Mathematical

PanCangchao
Zhejiang Normal university
Advanced Game Engineering

Abstract: 3D games have become mainstream products of the computer games. Truly reflecting the characters of the game roles and per-
forming the bump effects of the scenes are the important parts in the development of a realistic game. 13y using the normal mapping technology, it can still ensure the better performance of the bump effect without increasing the model grid and remain the good bump effect after changes in perspective.

In this paper, it will discuss the basic mathematical methods of the normal bump mapping technology used to show the dump effects in
the process of computer games development in terms of following parts, the construction of bump mapping, tangent space and tangent vector. These mathematical methods will provide the mathematical solutions of the normal mapping technology in the engine programs design
during the game development.

Key words: normal mapping technology; bump mapping; normal vector; tangent vector

In the game can see the face of wrinkles, stone relief and so on the concave and convex effect is done through the 3 d bump technology 3 d effect. Making AoTuGan performance.Roughly two kinds of method, a kind of method is in creating the model, make AoTuGan increase model of grid system. The advantage of this method is accurate, true, but the drawback is that model number, according to the large number of aspects and high, very high requirements for hardware equipment. It is difficult to apply in the game development. Another method is the concave and convex effect was achieved by material performance. In the material make up

Collection device used in the concave and convex map or NORMAL mapping to express the effect of concave and convex texture. BUMP map is a visual effect of concave and convex, model
True grid and the corresponding deformation does not occur, if the Angle of view changes, looks like a simple floor plan. In NORMAL map, in the process of mapping to map. For a certain processing, thus ensuring the perspective transformation after still have evident effect of concave and convex guarantee.Normal mapping is the concave and convex manifestation of more advanced technology, the normal map information changed just black and white, blue, and purple instead to represent the corresponding concave and convex information.Using the model of the normal map, the concave and convex information can produce corresponding under the irradiation of light highlights and shadows, on the premise of not change model polycount, and more . Polygon details, therefore, the normal map technology is widely used in the game engine applications.

1 normal mapping technology

Normal mapping technology is a kind of virtual 3 d technology. Objects are able to see the stereo sense is the main reason is that the two eyes due to the difference of see a scene, then
To distinguish a scene of stereo feeling. But computer screen is a plane, to distinguish between the 3 d effect can only be accomplished by lighting effects, on the

surface of the normal map is a concave and convex feeling Besides, recorded by the normal vector of each point down, when the map according to different normal maps do light and shadow, so as to realize bump effect. Lighting calculation is the number of normal mapping technology .To learn foundation.

Normal maps of the RGB values in not RGB color, but each point of the normal vector of the three components. At the time of map according to the normal vector of the three component of the light .Light shadow of transformation, and each pixel is made up of illumination calculation formula determined by the tangent vector and normal vector is used. If all the pixels on a map and normal vector . Record tangent vector, and then recorded in RGB color coding way, this can be achieved in the late effect of concave and convex.

2 the structure of the bump map

When objects observed from any direction of the edge, to see the surface detail is usually determined by the performance of light way. In the normal map is the record of a need.To carrying out the transformation of light of light and shadow map of concave and convex of the various points on the map, and each pixel light is determined by the normal vector used in the illumination calculation formula. Want to remember . Record all pixels in the textures of the normal vector information, is needs to be done by mathematics method, the bump map technology can be a very good solution to the problem of light and the normal vector. Through the use of texture mapping on each pixel to vector for disturbance, which can provide more detailed light details.

3 the tangent space

Because vector < < 0, 1 > in the bump mapping said without disturbing the normal vector, To the normal map and can't get a good effect of concave and convex, so it needs to be with the light luminance interpolation formula is often used in the normal vector. This can be achieved by each vertex positions in constructing a coordinate system to reality.Now, the coordinate system of the vertex normal vector is always pointing in the direction of the z axis is the direction. In addition to the normal vector at each vertex positions need two and surface.The tangent vector. The two vector orthogonal basis. This coordinate system which is formed by the called tangent space.

In the vertex positions, tangent space correspond to vertex tangent plane and the normal vector. The establishment of a triangular mesh tangent to each vertex Space coordinate system, can be in each vertex positions calculated pointing in the direction of light vector L, and will transform the tangent space, L then .L in tangent space vector in the whole triangle plane interpolation arithmetic.

conclusion

Normal mapping technology is through the bump map, tangent space mathematical methods. Bump mapping operation on each vertex positions calculated pointing in the direction of light vector Lo tangent vector t. read from the vertex array of attributes, b. vector with a formula to calculate. Combining RGB encoding format, record table bump mapping coordinates and texture mapping coordinates. With the continuous development of 3 d game development, normal map mathematical methods is applied to implement real-time 3 d effect of concave and convex, provide a mathematical method for developing the game engine.

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