Chapter 31 Download Notes

Build functions

I've included build functions for all ray traced images from Figure 31.18 onwards. I haven't included the build functions for Figures 31.1(a), 31.10(a), and 31.16(a) because the graphs in part (b) of these figures are tied to the images, and most of the noise details produced by the ray tracer are now different.

Ray traced images

I've re-rendered all the ray traced images from Figure 31.21 onwards. Most of the noise details are different from the images published in the book, and currently included in the RayTracedImages download. Some of these images were originally rendered about 10 years ago, and a lot has changed in the ray tracer in the ensuing years.

Most of the new images are of higher resolution than the originals, some of which were only 150 x 150 pixels in size. All re-rendered images are in RGB format.

Figure 31.25(f) is an additional image.

I've rendered Figures 31.27, 31.28, 31.29, 31.39, and 31.40 with a gray background instead of black, as this is better for visualizing the spheres.

I've reproduced Figure 31.88 as best I can. The sandstone details are different. I've also removed the ground plane, which had a hexagon texture on it. I haven't time to update the hexagon code which I got from POV-Ray. It was written by Ernest MacDougal Campbell III.

I've increased the light's radiance in Figure 31.42 to make the bunnies brighter.

For completeness I've included here Figures 31.31, 31.35, 31.36, and 31.37, which are not ray traced.

Code

This chapter download contains the noise classes `LatticeNoise`, `LinearNoise`, and `CubicNoise`. It also contains the texture `Wood`, which is discussed below. The other textures are left as exercises. As usual, I've included the chapter listings that deal with classes that are not provided in full.

`CubicNoise` uses the utility function `clamp` defined in Listing 31.7. The code is in `MathsFunctions.cpp`. You should add this to the Maths.h file.

I have not implemented a fractal sum texture class because fractal sum is a subset of fractional Brownian motion. The classes that implement the basic sums of noise functions are `FBmTexture` and `TurbulenceTexture`. There are also no marble or sandstone texture classes, as these are examples of `RampFBmTexture`.

The `Texture` base class is in the Chapter 29 download. The `TInstance` class, is an exercise in Chapter 30. This is used in some Chapter 31 build functions.

Wood

I've done some extra images of the Larry Gritz wood texture, which is implemented in the class `Wood`. I haven't written any notes on this, but the class is well documented. This texture is discussed in Apodaca and Gritz (2000). The `Wood` texture uses the utility functions `mod`, `smooth_pulse`, `smooth_pulse_train`, `smooth_step`, `mix_color`, and `mix_double`. You should add these functions to the `Maths.h` and `Maths.cpp` files. Their code is in `MathsFunctions.cpp`. `Wood` also uses `clamp`. Apodaca and Gritz discuss these utility functions. A templated `mix` function would make sense.

Bump mapping

Bump mapping didn't make it into the book because of time and space constraints. I still haven't had time to write any notes on this. The one example of bump mapping is the bath water in Figure 29.2.

Another thing I haven't had time to write about are clip maps, used in Figure 16.15.

Some notes and example code on these topics are coming, but I'm not sure when.

Errata

There are a number of minor errors in Chapter 31 that I'll put on the website as soon as I can, but there is one that I should mention here. It occurs in two places. The rhs expression for the fractal sum bounds in Equation (31.5) contains $(1/2)^{n-1}$. This should be $(1/2)^n$. This expression occurs twice. The same mistake occurs in Equation (31.8) for the *fBm* bounds. The $n-1$ summation bounds in these equations are correct. The correct closed form expressions follow from Equation (2.17).

This mistake meant the code in `LatticeNoise::compute_fbm_bounds` was incorrect. With the mistake corrected there were minor changes to some Chapter 31 images which were corrected in the course of re-rendering the images.

In doing this chapter I also re-rendered Figures 29.2, 30.1, 30.6, 30.13, and 30.16 as these involve noise-based textures, but I haven't put them on the website yet. Figures 19.11 and 19.17 also involve noise based textures, but I haven't re-rendered these yet.