The Animation of Natural Phenomena

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Questions

• What is your name?
  • Tell us about yourself.

• Experience...
  • OpenGL?
  • C++
  • Math?

• Why did you sign up for this class?
  • What do you hope to learn?
What is Physics-Based Animation?

Physics of our everyday lives...
What is Physics-Based Animation?

FLOW
100% Full CG Water from R&D to Final
What is Physics-Based Animation?

Data Structures

Mathematical Techniques

Algorithms

[Baraf 1996]
Overview The Class

- Will explore various phenomena...
- Questions you should ask:
  - What should we simulate?
  - How do you simulate it?
    - Interactively?
  - How can we break it?
  - How can we control it?
  - How can we couple it with other objects?
- How do we measure success?
Particles

Data Structures

DiffEQ

Constraints

Hair (1D)

Cloth (2D)

Crowds
Fluids

Incompressible Fluids

Free-surface Fluids

Particle Fluids
Rigid Bodies

Collisions and Stacking

[Guendelman 2003]
Deformable Objects

Animating Water Bottle Recycling Rates
Doug James
Cornell University

Deformable Objects
Deformable Object Collisions
Humans

Performance Capture

Data-Driven Motion

Physical Simulation

[Vlasic et al 2003]
[Treuille et al 2007]
[Lui and Popović et al 2002]
Advanced

Optimization

Control

Model Reduction

[Fattal and Lischinski et al 2003]

[Twig and James 2007]

[Treuille et al 2006]
Objectives

Goals
- Learn Techniques
- Fun Coding
- Quick Problem Solving
- Presentation Skills

Methods
- Weekly Lectures
- Paper Presentations
- Projects
- Questions
Logistics

- Topic A
- Topic B
- Topic C
- Topic D
- Topic E

Class $n$
- Paper Presentation
- Lecture
- Question

Class $n+1$
- Paper Presentation
- Lecture
- Question

Class $n+2$
- Paper Presentation
- Lecture
- Question

http://graphics.cs.cmu.edu/courses/15-869-F08/
Grading

- Do not take this class for a grade!

- 24% Project 1: Particles (due 10/1)
- 24% Project 2: Fluids (due 10/22)
- 36% Final Project (due 12/3)
- 16% Class Presentation / Participation
Logistics

Anonymous Feedback:
http://www.cmu.edu/blackboard/

Lab:
WeH 5336
/afs/cs.cmu.edu/project/weh5336/SetupAndrewAccount
Use Caps: hbovik@ANDREW.CMU.EDU

Disk Space:
/afs/cs.cmu.edu/academic/class/15869-f08-users
10GB per user
Questions

• What everyday things are we missing here?
  • *These could be final projects!*

• How can we measure success?
  • How do we measure “success” for chaotic systems can cannot be recreated?

• Can we come up with an objective notion of “visual correctness?”
Homework 1

Read:

*Differential Equation Basics*
Andrew Witkin and David Baraff
(on the website)