

# Simulación Eficiente de Fenómenos Físicos en Medios Continuos: Su Aplicación a la Locomoción Humana

## Abstract:

Persons used to actively interact with the environment, so that actions like moving, talking or handling objects are very common in our lives. The scientific world tries to exactly recreate the fundamental actions and the behaviours of the human being. Human simulation has associated complex problems because of the capability of an observer to detect anomalies or irregularities in familiar actions like the shape or the movement of the human body. Regarding the advances in computer graphics in the last years in the area of human animation, it must be considered that the shape of the body can vary during the animation because muscles move, length and stretch and the external appearance continuously changes. So that, in order to represent the complexity of the human body it is essential to tackle muscle simulation and the muscle deformation during movement.

In this work a complex system called MOBiL (Muscle defOrmation in Biped Locomotion) is presented. The system allows to animate, in a coordinate way, the global movement of the body and the local and volumetric deformation of the muscles during locomotion.

For this purpose, the model used is based in two phases: skeletal and muscle-skeletal.

In the skeletal phase, the realistic movement is obtained by an hybrid locomotion model: dynamic-kinematic. The dynamic model is very simple and constitutes the base for a subsequent kinematical model that allows the real time simulation of the global movement of locomotion.

In the muscle-skeletal phase, the muscle deformations are physically simulated with a finite element system, fed by the forces got from the locomotion system by a model of muscular lines of action.

The system is completely parameterized in order to generate animations of individual with different anthropometric characteristics (height, weight and complexion) and to generate different locomotion (step speed, length and frequency).