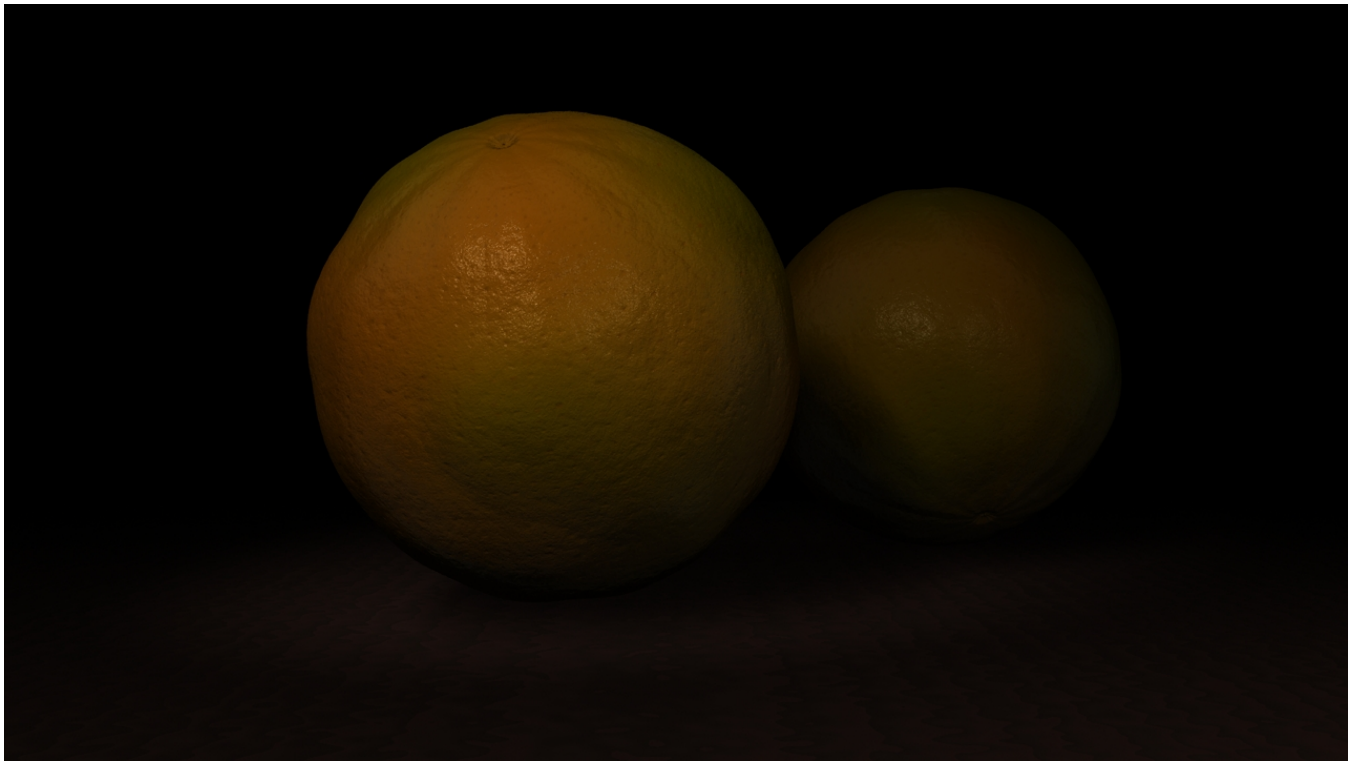
Orange Shader



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Computer Generated Image Tools

Original Orange and its surface

Orange fruit has a surface colour blend of orange and green along with dark orange spots on to the surface. When it is exposed to bright light its tends to shine like a metal having a small specular roll of but dues it uneven surface soft displacement it ends up getting a wet shiny look on to its surface. This kind of effect is seen in water bodies with high turbulence.

Other unique feature of its surface is its displacement on the surface. Its has a rough cellular surface but the displacements are so soft that it tends to give it an organic look along with a wet surface feel. Other major remarkable thing is the creases that develop at the top and bottom of the orange. It also has a small and large cellular noise in its surface.

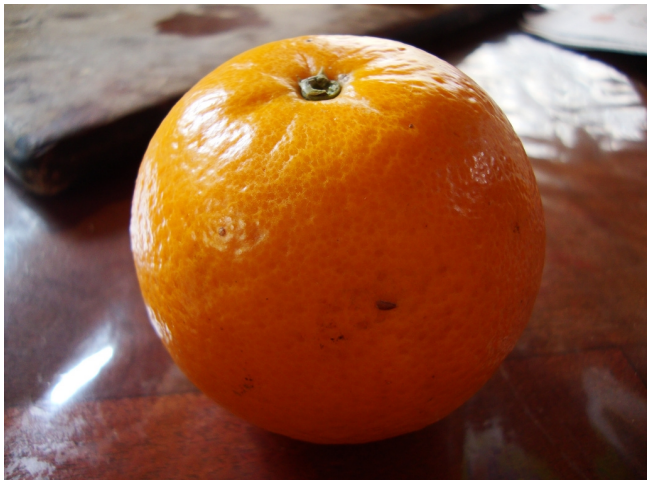


Image1

Image2

Modelling it using simple primitives in a RIB file

Modelling the orange is quite simple. No complex modelling method are required to create a simple orange. It can be created simply by creating a primitive geometry of a sphere and placing it on a Patch bilinear surface. Scene is directly created writing a rib file.

Identifying and implementing an appropriate BRDF Model for a shader of an Orange

Looking at the original images of orange its, quite clear that it does not require any special BRDF Model. The default Plastic shader of Renderman BRDF model can be used to achieve the same look by just adding Kr() and Cr, that calculates the reflection colour according to the environment map or image provided. The formula used is Ci = Oi * (Ct * (Ka*ambient() + Kd*diffuse(Nf)) +specularcolor * Ks*specular(Nf,V,roughness)+ Kr*Cr). Here Ka, Kd, Ks and Kr are Ambience Contribution, Diffuse Contribution, Specular Contribution and Reflection Contribution respectively that define their overall contribution value to overall colour of the surface calculated using the above formula.

The function used to calculate the final specularity is [specularcolor * Ks*specular(Nf,V,roughness)]. Here Ks defines the intensity of specular hot spot while roughness controls the way the specular is suppose to spread on the surface. Specular colour defines the specular colour in the RGB mode. Decreasing the value of roughness to a minute value of around 0.05, the same kind of specular effect can be achieved with respect to the proper surface displacement shader.

Identifying and implementing distinct patterns of texture or displacement on the Orange Surface

Looking at the original images of the orange the following distinct features of the surface can be seen. Below each of them will be explaining how they are created and implemented in the shader.

Ambiance,Diffuse and Specular properties of the surface

1) **Blend of orange and green colour on the surface.**

   An example (spots.sl) shown in Essential Renderman with some modification is used to blend orange and green colour creating a natural pattern (Orange.sl line 21).

2) **Dark orange random spots on the surface of the orange.**

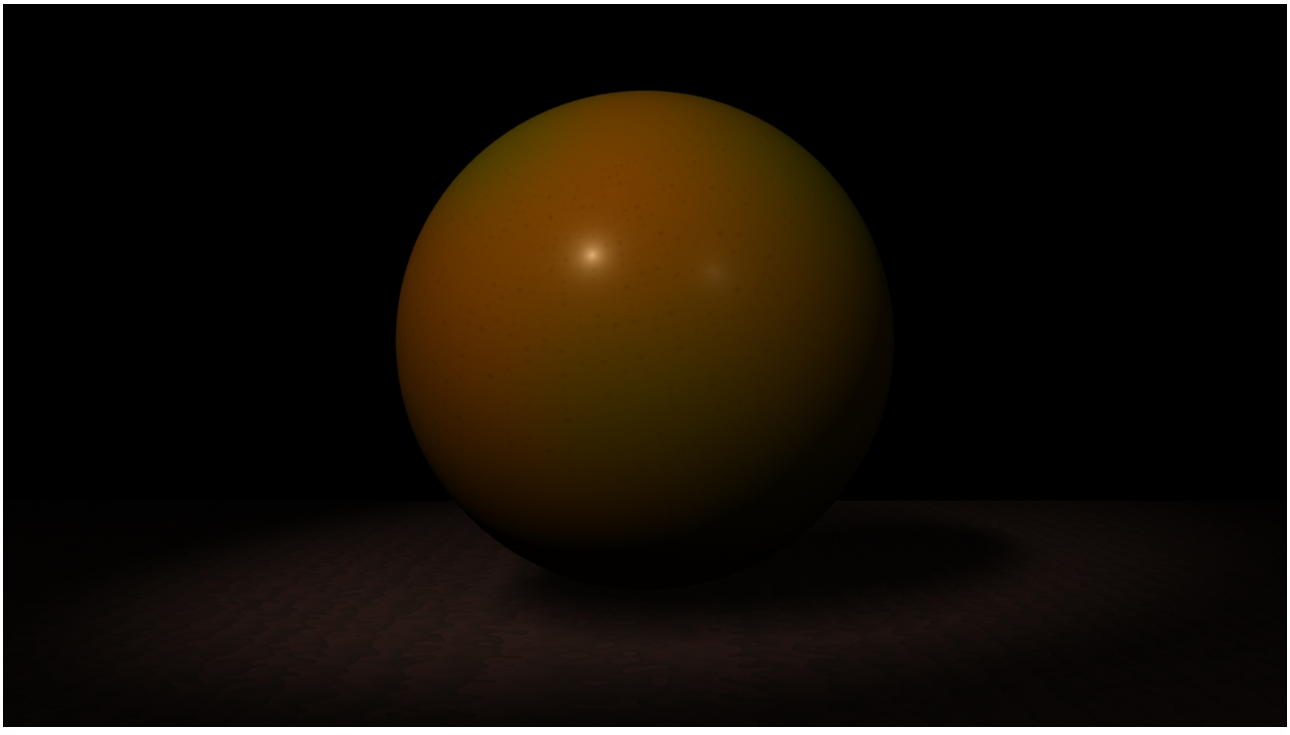
   An example (repeat.sl) as shown in Essential Renderman with some modification is used to create dark orange spots on the surface. (Orange.sl line 27).

3) **Specular colour is grainy and gives a wet look to the surface due to the uneven cellular noise on the surface of the orange skin.**

   This is achieved with assigning roughness a value of 0.05.(Orange.sl line 8)

4) **Specular colour spreads over the surface with high noise density and its is white colour.**

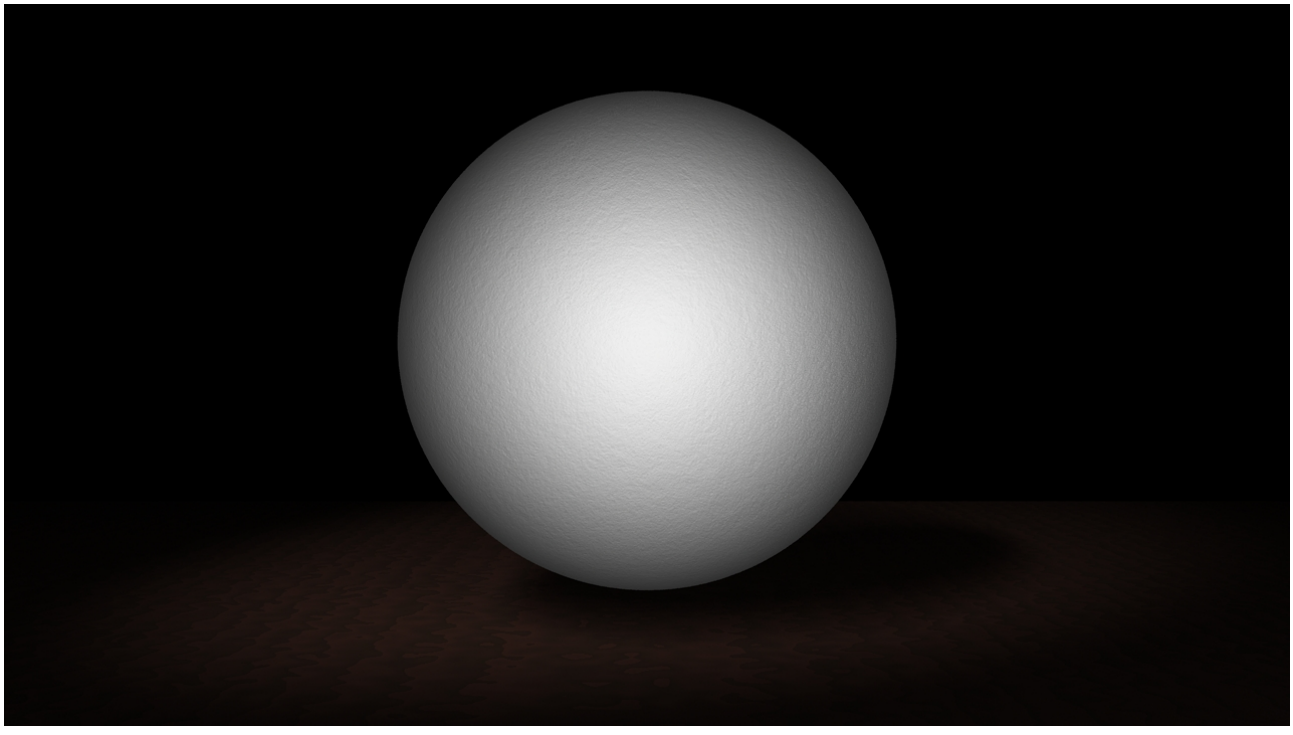
   This is achieved by assigning Ks a value of 0.8 and specular colour a value of 1. (Orange.sl line 6 and line 9)



Displacement on the surface

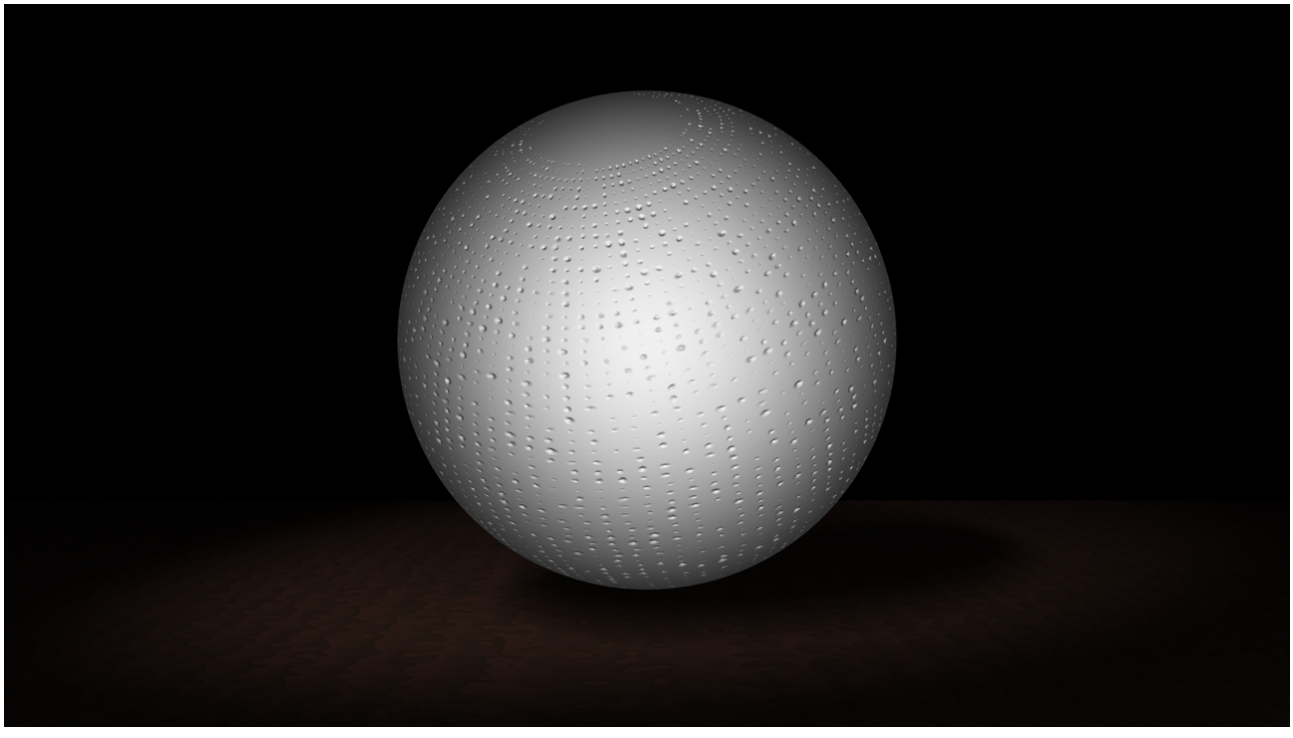
1) Minute Pores

An example (turbulance.sl) shown in Essential Renderman with some modification is used to creating very minute pores on the surface (OrangeDisplace.sl line 60).



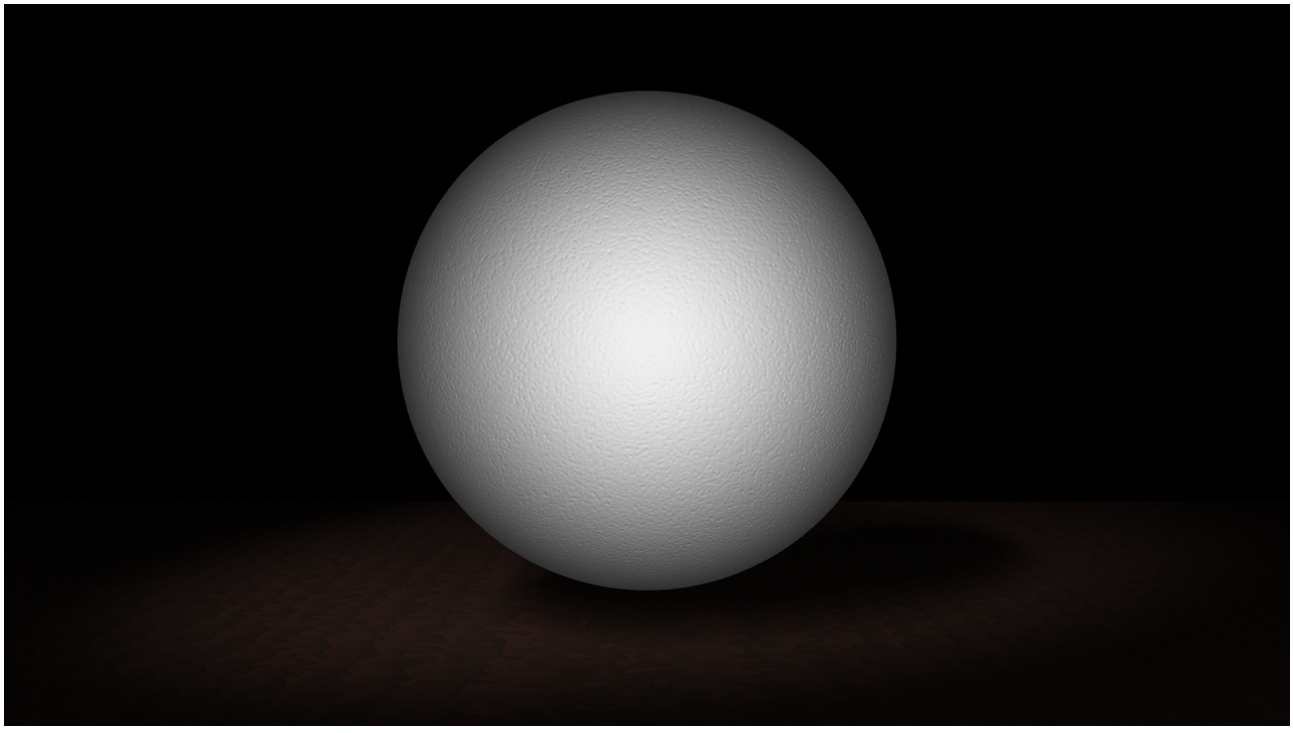
2) Large Pores

An example (repeat.sl) shown in Essential Renderman with some modification is used to create repeating uneven circles at random distance from each other.(OrangeDisplace.sl line 69).



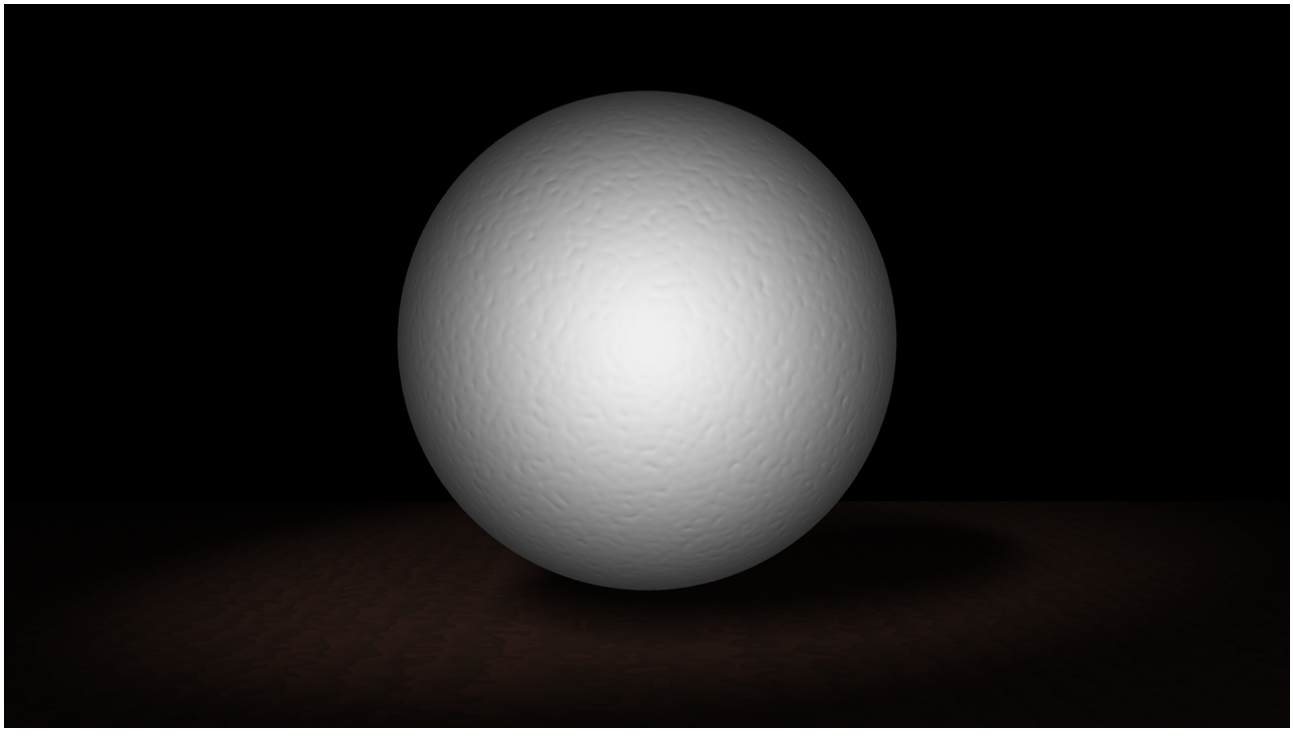
3) Minute Uneven Cellular Pattern

An example (spots.sl) shown in Essential Renderman with some modification is used to create minute cellular natural pattern (OrangeDisplace.sl line 69).



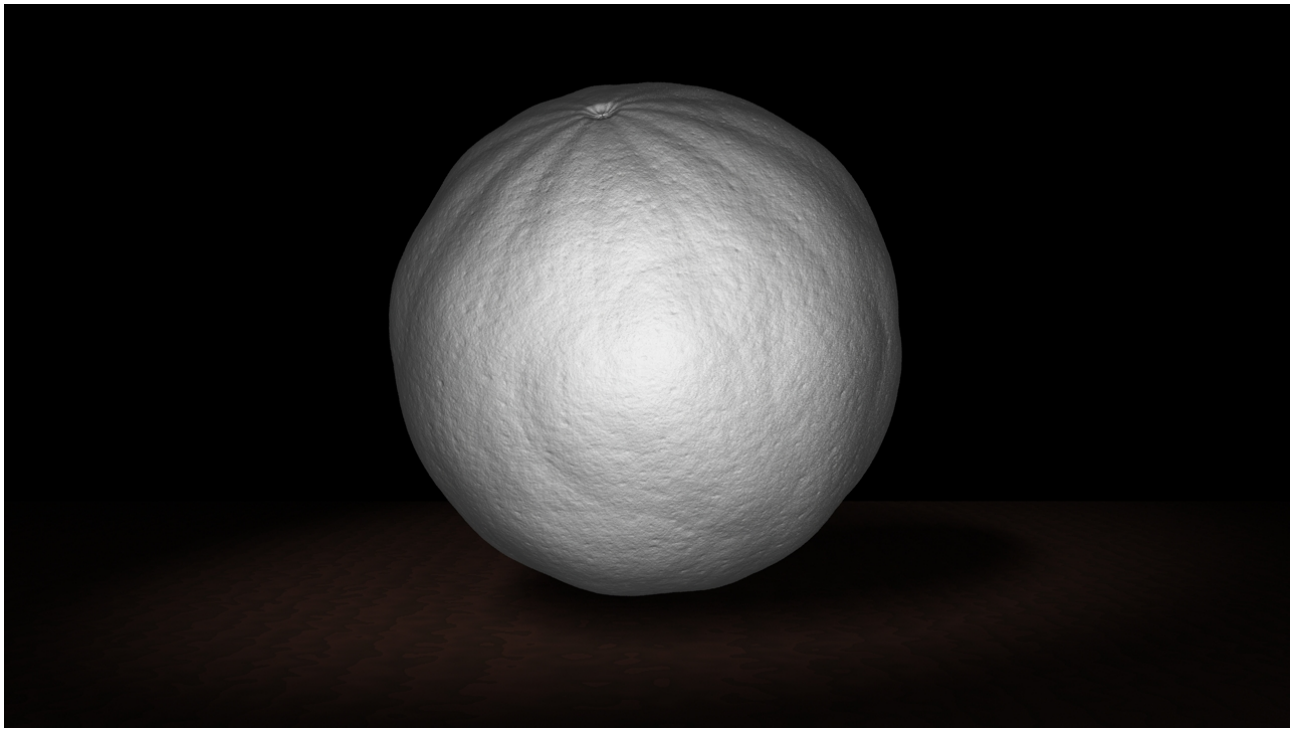
4) Large Uneven Cellular Patter

An example (spots.sl) shown in Essential Renderman with some modification is used to create large cellular natural pattern.(OrangeDisplace.sl line 76)



Adding Natural variation and wear to the orange using noise technique

As seen in the original orange it has following displacements to its surface that gives it a look natural organic look.

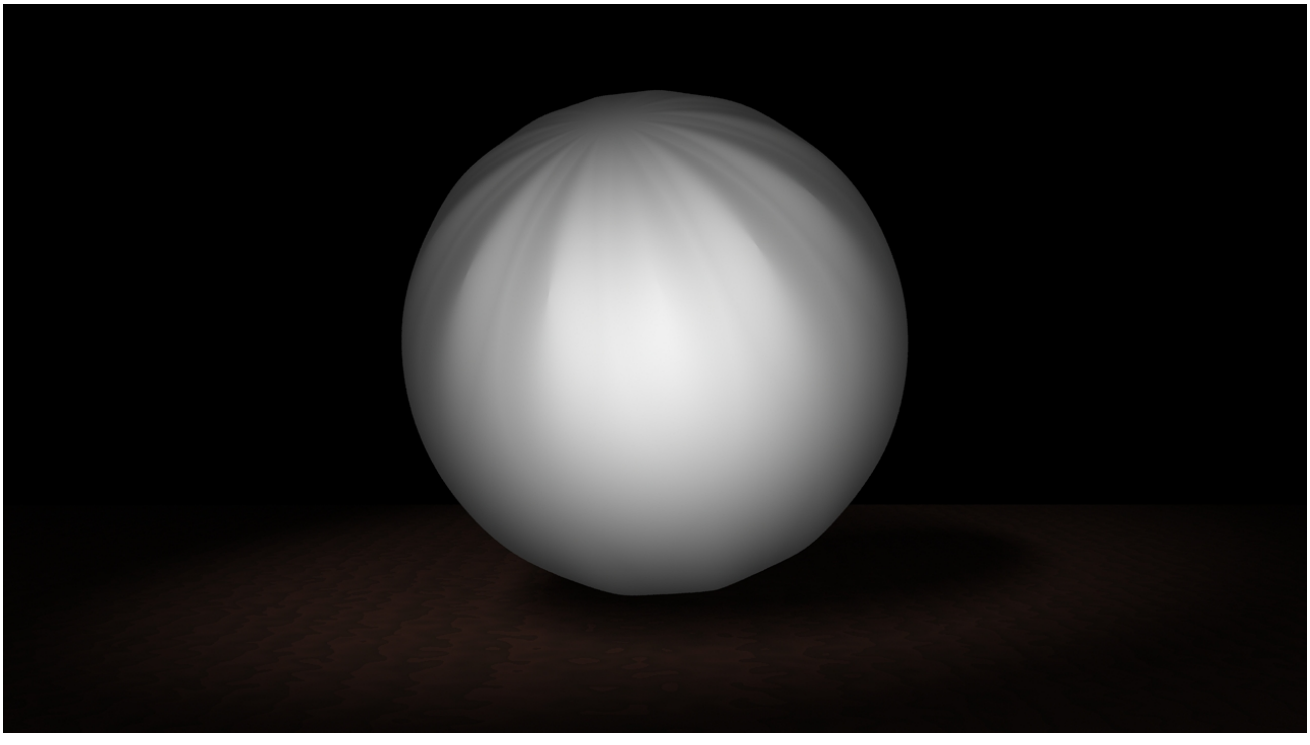


1) Natural Soft Displacement on the surface of the orange to give it an organic look.

This is done by adding all the individual magnitudes multiplied with their weights. All the individual magnitudes are calculated using different formulas as shown in different example codes of Essential Renderman Fast. (OrangeDisplace.sl line 122)

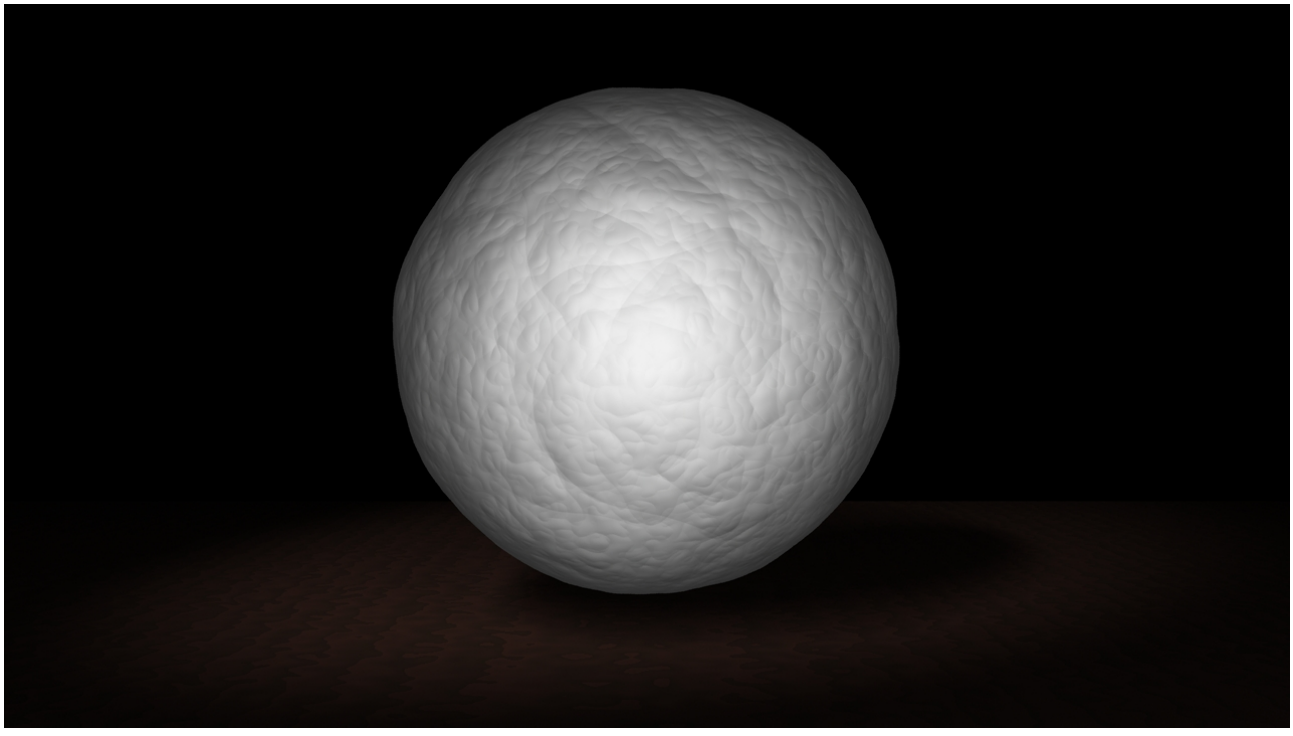
2) Creases on surface at the top and bottom of the Orange.

An example (repeat.sl) shown in Essential Renderman Fast with some modification is used to create creases on the top and bottom of the orange.(OrangeDisplace.sl line 107)



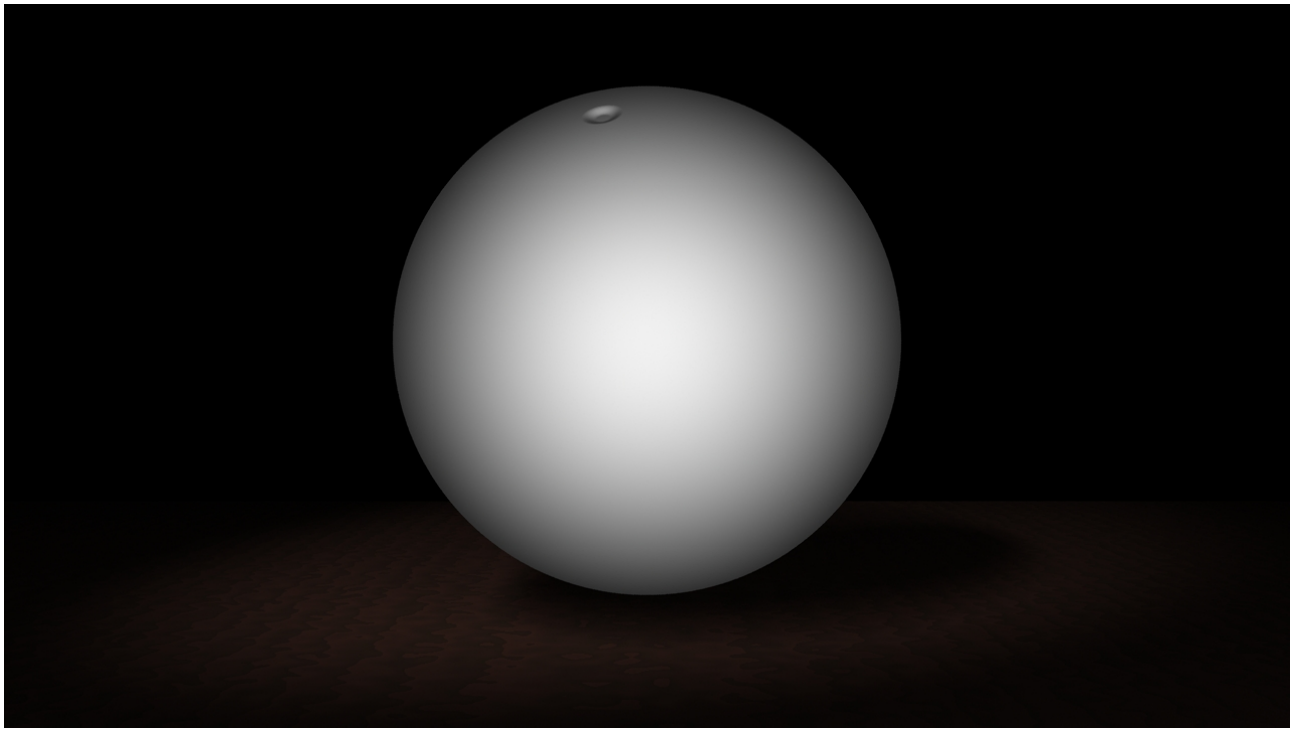
3) A bit of overall deformation to the orange.

An example (turbulance.sl) shown in Essential Renderman with some modification to deform the whole. (OrangeDisplace.sl line 85)



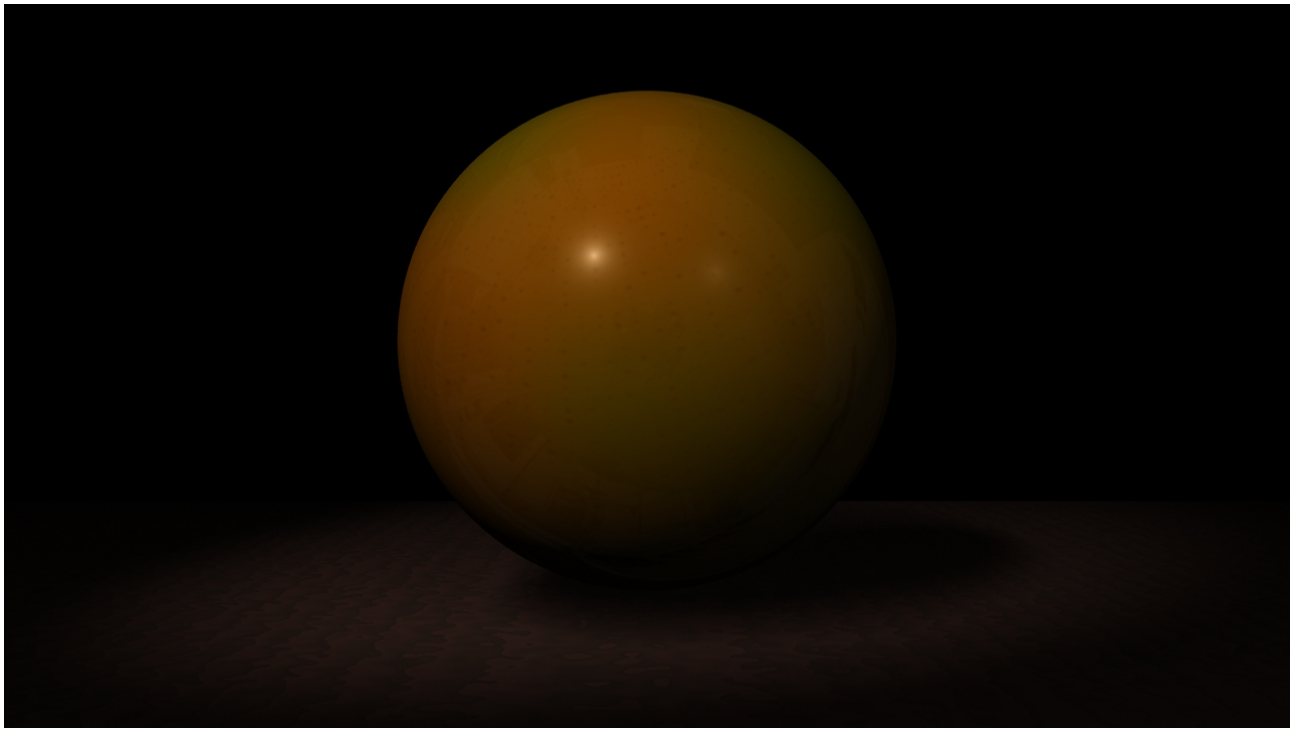
4) Dent on the top and bottom part of the Orange.

This is created by using smoothstep and mix function calculated with respect to the t.(OrangeDisplace.sl line 95)



Applying an appropriate Environmental map

A simple environment image map is used to show a bit of environment effect on the object using the example code(env.sl) as shown in Essential Renderman Fast.



Placing the object in the appropriate scene

The object is place simply on top of a bilinear patch with a ambient light, a shadow spot light, and a point light. The entire scene is generated by directly writing a rib file manually with proper comments explaining the flow of code.

Giving the effect of depth of field to the scene

Depth of field is an effect that is seen naturally. As the object moves away from the camera it starts to blur.

Depth of field effect is given to the entire scene using the example code (depthfade.sl) shown in Essential Renderman Fast.

Conclusion

Tried to achieve a photo realistic look of an orange shader. There are few errors still prevalent but overall I think its near to realistic look.

This shader can be enhance further by implementing feature of subsurface scattering. Even the displacement shader can be enhanced furthers by using image maps and merging them to the current displacement. But overall I think the current shader gives a bit desired output near to the reference images of the real orange.

Refernces

Stephenson, I. Essential Renderman Fast, Springer Verlag 2003

Image 1:
http://www.cepolina.com/photos.asp?V=fruit_orange&S=od&A=all
Cepolina photo, 2004-2010
Last accessed: 01/05/2011

Image2:
http://www.fotopedia.com/items/flickr-5155358267
Rubén Daniel De Bona, 2010
Last accessed: 01/05/2011