Tran Tran – Geometric Modelling Spring Project

Generation and Rendering of Fractal Terrain

Paper Reference: <https://worldcomp-proceedings.com/proc/p2013/CGV4061.pdf>

**Summer 2025**

1. Tetrahedron subdivision algorithm – the algorithm was proposed in the paper

A red triangle in a circle

AI-generated content may be incorrect.

The algorithm used the tree traversal data structure to subdivide the normalized regular tetrahedron to approximate the sphere. Each triangular faces are then subdivided into four smaller triangles by connecting three additional midpoint vertices with some random variation along the edges and we can recursively divide each smaller triangle to get the approximated sphere with random elevation bounded by the unit sphere. As we divide the tetrahedron and assign elevation for midpoint vertices we need additional computation to check whether that the vertices have been created by the neighboring triangles. If it does, we should use the same vertices to make sure the triangles don’t have any gaps (additional code about how to identify the neighbor triangle are explained in the paper).

1. Biome

For biome categorization, I simplified the Whittaker biome model. There are two main factors: temperature and precipitation. Temperature is determined by elevation and latitude.

Node is first assigned baseline temperature by their latitude group (high temperature from 0 – 30, mid temperature from (30 to 60) and cold temperature from 90 to 90). Then temperature decreases further by difference in elevation from the land height. Precipitation is determined by elevation alone because elevation also represents the distance from water.

A graph showing the average temperature

AI-generated content may be incorrect.

I assign the temperature and moisture level to different level and used the biome matrix to determine the biome and assign color.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Temperature level | | |
|  |  | 0 | 1 | 2 |
| Moisture level | 0 | **Tundra** | **Hot Desert** | **Cold Desert** |
| 1 | **Ice** | **Hot Forest** | **Cold Forest** |
| 2 | **Ice** | **Hot Rain Forest** | **Cold Rain Forest** |