An Overview of Physically Based Modeling

References

We started with some detailed notes on integration and on setting up and simulating particle systems. These notes can be found in the third reference below. The other references may also be of interest! Many of the movies can be found online, if you would like to see them again. (Search for the web pages of the authors.)

  - http://portal.acm.org/citation.cfm?id=357320&dl=ACM&coll=portal&CFID=12858257&CFTOKEN=79983367

  - http://portal.acm.org/citation.cfm?id=979025&dl=ACM&coll=portal&CFID=12858257&CFTOKEN=79983367


- Partial slide credit: Thomas Funkhouser
More Particle Systems

• With some adjustments to the particle and spring-mass systems we have seen so far, we can handle
  – large numbers of rigid bodies
  – cloth
  – hair and fur

Handling Lots of Collisions

• B. Mirtich, Time-warp technique
  (SIGGRAPH 2000)

Figure 1: *Avalanche*: 300 rocks tumble down a mountainside.
Guendelman, Bridson, and Fedkiw (Stanford), SIGGRAPH 2003

Bridson, Fedkiw, and Anderson, SIGGRAPH 2002

Baraff and Witkin, SIGGRAPH 1998
Cloth

Animation #3

Choi and Ko, SIGGRAPH 2002

Cloth

Animation #4

Choi and Ko, SIGGRAPH 2002
Cloth

- Clothing with wrinkles
  Bridson, Marino, and Fedkiw (Stanford), SCA 2003

- Dealing with self-intersection
  Baraff, Witkin, and Kass (Pixar), SIGGRAPH 2003

Hair, Fur and other Strands
Beyond Particle Systems

- Many natural phenomena are based on approximations of the Navier-Stokes equations characterizing fluid flow
  - water
  - smoke
  - steam
  - fire
  - explosions!
Smoothed Particles

Stam & Fiume, Turbulent Wind Fields for Gaseous Phenomena, 1993

Explosions

Feldman, O’Brien, and Arikan (Berkeley), SIGGRAPH 2003
Finite Element Models

- Fracture
- Deformation
Fracture

Multiresolution Simulation

Dynamic Real-Time Deformations using Space-Time Adaptive Sampling

paper #235

Deunne, Desbrun, Cani, and Barr, SIGGRAPH 2001
Multiresolution Simulation

Capell et al., SCA 2002

Multimodal Aspects: Sound

FOLEYAUTOMATIC:
Physically-based Sound Effects for Interactive Simulation and Animation

van den Doel, Kry, and Pai, SIGGRAPH 2001
Annoucements

• Ray tracing due today
• Last homework out this afternoon (due next Thursday)