A 3-D Flowering Simulation Based on Botany Characteristics and Random Generation Algorithm

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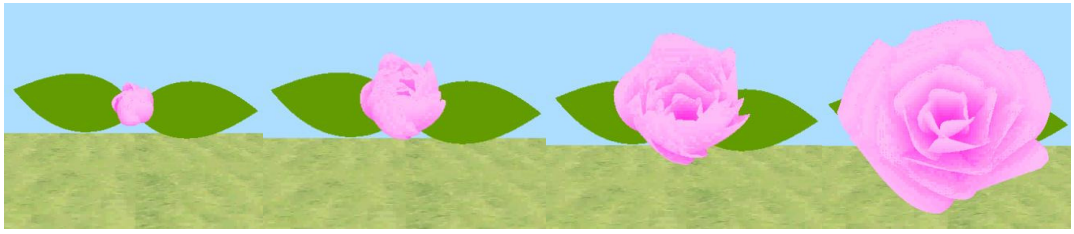

Fig.1. Different Stage of Blooming Process

1 Introduction

In recent years, virtual reality is experiencing a rapid development, which is also applied in plant morphology simulation. With a variety dynamic process of blooming, you are not only able to create a virtual landscape but to decorate a virtual space. In the internet, people can enjoy flowering anytime and anywhere to promote flower exhibitions and business. This paper focuses on the botanical characteristics of blooming process and creates a vivid effect based on Bezier curves and surfaces theory.

In this paper the botany characteristics of various types of flowers are analyzed, daffodils are taken as a representative, then a mathematical model is built, and a dynamic blossom process is achieved with OpenGL programming technology, and finally the simulation effect of other types of flowers are exhibited., some prospects for future work are discussed too.

2 Our Approach

A general complete flower includes six components, namely, pedicel, receptacle, calyx, corolla, stamen group androecia and gynoecia.

The pedicel and receptacle is equivalent to the branch part[Ijiri and Owada 2005], while other four parts are equivalent to metamorphosis leaves. flowers with four full parts are called complete ones, otherwise they are incomplete.

This paper focuses on how to simulate the flowering process, it is necessary to study the physical characteristics of an opening flower, i.e., what changes occur during the blossom process. Changes happened in blooming are: tilting angle of the axis and flower petals become larger gradually as flowers open up, which is the most important change.

The most obvious and important one is the inclination rate reflected in the axial and flower petals as the flowers open become larger, usually from 5 degrees to 85 degrees, this change is not a linear process, it cannot be directly described using linear equations, botany information suggested that the inclination of petals at first at a more rapid pace, after reaching a certain extent, then the increase pace slowed down. We can use Fig 2 as follows:

In Fig2, G says the size of the angle, T represents time. It can be seen that G increases rapidly at first, then slowly.

Firstly the key points of Bezier surface is modified, using a three-dimensional array to store coordinates of key points, then a random texture is generated with recycling calculation and texture information is stored in an array.

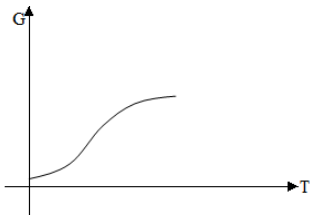

Fig 2 Curve of relation between time and inclination

3 Result

As mentioned above, the most important feature of flower blossom is the changing inclination, which is the key element to mathematical modeling. The variable angle in the class Petal indicates the final inclination during blossom process and should also be a random value, so *angle=75 + rand()%10*, which means angle values should be from 75 to 85. Variable *r* represents the inclination of the current moment; variable *dr* represents the inclination increment to the next time moment. When *r* is less than half value of the angle, *dr* increases linearly; when the value of *r* is greater than or equal to the half value of angle, *dr* decreases linearly. Different Stage of Blooming Process is shown in Fig.1.

References

Ijiri T, Owada S. Floral diagrams and inflorescences: Interactive flower modeling using botanical structural constraints. *ACM Trans. on Graph*, 2005,24(3):720−726.

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SIGGRAPH 2010, Los Angeles, California, July 25 – 29, 2010.
ISBN 978-1-4503-0210-4/10/0007