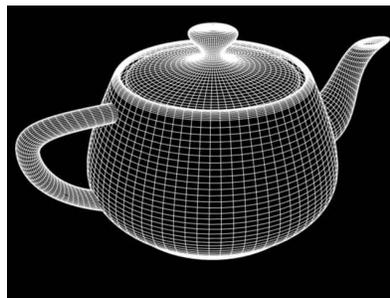
Now, there's one more area that we can explore, and that's the alpha value of the matte black teapot. Let's say you wanted to composite a hidden wireframe image over a picture. With the settings the way they are, you would have solid black in between the wire mesh of the teapot. It's very simple to get the same hidden wireframe effect and still allow the background image to show through. What we are going to do is change the alpha value of the teapot from solid white to solid black.

NOTE *You can use this exact same method if you are planning to do your compositing in After Effects.*

7. Add a background image to the Camera – any image will do. Open the Material Editor for the Black Teapot group. You will see three grayscale sliders. The bottom one, which goes from Opaque to Transparent, is the one we need. This opacity value is assigned to the alpha channel. Set the slider from opaque to transparent. Now do another snapshot render.



Teapot with composited background



Teapot's Alpha Channel

As you can see in the images above, the alpha channel has changed from a solid white (matte black teapot with a 100% opaque alpha channel) to a "hidden line" alpha channel (100% transparent alpha channel for the black teapot, 100% opaque alpha on the wireframe.) With these settings, the matte black teapot does not render in the RGB channel, nor does it render an alpha channel. Its sole purpose is for the obscuration of the back face of the teapot.

TIP

This same technique is what you would use in a multi-pass render situation, where you have geometry in one pass that is obscured at some point by other geometry that is not a part of the current pass. If this foreground geometry has its alpha value set to 100% opaque, it will not render in the RGB channel: it will effectively cut a hole in the alpha channel of the background object, allowing for a perfect composite.

There are many different options you can use to customize these techniques. Play around with the luminance values; try making your wireframe a glow object; add a ground plane and experiment with shadows.

Hidden wireframes are a really quick and easy technique, and there are many different applications of the methods used here in other aspects of ElectricImage.

Please feel free to contact me with any questions or comments at lee.croft@electricimg.com.