Colorado School of Mines

CSCI 444

Advanced Computer Graphics

Existing Work Survey

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1 Previous Works

1.1 Designer Worlds: Procedural Generation of Infinite Terrain from Real-World Elevation Data

This research paper delves into sending real world geographical elevation data into a variation of the perlin noise algorithm called value noise. The geographical data used is from the United States Geological Survey of Utah. The value noise algorithm differs from the noise algorithm in that it chooses a randow height to interpolate between as opposed to the gradients. Additionally value noise isn't contrained to be zero at grid points. It has a small speedup over perlin noise, however this is only visible at higher dimensions.

1. Link

1.2 Realtime Procedural Terrain Generation

This paper provides an overview of erosion techniques used in games for terrain synthesis. It also goes into detail on how basic perlin noise is inferrior to voronoi diragrams. The 2D texture is then perturbed. Afterwards, seperate erosion techniques can be used such as thermal erosion, Hydraulic erosion, or an algorithm that the writers propose that combines the advantages of the two previously mentioned algorithms.

2. Link

1.3 A Survey of Procedural Methods for Terrain Modelling

This paper surveys multiple different generation technques such as height-mapping, generating rivers, oceans, and lakes, plant modeling and vegetation distrobution, Road networks,

and urban environments. One such technique for vegetation generation uses relative elevation, slope, and multi fractal noise to define ecosystems and the ground vegetation is generated at run-time. Another techniques ....

3. Link

1.4 GDC talk on Building worlds with Noise Gerneration in No Man's Sky

This video clip from the Game Developer's Conference in March of 2017 discusses the techniques used by the developers of No Man's Sky to procedurally generate an entire univers in no more than 300MB of code, and 200GB of pre-developed assets. They create their own generation technique using a new noise method dubbed Uber Noise by the speaker Sean Murray. It combines several noise methods including Analytical derivative and domain warping.

4. Link

1.5 Procedural Generation of Rock Piles using Aperiodic Tiling

This paper discusses a tiling method for generating piles of rocks without any computationally demanding simulations. It also attempts to achieve a more realistic outcome than previous tiling methods. It utalizes a modified corner cube algorithm to generate a set of aperiodic (not periodic/ irregular) tiles. This also makes use of Varonoi polygons to enhance the control the shape of the rocks. The method that the writers discuss not only using ellipsoidal anisotropic distance to generate the shape of the rocks as voxels, but also take into account rock erosion.

5. Link

2 Sources

1. Ian Parberry, Designer Worlds: Procedural Generation of Infinite Terrain from Real-World Elevation Data, Journal of Computer Graphics Techniques (JCGT), vol. 3, no. 1, 74-85, 2014

2. Olsen, J. (2018). Realtime Synthesis of Eroded Fractal Terrain for Use in Computer Games. [ebook] Available at: https://pdfs.semanticscholar.org/5961/c577478f21707dad53905362e0ec [Accessed 23 Mar. 2018].

3. Smelik, R., Tutenel, T., Bidarra, R. and Benes, B. (2014). A Survey on Procedural Modelling for Virtual Worlds. Computer Graphics Forum, 33(6), pp.31-50.

4. Sean Murray GDC-Talk (2017) — Building Worlds with Noise Generation — No Man's Sky. (2017). [video] Game Developer's Conference

5. Peytavie, A., Galin, E., Grosjean, J. and Merillou, S. (2009). Procedural Generation of Rock Piles using Aperiodic Tiling. Computer Graphics Forum, 28(7), pp.1801-1809