High Fashion in Equations

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1. Introduction

Tailored out of exquisite materials and artful designed patterns, high fashion garments constitute the most sophisticated kind of clothes. The unique manufactured pieces, only affordable for a small circle of clientele, are not only envelopes for the human body, but artworks, visualizing cultural aspects, tendencies and trends. Historical haute couture garments are characterized by an additional aspect: Time specific garment details, which allow their affiliation to certain époques, become visible.

The computation of this kind of art pieces can thus be seen as the most challenging part in the field of virtual garment simulations, an area that was not touched on before. It represents new challenges for the computation system as well as for the realisation of the design. With the 3D animation “High Fashion in Equations” MIRALab University of Geneva brought to life virtually 18 Haute Couture garments from the 1950’s to the 1960’s after designs from Marc Bohan, Serge Guérin and Hubert de Givenchy, former assistants of the Swiss couturier Robert Piguet.

2. Design and implementation

The overall visual appearance of a garment (real or virtual) is influenced by two main components: The shape of the 3D garment, determined by the corresponding 2D pattern and the fabric material used which behaviour is influenced by its mechanical and physical properties.

2.1. 2D Patterns

The creation of high fashion 2D patterns is a precise handiwork. Having the desired 3D shape in mind, a flat pattern is drawn by skilled experts according to pattern construction rules. Therefore, ancient garments of that period have been studied for a better comprehension of former pattern making methods [Steele 2000]. For the design of the 2D pattern, correct assembly, seaming and final animation of those complex virtual artworks, a highly versatile virtual garment design system was used [Volino 2005]. New innovative design tools allow the fast alteration of the elaborated 2D patterns both in 2D and 3D with real-time preview of the 3D garment. During fitting, the system automatically evaluates the comfort of the garment on the overstated body with its wasp waist silhouette. Based on the mechanical interactions between the cloth and the body, the designer receives the feedback for optimizing the pattern shape. Other important features, inevitable for those challenging calculations, are a powerful collision response method able to simulate multilayer cloth with stability and robustness, complemented with an intersection recovery system for addressing the possible remaining problematic situations [Volino 2006].

2.2. Fabric materials

Since only precisely computed fabric characteristics can visualize the exquisite fabric qualities of high fashion garments, their correct derivation from real fabric characteristics plays an important role. Information on the fabrics used for those designs was limited to material descriptions regarding structure and fibre compositions. Therefore, similar fabric materials have been chosen and measured with fabric characterization experiments, to obtain strain-stress curves for the main mechanical and physical fabric properties, which were fitted with polynomial splines.

The fabric behaviour in virtual simulations is not only influenced by the measured mechanical fabric properties but also by the accuracy of the applied mechanical computation model. The used computation model is a particle system that represents the nonlinear anisotropic viscoelastic properties of cloth materials with the accuracy of continuum mechanics [Volino 2005]. A fast linear bending model is implemented allowing robust simulation of the elastic bending stiffness of cloth, along an efficient numerical integration system based on Implicit Euler for draping and BDF-2 for animation.

3. Conclusion

Ancient High Fashion garments have been simulated and animated with a highly multifunctional virtual garment design tool and its versatility for complex historic garments has been demonstrated. Based on this experience, new applications for those tools can be thought. Virtual simulations of historic high fashion clothes, which basic constraint is their physical fragility, would preserve them for the next generations, including all their cultural information.

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