Modelling and Animating Virtual Humans

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For years, modeling and animation of the human figure has been an important research goal in Computer Graphics. In the beginning, humans were represented as simple articulated bodies made of segments and joints with a kinematics based model to simulate them. More recently, dynamic models have been used to improve the continuity and fluidity of the movement. In fact, there are two major difficulties in rendering human animation: motion of the hierarchical structure or skeleton and deformation of the body.

There are various methods to control the skeleton's motion. In this paper, we will discuss the most important aspects: real-time motion capture[1], balance control and equlibrium[2], walking model[3], object grasping[4].

The second problem, modeling the deformations of human bodies during the animation process is an important but difficult problem. Researchers have devoted significant efforts to the representation and deformation of the human body shape. We work with different approaches to solve this problem of human body deformations depending on the performance and the applications: entertainment, medicine or Virtual Reality. For Virtual Reality and entertainment applications that require real-time Virtual Humans we aim to find a way to interactively, intuitively, realistically, and efficiently create and animate a rich variety of human shapes. We have described an efficient method we have been using to render and animate realistic virtual humans in real-time[5],. By relying on cross-sectional data and deforming skin contours we succeed in representing virtual humans in a most accurate fashion while preserving a consistent frame rate. For medical applications, we have modelled bones and soft tissues[6] structures such as muscles, skin, fat and define associated simulation procedures allowing the deformation of the final surfaces. Starting from the basic layer of the topology of anatomical structures, including the inner fiber orientation of the muscles, the surfaces will be parametrically fitted to medical images to get an anatomically validated database. Concurrently, mechanical models of soft tissues deformation and muscle contraction have been based on physiological data.

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