Animating Puss in Boots' Feather in *Shrek 2*

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1. Abstract

Puss in Boots, one of the new characters in the CG animated feature movie *Shrek 2*, wears an ostrich feather in his hat. We developed a technique to animate the feather by combining a coarse simulation of an underlying surface with detailed procedural animation on the barbs of the feather.

The feather's coarse simulation is designed to run quickly and produce stable, predictable results. The procedural animation, computed at render-time, oscillates the individual barbs of the feather.

Fig 1*: Puss in Boots*

2. Simulation

Puss's feather is composed of over a thousand barbs connected to a single quill. The shape of the barbs is based on a single NURBS patch, which is referred to as the feather surface. The feather animation begins as a very coarse simulation of the quill. A few joints are connected together by length and torsion springs, which in turn deform the first feather surface.

In a batch process, we import the feather surface animation into Maya and apply soft-body dynamics to the control vertices. We bypass Maya's built-in goal-based, soft-body dynamics by using a custom expression that mimics feather motion.

The dynamics are governed by three velocity components. The largest and most important component is based on the distance to the goal surface. If the distance is large, the particle will reach the goal on the next frame. If the distance is small, the particle will travel a small fraction of the distance towards the goal.

This technique makes the simulation very stable because it does not allow for any oscillation. The second and third small velocity components add wind and momentum, respectively.

3. Procedural Animation

Barbs are placed procedurally using the simulated feather surface as a guide. Each barb animates procedurally by oscillating in the direction opposite of travel. A second soft-body feather surface called the ghost surface influences the amplitude of oscillation.

The amplitude is proportional to the distance between the two surfaces. The ghost surface is simulated at the same time as the feather surface, using nearly the same dynamics. We eliminate stretching by using a reference surface to determine the length of each barb.

Fig 2: *Yellow Feather Surface and Red Ghost Surface*

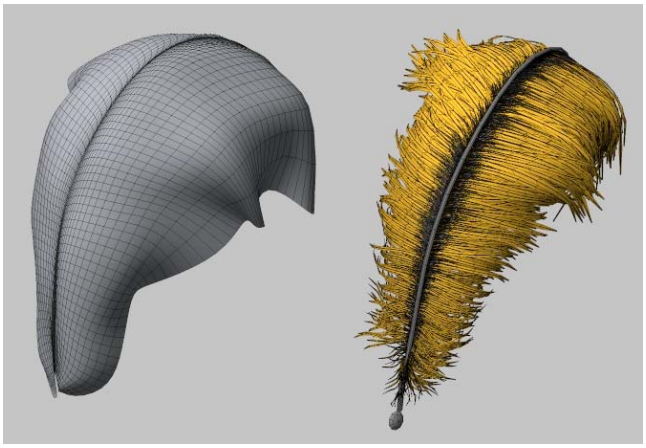

Fig 3: *Feather Surface and Final Feather Geometry*