

DPA 819 Physically Based Effects/pyroclastic sphere

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Note on the Implicit Function for a Pyroclastic Sphere

The pyroclastic sphere is an implicit function built by changing the implicit function for a sphere via spatial noise such as fractal summed perlin noise.

Implicit Sphere

The implicit sphere formula centered at the origin with radius R is simply

$$f_S(\vec{x}) = R - |\vec{x}|$$

Noise

The pyroclastic aspect is driven by a noise function $N(\vec{x})$. Most commonly, it is a fractal summed perlin noise, but it may be any noise function that returns a value at each point in space.

Pyroclastic displacement

The displacement is accomplished by adding a noise value to the sphere implicit function f_S . It is not necessary to actually move vertices or points anywhere. The pyroclastic implicit function looks like

$$f_{PS}(\vec{x}) = f_S(\vec{x}) + D(\vec{x})$$

The secret sauce is that the displacement D comes from sampling the noise on the surface of the sphere closest to the point \vec{x} . For the sphere, this is

$$\vec{Y}(\vec{x}) = \frac{\vec{x}}{|\vec{x}|}$$

The displacement is then

$$D(\vec{x}) = |N(\vec{Y}(\vec{x}))|$$

The absolute value of the noise is used in order to get deep narrow values in the structure. Without the absolute value, the displaced structure would have rounded values that don't have a pyroclastic appearance.

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- This page was last modified on 8 February 2011, at 11:57.