

图形、图像、模式识别

## 柔软物体物理自由变形仿真

夏开建, 王士同

江南大学 信息工程学院, 江苏 无锡 214122

收稿日期 2008-5-29 修回日期 2008-11-5 网络版发布日期 2009-10-10 接受日期

**摘要** 在虚拟现实和计算机动画技术中, 基于几何模型和基于物理模型的方法已经得到广泛的研究。利用几何模型和物理模型相结合的方法, 将质点弹簧模型加到Bezier网格上, 通过控制Bezier网格上的控制点来达到物体的变形, 该方法与直接在物体上建立质点弹簧模型的方法相比更加简单、快速, 且更加容易达到物体的全局变形。质点的运动满足拉格朗日运动方程, 采用了微分方程组来表示质点的运动规律, 并给出了用数值求解法对系统进行实时计算的求解过程; 同时还将一个简单的柔软物体碰撞处理方法应用在质点-弹簧模型中, 实验表明该方法简单有效。

**关键词** [柔性物体](#) [自由变形](#) [质点-弹簧模型](#) [碰撞处理](#)

**分类号** [TP391.9](#)

## Simulation based on physically soft-object free-form deformation

XIA Kai-jian, WANG Shi-tong

Information Engineering of Technology, Jiangnan University, Wuxi, Jiangsu 214122, China

### Abstract

In the computer animation and virtual reality applications, both geometric and physical modeling based methods have been widely studied. In this paper, a mass-spring Bezier volume space is constructed through attaching a basic mass-spring lattice to the bounding box of the object. This method is simpler and faster than that utilizes the common mass-spring model which connects the mass points and springs on the object itself, and it is easier to achieve the global deformation. The mass movement meets Lagrange's dynamics equation. This paper adopts a differential equation to express the movement of particles, and uses numerical solution of the system of real time computation, which increases efficiency. At the same time this paper applies a simple soft-objects collision approach on mass-spring model. The experiment shows that the method is simple and effective.

**Key words** [soft-object](#) [free-form deformation](#) [mass-spring model](#) [collision handling](#)

DOI: 10.3778/j.issn.1002-8331.2009.29.052

通讯作者 夏开建

### 扩展功能

#### 本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(660KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献](#)

#### 服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)
- ▶ [Email Alert](#)
- ▶ [文章反馈](#)
- ▶ [浏览反馈信息](#)

#### 相关信息

- ▶ 本刊中 [包含“柔性物体”的相关文章](#)
- ▶ 本文作者相关文章
  - [夏开建](#)
  - [王士同](#)