Optimized Multi Strand Beard Setup for Shrek the Halls

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Figure 1: MOTION: Motion/Simulation Joints, Animation Controls, Deformation Cage, Beard Strands, Rendered Result

In the Shrek the Halls TV special, both Santa Claus and Shrek have long beards. As natural looking beards are a hard problem to solve and they are computationally slow, an optimized solution for solving the beard motion was sought. The beard is an integral part of the face; therefore, it is important for animation to have poseable controls which influence the simulation results. The beard’s animation and simulation should be interactive enough for the animators to animate and simulate the beard on their desktops. An optimized approach to the setup was developed in order to achieve interactivity and avoid simulating all 490 beard hair strands. The system allows the animators to interactively pose and simulate a reduced number of hair strands and propagate their motion to the total number of hair strands. It also handles the attachment of the beard to the character’s face and the influence of the skin’s motion on it. Our approach supports different beard motion behaviours, as Shrek’s beard is supposed to be a fake one, and Santa’s a real beard.

1 Animation and Dynamic Simulation

The main optimization is the simulation of 5 hair joint strands instead of simulating the total number of hair strands. The 5 strands are simulated using a rigid body simulator [Hadap 2006] and collided against a simplified object that encompasses the character’s body and outfit. This allows the animators to run the simulation at their desktop at animation time. If necessary, the simulation can be tweaked by animating any or all of the 5 joint strands, adding poses in order to influence the simulation results (Fig 1). The ability to pose the strands is mainly used to help to avoid interpenetrations with external objects such as other characters. In order to apply the optimized simulation to the total number of strands, a deformation cage encompassing the beard volume is created. The vertices of this cage are driven by the simulated motion of the 5 strands and by procedural rules that more accurately maintain the beard’s volume. The system performs collision detection of the cage’s vertices against the fully deformed body and clothing in order to avoid interpenetration at a more detailed level than the simulated collisions.

2 Hair and Skin Attachment

A long beard has its motion dampened by friction of the beard strands with each other and with the chest surface. In order to emulate this, Santa’s beard joint strands are parented to the head joint, to reduce the influence of the jaw’s higher frequency motion over the simulation. Most of a beard’s behavior caused by jaw motion is concentrated under the mouth and chin and it blends off down towards the neck and sideways toward the cheeks. As the deformation cage only represents the motion caused by the head, in order to mimic the dampened hair motion driven by the jaw’s skin, each hair strand is driven by surfaces that are attached to the deformation cage and to the skin. The connection and motion propagation between skin and beard can be adjusted by tweaking the attachment points of these bridging surfaces to the beard deformation cage and skin. (Fig 2, Fig 3).

3 Fake Beard Behavior

To create the feeling of a fake beard for Shrek, the beard’s 5 simulated joint strands are attached to Shrek’s jaw, in order to inherit it’s bouncy motion and propagate it to the simulation. The attachment to the skin is also tweaked so that the influence of the skin on the beard behaviour is minimal, giving it the feeling that it is just a fringe resting on the face and not growing from it.

4 Conclusion

This optimized approach is quite robust. The simulated results were satisfactory enough that, in most shots, no hand tweaking of the simulation results was necessary. The animation controls were used mainly to tweak the beard pose where collision of the beard with another character had to be avoided or in order to achieve a better silhouette. This system was successfully used on Shrek the Halls, and it is being expanded and incorporated into future productions.

References