Abstract

The construction of realistic characters has become increasingly important to the production of the blockbuster films, TV series and computer games. The outfit of the character plays an important role in the application of virtual characters. It is one of the key elements reflects the personality of the character. Virtual clothing refers to the process that constructs the outfits for virtual characters, and currently, it is widely used in mainly two areas, fashion industry and computer animation.

In the fashion industry, virtual clothing is an effective tool which creates, edits and pre-visualises the cloth design patterns efficiently. However, using this method requires lots of tailoring expertises. In computer animation, the geometric modelling method is the most popular method for cloth modelling due to its simplicity and intuitiveness. However, because of the shortage of the tailoring knowledge among the animation artists, current existing cloth design patterns can not be used directly by animation artists, and the appearance of the cloth depends heavily on the artistic skill of the artists. Moreover, geometric modelling method requires lots of manual operation. This tediousness is worsen by modelling cloth for different characters with different body shape and proportions.

This thesis addresses this problem and presents a new virtual clothing method which includes automatic character measuring, automatic cloth pattern adjustment, and cloth patterns assembling.

There are two main contributions in this research. Firstly, a geodesic curvature flow based geodesic computation scheme is presented which mimics the tape measuring process in tailoring. This scheme is capable of calculating geodesics on the character models in the form of both polyhedron and point cloud. In computer animation, the number of the virtual characters that can be handled simultaneously is increasing rapidly. In order to reduce the cost for modelling cloth for multiple different characters, a fast geodesic algorithm that has linear time complexity with a small bounded error is also presented. Secondly, a cloth pattern adjusting genetic algorithm is developed for automatic cloth fitting. This thesis considers the cloth fitting process as an optimization procedure. It optimizes both the shape and size of each cloth pattern automatically, the integrity, design and fit of the cloth are evaluated in order to generate a fit cloth while preserve the original cloth design. This is the first attempt to utilize the genetic algorithm in 2D cloth pattern adjusting problem for dressing different characters.

By automating the cloth modelling process, the tedious modelling work required by current cloth modelling method will be avoided. It empowers the creativity of animation artists and improves their productivity by allowing them to use the large amount of existing cloth design patterns in the fashion industry to create various clothes that fit multiple characters with different body shapes and proportions.