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Organic Textures with Controlled Anisotropy and Directionality

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Introduction

We propose a computational method for generating organic textures with controlled anisotropy and directionality. The method first tessellates a region into a set of pseudo Voronoi polygons (cells) using a particle model, and then generates the detailed geometry of each of the polygons using a subdivision surface method with fractal noises.

A user can create various types of realistic looking organic textures with ease by simply choosing a cell arrangement type, anisotropy, and directionality, along with the geometry control parameters.

Pseudo Voronoi Tessellation via Anisotropic Meshing

Our tessellation technique to represent organic texture consists of three steps: (1) elliptic or rectangular particle packing;[1] (2) anisotropic meshing by connecting the centers of the particles; and (3) Voronoi tessellation as a dual of the anisotropic mesh. Given preferred cell sizes and directionality within a geometric domain, the technique outputs Voronoi polygons compatible with the specified cell sizes, directionality, and anisotropy.

Organic Texture Generation

An organic texture is obtained by generating a skin texture for each of the pseudo Voronoi cells created by the method described in the previous section. Each skin texture is generated in the following three steps:

- generation of an initial skin mesh for each polygon.
- smoothing of the initial skin mesh by a subdivision surface method.
- addition of small bump features with fractal noises.

First, an initial skin mesh is generated according to the geometry of each cell. A 3D prism shape is obtained by sweeping each cell by a given skin height in the skin's normal vector direction. The initial skin mesh is then generated by deforming this prism by displacing each of the top corners randomly, skewing each of the top corners in a specified flow vector, and tapering the prism.

After initial skin meshes have been generated, they are subdivided and refined by using Loop's subdivision method.[2] Finally, small bump features are added to the skin meshes with fractal noises.

Results

The processing time depends on the number of the cells, but it is much faster than previous methods. On an Intel Pentium III 650MHz processor it takes only 10 seconds on average for the packing process and only 10 seconds on average for the skin texture generation for a texture size of 512 x 512. Figures 2 and 3 show organic textures with controlled anisotropy and directionality created by the proposed method.

References

1. Shimada ,K., L. Liao, and T. Itoh. (1998). Quadrilateral meshing with directionality control through the packing of square cells. Seventh International Meshing Roundtable, 61-76, 1998.
2. Loop, C. (1994). Smooth spline surfaces over irregular meshes. In *Proc. of SIGGRAPH '94*, 303-310, 1994.

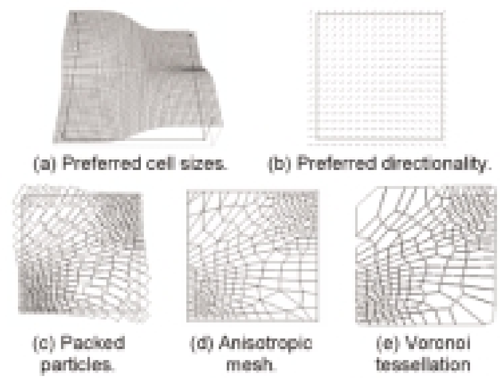

Figure 1.Three sub-steps of packing pattern generation.

Figure 2. Example of organic textures.

Figure 3. Textured leg.