Fei Zhu (朱飞)

Ph.D. student
Graphics and Interactive Technology Lab, Peking University
Beijing, P.R.China
Mobile: +86 136 0120 9076
E-mail: feizhu@pku.edu.cn
Homepage: http://www.graphics.pku.edu.cn/members/zhufei/index.html

Research Interests

Physics based animation

• Deformable solids, fracture, fluids

• Animation control

Education

Peking University   **September 2010 - June 2015 (expected)**

• Ph.D. Candidate in Computer Science

• Advisor: Dr. Guoping Wang

Xi'an Jiaotong University   **September 2006 - June 2010**

• B.E. with Honors, Computer Science

• Thesis: Comparative Study and Implementation of two GPU-friendly Mesh Refinement Algorithms

Research Experience

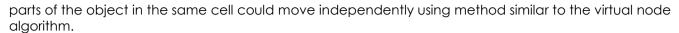**Control of Physics based Simulation**   **August 2012 - present**

Working on easy and intuitive ways to control physics simulation, with primary focus on deformable control. Physics based simulation has the advantage of physical plausibility, but the simulation process is hard to control. Traditional animation methods like key-framing and skinning can produce predictable results. I am currently investigating a compromise between physics simulation and traditional animation. "Example-based Elastic Materials" is one of the methods that add easy control to physics simulation. However, the original algorithm requires that the given examples must have the same discretization with the volumetric mesh used for simulation. I propose an algorithm that uses the Laplace-Beltrami Eigenfunctions as shape descriptor. Isometric shapes have same Laplace-Beltrami Eigenfunctions, thus same discretization between shapes is no longer a necessity. My method also supports using similar objects as examples, because similar shapes have similar Laplace-Beltrami Eigenfunctions. This work is in preparation for submission.

Eulerian Fracture Simulation with Embedded Surface Mesh   **September 2011 - July 2012**

I spent my second academic year working on new algorithms to simulate solid fracture. Existing methods include FEM and meshless methods, each with limitations. Inspired by SIGGRAPH 2011 paper "Eulerian Solid Simulation with Contact" and recent trend of embedding surface mesh in simulation, I proposed an algorithm that simulated solid deformation in Eulerian perspective and represented the object surface with embedded surface mesh. When fracture occurred, crack surface mesh was dynamically created and propagated.

My algorithm was supposed to have following advantages: Eulerian simulation avoided the remeshing/resampling problems due to its nature of fixed discretization; The embedded surface mesh allowed more accurate simulation at object boundary and higher resolution of visual detail; Disconnected

parts of the object in the same cell could move independently using method similar to the virtual node algorithm.

However, my implementation didn't get satisfactory results. The simulation always blew up and failed to continue. I don't think it's a dead end nevertheless, and I'm working on finding the problems.

Geometric Modeling with Semantic Constraints   April 2011 - May 2011

Working on the "Theory and Methods of Geometric Computing in Production Design" project of our lab, the goal of this project was to improve the efficiency of computer-aided design by exploring the high-level information in geometric shapes. The focus of my work was the editing of 2D shapes with semantic constraints. I implemented the 2D editing component in our CAD system and it supported 2D shape editing with predefined constraints like parallelism and verticality between two line segments.

Meshless Simulation of Fluids and Solids   November 2010 - January 2011

I did some research on meshless methods and their application to the simulation of fluids, solids and fluid-solid coupling. I implemented a fluid simulator based on SPH as a course project. Together with Ning Liu, I tried to improve the stability of meshless solid simulation. We proposed an algorithm that used anisotropic kernels to achieve the goal. We stretched the kernels along the direction of principle stress in each time step. Our algorithm was versatile and could be applied to various meshless methods: SPH, co-rotational SPH, etc. The work was published in the proceeding of CAD/Graphics 2011.

Geometric Problems in Multi-View Reconstruction   September 2010 - May 2011

Working on the "3D Reconstruction from Multiple Views" project of our lab, we developed a system that could reconstruct 3D model of an object from photographs taken from multiple views. My part of work was to improve the quality of the reconstructed mesh. The triangle mesh was reconstructed from binary visual hull data using the Marching Cubes algorithm and the staircase artifact was very obvious. I drew inspiration from Laplacian smoothing algorithm and smoothed the visual hull data before reconstruction. The quality of the resulting mesh was much better. Additionally, I developed the mesh simplification component of the system. I chose to integrate the QEM algorithm of Michael Garland into our system, after surveying various mesh simplification algorithms.

Publications

Ning Liu, **Fei Zhu**, Sheng Li, Guoping Wang: *Anisotropic Kernels for Meshless Elastic Solids*. Proceedings of the 12th International Conference on Computer-Aided Design and Computer Graphics: 349-356. DOI: 10.1109/CAD/Graphics.2011.33

Skills

• Languages: Mandarin Chinese (native), English (good, TOEFL: 103)

• Programming Languages: C, C++, Java

• Operating Systems: Windows, MacOS, Linux

Honors & Awards

President Scholarship, Peking University	2010 - present
Founder Scholarship, Peking University	2011
Outstanding Graduate, Xi'an Jiaotong University	2010